

# FACTORS INFLUENCING THE SELECTION OF PAYMENT SYSTEMS IN CONSTRUCTION PROJECTS

Elhadi Sherif<sup>1</sup> and Ammar Kaka

*School of the Built Environment, Heriot-Watt University, Edinburgh EH14 4AS, UK*

Construction contracts are fundamental to any project, and the selection of an appropriate payment system is vital given that the ultimate success of any construction project depends on the suitability of the selected payment system to the project's characteristics and client's requirements. In this paper we have defined the payment system in terms of four layers as Payment mechanism, Pricing mechanism, Payment chain (who pays who), and Other Cash-flow factors. In order to develop a tool that will help the project team to select an appropriate payment system, a list of factors that influence the selection process was created. The most influential factors were identified using a U.K based nation-wide postal survey. In this questionnaire the opinions of different types of organizations- consultants, contractors and clients were collected and assessed. The results showed that different factors were perceived to influence the selection of each layer linking the payment system. According to the results a total of seventeen factors were found to influence the selection process. This paper presents the work, which is part of an ongoing PhD study.

Keywords: cash flow, payment mechanism, pricing system.

## INTRODUCTION

In the construction industry it is often said that 'cash is king' and in construction contracting cash is the contractors' (and the subcontractors') number one concern. Over the years, contractors have come up with many innovative ways of enhancing cash flow. Some of these ways have been found through implementing more efficient management processes and information systems, thereby allowing contractors to minimize the outstanding balances owed by clients. Others have been found through adapting pricing policies (e.g. unbalancing and front-end loading) or somewhat unfair procedures such as over-measurement and the delaying of payments to subcontractors and suppliers. In the UK, the normal practice in the construction industry is for the contractor to price the products and services provided based on unit rates and quantities. The contractor is then paid monthly and the value of these payments is determined by agreement between the respective quantity surveyors of the employer and the contractor. Payment systems based on measurement are approaches that neither require detailed and time-consuming management and neither reward achievement nor distinguish between the inefficient and the efficient contractor. Crucially, this is a system that does not help to deliver value for money. Indeed, from a wider supply chain perspective, the conventional payment mechanism places a considerable and unfair strain on particular parties and thus on the overall spirit of team working, partnering and supply chain management called for by Egan and others. The current payment system has not been designed to cater for the 'newer'

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<sup>1</sup> e.sherif@hw.ac.uk

procurement routes being developed in the post-Egan industry as the traditional payment mechanism was designed when the architect was essentially the project manager and contractors were asked to tender only after a complete set of drawings were available and projects ended at commissioning. However, today, the construction industry is totally different and is comprised of different types of delivery systems that use more flexible supply chain organizational arrangements. As a result, a number of alternative payment and pricing systems are emerging. In the UK, the Latham report contained some radical proposals regarding contracts and the current practice of producing monthly valuations. The government has echoed the above in their application of the Government Public Procurement form of Contract (GC WKS1 Edition 3) which recommends stage payment chart and milestone payments. In the US as well, a new type of contract is emerging and the Department of Energy is already adopting it for its own projects. Performance-Based contracts are gaining momentum in both the US and Europe and the concept underlying these contracts are to align targets and clients' satisfaction with payments. The UK Trust and Money model is a radical and new model developed by the M4I. Its concept is very similar to that of the DOE in the US, but it goes further in that it suggests radical ways for setting up a virtual company consisting of different members of the supply team being seconded from their own companies. The success of any construction project is likely to depend on the suitability of the selected payment system to the project characteristics and client requirements. With the proliferation of alternative payment systems, factors influencing the selection of an appropriate system need to be identified and understood. This paper presents the results of a survey that was undertaken in order to identify key factors that are considered when selecting a payment system. These factors are related in the main to project characteristics and client requirements, but also to factors influencing the favourability of the system to contractors (in terms of cash flow). The results of the survey will help the ongoing PhD research project to develop a decision support system aimed at selecting an appropriate payment system for a given construction project.

## **LITERATURE REVIEW**

Research into cash flow has in the main concentrated on two main processes: how to forecast cash flow (Kaka 1996; Kenley and Wilson 1986; Khosrowshahi 1991; Navon 1996) and how to manage cash flow, (Kenley 1999; Kaka 1995; Cheetham, Kaka and Humphreys 1996) with the former receiving significantly higher attention than the latter. Although cash flow has been much studied and much researched in recent years, there has not been enough of a link made between cash flow and payment mechanisms. In fact, although cash flow is seen as being one of the major concerns for contractors, its link with payment mechanisms is almost completely neglected. The current payment mechanism is however, not making use of this important factor and it is literally wiping away any link between project performance and clients' satisfaction on one hand and stakeholders' cash flow on the other. Alternative payment systems are emerging but there has to date been no research to identify the factors influencing the selection of an "appropriate" payment system for a given project (Kaka 2001). Rather, research in this area has been focused on procurement systems and contracts, with the latter mainly focusing on disputes and claims. There has been growing international interest aimed at linking client satisfaction to procurement systems, business processes and organizational structures. This includes, in the UK, the work on reengineering the procurement decision-making process (Hardcastle, Tookey and Langford 2001) in order to evaluate how decisions are made about the selection and

modification of procurement methods used by clients and their contractors. In Australia, governmental departments (e.g. NSW and ASD) are finding it necessary to develop their own guidelines that will enable the matching of individual projects to the appropriate procurement system (Ambrose and Tucker 1999). This emphasizes the point that clients' requirements (and hence satisfaction) is essentially project based, thus necessitating the need for a system that addresses project characteristics in addition to those of the client. In the US, the Construction Industry Institute recently sponsored research aimed at empirically comparing the performance of different procurement systems in the US and to later compare these with others used in the UK. It was concluded that whilst procurement systems could have a significant impact on project performance, other factors were identifiable (Konchar and Sanvido (1998)). These factors differed according to the different procurement systems being used, thus highlighting the need to consider project characteristics when selecting or even defining a procurement system. Similar findings have been obtained in studies in Singapore (Teo and Ofori 1999), Brazil (Oliveira and Heineck 1999) and South Africa (Bowen 1997). The payment system so far has been dealt with in isolation to the "procurement system". Indeed, the traditional payment system (or at least parts of it) is being used in different procurement routes. Whilst there has been a significant amount of work aimed at mapping and analysing procurement systems, sufficient work on payment systems has not been done and research specifically aimed at assessing and analysing payment systems is scarce. New forms of contracts are being used to manage a new procurement situation between client and contractor aimed at stabilizing contractor client relationships. These range from Cost-plus fees contract to Target price contracts, Prime contracts and Incentives contracts. Traditional pricing and payment mechanisms have not changed at the same rate as procurement systems and current contracts and their payment mechanisms do not support implementation that satisfies the diverse goals of clients. Client orientation is often wishful thinking when the margin of profit is earned by holding tightly to contractors own goals by severe cost cutting although payment bases of a project should **probably** reward performance corresponding to the client's goals much more effectively than is presently the case and also encourage the contracting team to serve the client and solve problems through effective co-operation. Weitzman (1980) states that 'an incentive contract' is a linear payment where the buyer pays a fixed fee plus some proportion of the audited project cost. The remaining proportion of project cost borne by the seller is called the 'sharing ratio'. Kruijff (2002), states, "The trust and money report gives an idea of where the major changes must take place. The report suggests that there should be a three part financial structure; payment for the team of secondees; payment for the physical facility provided and reward to the practices and companies to the extent that the owners objectives are actually met".

## **RESEARCH METHOD**

The research presented in this paper is part of a PhD study aimed at developing a decision-aid tool to assist project managers when selecting an appropriate payment system for a particular project. The selection process will be based on factors relating to the needs of the construction projects and their participants. The research method used to identify the most influential factors was a UK based nation-wide postal survey. The initial stage of the research process was to identify alternative payment systems being used in the construction industry. Discussion with the industry revealed that payment systems were not easily classifiable and that a new model of payment was emerging whereby there was evidence of methods of payment being tailored to

particular projects. Clients and their advisors were creating bespoke payment systems that were suited to the circumstances of the project by taking the ‘best’ terms of generic systems available. It was thus agreed that a framework was needed where a payment system could be defined. The developed framework defines the payment system in terms of the four layers: namely ‘the supply chain’, ‘the pricing method’, ‘the payment method’ and ‘cash flow factors’. ‘Supply chain’ defines the project stakeholders, the products and the services they will be providing and the contractual link (or cash flow link if different) between them. ‘Pricing method’ defines the way in which each product or service is to be priced. ‘Payment method’ defines how these products and services will be paid, and ‘cash flow factors’ includes other cash flow factors such as payment time lags, retention arrangements, etc. Figure 1 illustrates the framework and examples of alternative mechanisms within each layer.

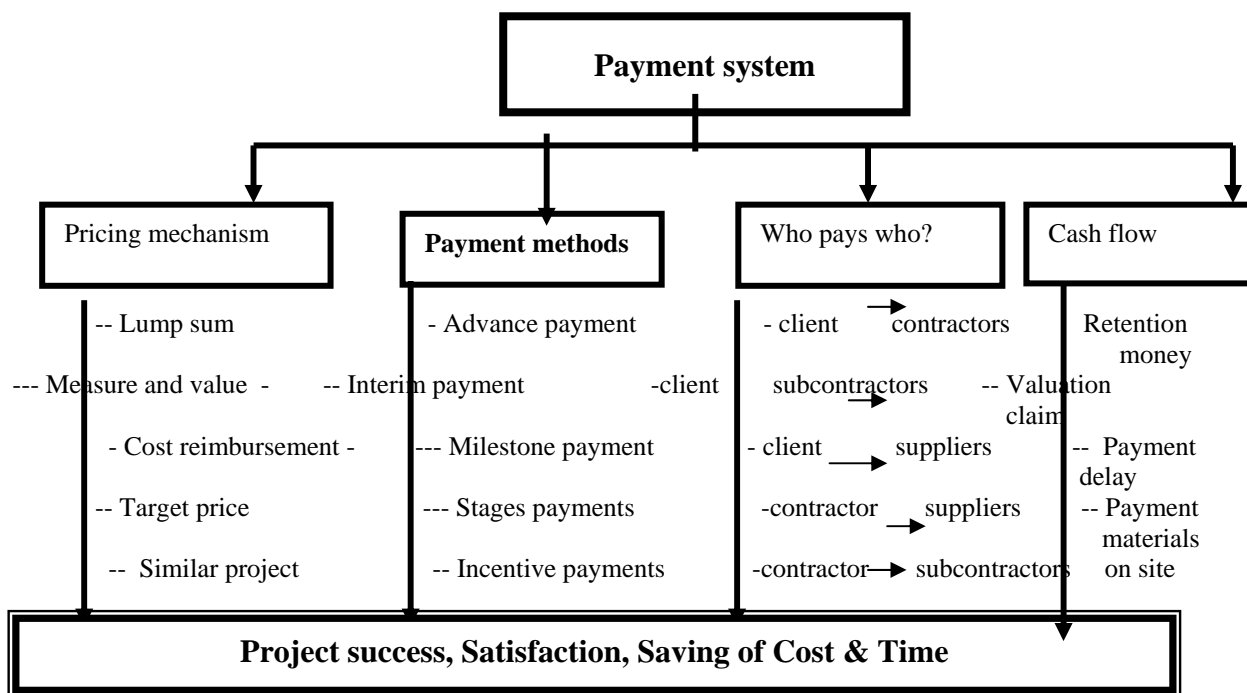


Figure 1: A framework for defining payment systems

## THE RESEARCH SURVEY

At the preliminary stage of the study a review of current literature revealed a number of factors that may influence the process of selecting project payment systems. These factors formed the basis for a pilot study with five selected construction organizations. The pilot study was undertaken with a view to identifying essential issues, and to provide any comments or add other factors. Four of the organizations agreed with the list proposed whilst the other added three more factors. These factors were defined for example; **Cost certainty**: the cost is the most important aspect, Cost estimating is crucial to all parties involved with construction project, providing a basis for establishing the likely cost of resource elements of the tender price for construction work. The impact of inaccurate cost estimating on contracting business is significant, **Time certainty**: It is a degree of certainty that the project will be completed on the date, which is agreed by client and contractor when signing the contract. **Project complexity**: it is made up of type of structure, scale and scope of construction, complexity of design and site constraints. Gidado and Millar (1992) regarded complexity as factors that hinder performance on site, including technical complexity

of the task, amount of overlap and interdependencies in construction stages, project organization, site layout, an unpredictability of work on site. It is considered that project complexity affects contract duration, new prices are required and consequently the construction cost. **Flexibility for changes;** flexibility in accommodating design changes is crucial to the success of the project and client satisfaction; **Forms of contracts:** The wide range of available standard contract options makes the use of decision-making techniques advisable to ensure that rational selection are made. Selecting an appropriate form of contract requires careful exploration of each project characteristic and the procurement route to meet the client needs. In a construction contract, the contractor undertakes to carry out the works, including the provision of all things necessary for completion. The employer's side of the bargain is usually the payment of money. Problems may arise in deciding when the contractor's obligation is discharged, what amount of money is payable and when. **Contractor Cash flow,** A cash flow is the transfer of money into or out of the company. The timing of a cash flow is important. There will be a time lag between the entitlement to receive a cash payment and actually receiving it. There will be a time lag between being committed to making a payment and actual paying it. These time lags are the credit arrangements that contractors have their creditors and debtors. The main input data required to forecast cash flow for individual projects are field costs, clients' payments and the time lag between disbursement and receipt. 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. Cash flow forecasts are often essential at the bidding stage in order to estimate the financing of the project and its possible influencing of the overall liquidity of the company. **Procurement methods:** the selection of the most suitable procurement method consequently is critical for both client and project participants, and is becoming an important and contemporary issue within the building industry. Procurement system may have a significant impact on the success of the project. However, determining which is the most appropriate procurement system is not a straightforward process. The needs of the client and the characteristics of the project should be considered to be as important as the chosen procurement system to meet those needs and characteristic. **Risk allocation:** to what extent the payment mechanism selection helps the client to avoid or transfer the risk. **Disputes likelihood:** to which extent the payment mechanism help to avoid or limit disputes. **Project size:** the projects categories are small size project less than 0.5 million pounds, medium project size 0.5-2.5 million pounds and the large size more than 2.5 million pounds. The contractors should select the suitability of different price mechanisms to the different project size. **Speed** (during the design and construction): The time is the most important aspect for the construction project success. The speed is crucial to all parties involved with construction project. Overall list of thirty-five factors were identified (appendix 2). Scales ranging from 1 (representing a perception of negligible influence) to 5 (representing a perception of significant influence) were used to set quantitative measures to allow for further statistical analysis. The questionnaire accompanied with a covering letter indicated the objectives of the research and requested that a senior member of staff, and one who was responsible for payment system activities in the firm, complete the questionnaire for three layers, payment methods, pricing mechanism and cash flow. The questionnaire was mailed to 83 selected construction contractors and a total of nineteen usable responses were received, representing a 23% response rate.

## OBSERVATIONS AND RESULTS

The responses recorded different rankings of influential factors. For example, in the payment methods selection (time certainty) was ranked by 13 respondents as having a significant influence (5 or 4) whilst others ranked it as having a low influence (3-1) and, although the factor of cost certainty was ranked (5or4) by 12 respondents and four ranked it as having a low influence (3or2). However other factors (e.g. flexibility) that had a mean average less than 3.5 were ranked by the respondents within the range (1-4) as shown in fig (2). In terms of the pricing mechanism the ranking of the above mentioned factors were differently (time certainty) ranked as having a high significance where the cost certainty was as low significant, but the flexibility was ranked by 14 respondents as having a significant influence (5 or 4) as shown in fig. (3)

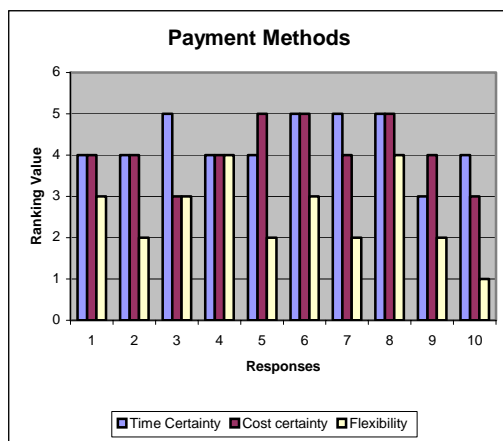


Figure 2: Factors ranking

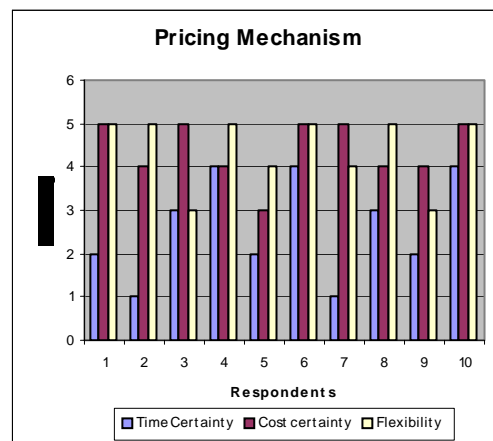


Figure 3: Factors ranking

In terms of Payment Methods and Pricing Mechanisms, although the questions asked to each respondent were the same, respondents' perceptions of Time certainty, Cost certainty and Flexibility were different according to whether they were answering the question from the perspective of Payment method or Pricing mechanism. For example, as can be seen from figures two and three above, although respondent one had quite a high perception of Time certainty for question one in terms of payment methods (ranking 4), this respondent had a much lower perception of time certainty for this question in terms of pricing mechanisms (ranking only 2). Different clients, contractor and different project circumstances demand different criteria weights. For example if for one project the cost is the most important aspect, then the respondent weight the cost criterion higher than the other criteria. For another project where the speed of construction is the most important then the response would weight the speed criteria as significant factor. It is suggested that the main factors influencing the payment mechanism are divided into three groups. Statistical analysis was undertaken using the mean value of the respondent's rankings factors recorded, and those, which, had a mean equal, or higher to 3.5 were selected. The results are shown in Appendix (1).

## CONCLUSION

The research identified the factors influencing the payment mechanism, which was divided into four layers (payment methods, pricing system, payment chain and cash flow). The total number of these factors was 35 for each layer and the selections of

the influencing factors for each layer was based on the average mean score of each factor being greater than 3.5. The paper shows that different factors are perceived to influence the selection of each layer linking the payment system. In total, seventeen factors were found to influence the selection process. The findings show that the three factors: contractors' cash flow, contract form and disputes likelihood influence the three layers of the payment mechanism and these factors were a major consideration when selecting the payment system. The selection of a suitable payment system are needed to help achieve optimal solutions in terms of successful projects and the choosing of an inappropriate payment system may lead to cost and time overruns, and also to unnecessary claims and disputes on projects. The ongoing PhD study will be carried out to develop more flexible methods of payment, pricing and streamlining of the retention system, which would be based on the perceptions of the industry and its clients.

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## APPENDIX 1: SELECTED INFLUENCING FACTORS

| Payment Methods                     | Pricing system                | Cash flow             |
|-------------------------------------|-------------------------------|-----------------------|
| Time certainty.                     | Cost certainty.               | Time certainty.       |
| Cost certainty.                     | Project size.                 | Project duration.     |
| Contractor cash flow.               | Contractor cash flow.         | Contract form.        |
| Contract form.                      | Contract form.                | Client reputation.    |
| Speed (during design and building). | Disputes likelihood           | Contractor cash flow. |
| Disputes likelihood.                | Procurement system            | Disputes likelihood.  |
| Risk allocation.                    | Flexibility (design changes). | Project size          |
|                                     | Value for money.              |                       |
|                                     | Tender methods.               |                       |
|                                     | Risk allocation.              |                       |
|                                     | Budget availability.          |                       |

## APPENDIX 2: LIST OF THE INFLUENCING FACTORS

| No | Influencing Factors      | No | Influencing Factors          | No | Influencing Factors          |
|----|--------------------------|----|------------------------------|----|------------------------------|
| 1  | Time Certainty           | 13 | Economic conditions          | 25 | Site location                |
| 2  | Cost Certainty           | 14 | Speed (during D & C)         | 26 | Project security level       |
| 3  | Project size             | 15 | Tender documents             | 27 | Flexibility in time working  |
| 4  | Project complexity       | 16 | Procurement system           | 28 | Peer relationship            |
| 5  | Project type             | 17 | Disputes likelihood          | 29 | Allocation of responsibility |
| 6  | Project duration         | 18 | Tender Methods               | 30 | Client reputation            |
| 7  | Contractor(s) cash flow  | 19 | Extent of competition        | 31 | Project budget availability  |
| 8  | Contractor(s) Experience | 20 | Flexibility (design changes) | 32 | Integrated project team      |
| 9  | Client Experience        | 21 | Contract Qualification       | 33 | Investment in briefing       |
| 10 | Tendering Time           | 22 | Risk allocation              | 34 | No blame culture             |
| 11 | Contract form            | 23 | Value for Money              | 35 | Authority of project manager |
| 12 | Quality                  | 24 | Site conditions              | 36 |                              |