The impact of contractor selection method on transaction costs: a review

THE IMPACT OF CONTRACTOR SELECTION METHOD ON TRANSACTION COSTS: A REVIEW

Helen Lingard[1], Will Hughes[2] and Ezekiel Chinyio[3]

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Abstract: The basic premise of transaction-cost theory is that the decision to outsource, rather than to undertake work in-house, is determined by the relative costs incurred in each of these forms of economic organisation. In construction the "make or buy" decision invariably leads to a contract. Reducing the costs of entering into a contractual relationship (transaction costs) raises the value of production and is therefore desirable. Commonly applied methods of contractor selection may not minimise the costs of contracting. Research evidence suggests that although competitive tendering typically results in the lowest bidder winning the contract this may not represent the lowest project cost after completion. Multi-parameter and quantitative models for contractor selection have been developed to identify the best (or least risky) among bidders. A major area in which research is still needed is in investigating the impact of different methods of contractor selection on the costs of entering into a contract and the decision to outsource.

Keywords: bid evaluation, contractor selection, pre-qualification, transaction costs.

INTRODUCTION

Production can be organised administratively within firms as well as contractually between them. Having selected an end product line, a producer must decide which products and services will be undertaken and administered within the organisation and which products or services will be outsourced.

Economic analyses have often implicitly assumed that the costs of economic organisation are zero, when, in fact, they are not (Klein *et al*. 1978). Transaction cost theory holds that the relative costs associated with different forms of economic organisation are a major factor in the decision to outsource. Coase (1937), with his pioneering theory of the firm, holds that if the costs of in-house production exceed those of contracting out the work, the firm will opt for outsourcing. The structure of a firm is regarded as the result of a competition between the price of internal resources and the market price.

Construction work is almost invariably outsourced. If Coase's theory is valid, this may be attributed to the fact that the market price is less than the cost of using internal resources to complete a project. Outsourcing requires that the process of contractor selection take place and that a contract be formed between the buyer and the producer or service provider. In construction, commonplace contractual relationships include those between client and designer, client and builder, and builder and subcontractor.

[1] Department of Buiding and Construction Economics, Royal Melbourne Institute of Technology, Melbourne, Australia
[2] Department of Construction Management & Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK
[3] School of Construction Engineering and Technology, University of Wolverhampton, Wulfruna Street, Wolverhampton, UK

The contractor selection decision is crucial to ensuring that costs incurred in entering a contract are minimised. It is with this in mind that the following review endeavours to:

- explore the contractor selection process in the wider context of economic organisation theory;
- identify different contractor selection models;
- discuss the likely impact of contractor selection methods on transaction costs; and
- develop a framework for future research in contractor selection.

THEORY OF THE FIRM

Production arrangements can be represented as a continuum with vertical integration and outsourcing as the opposite extremes. In vertical integration, production processes are internalised by the firm. Outsourcing involves selecting, from the market, the firm that will render the required services or deliver the specified product. Between these extremes, there are several intermediary organisational arrangements. Coase suggested that within firms, "the complicated market structure with exchange transactions is substituted by the entrepreneur-coordinator who directs production." The main reason for the establishment of firms is that there is a cost to using the price mechanism (Coase 1937).

TRANSACTION COSTS

Williamson developed Coase's theory further to suggest that economic agents primarily seek to economise on transaction costs. Despite repeated reference to transaction costs in his works, Williamson failed to provide a satisfactory definition of this term (Hodgeson 1993). Dahlman categorises transaction costs as search and information costs, bargaining and decision costs and policing and enforcement costs (Dahlman 1979). Transaction costs can also be categorised as either *ex-ante* or *ex-post*. *Ex-ante* costs include the costs of tendering, negotiating and writing the contract while *ex-post* costs may be incurred during the execution and policing of the contract or of resolving disputes arising from the contracted work (Williamson 1975).

Dahlman (1979) argues that all categories of transaction cost represent a lack of information. Information is defined elsewhere as a prime source of high transaction costs (Casson 1994, Holstrom and Tirole 1989). According to Casson (1995) vertical integration emerges when people with access to decisive information, which others need to use, inform these other people of their decisions rather than of the information itself. The transfer of information within a firm rather than between firms is believed to reduce transaction costs (Kay 1982, Pass *et al.* 1995).

SOURCES OF TRANSACTION COSTS

Williamson (1975, 1985) assumed that:

- human beings are subject to bounded rationality or an inability to predict events in a complex and uncertain future;
- people are given to opportunism in that they will behave in a self-interested way; and
- asset specificity, or a specialisation of assets with respect to use or users, exists.

The interplay of these three factors gives rise to transaction costs (Coase 1988) and their co-existence may lead to business failure in general and may ultimately bring about market failure (Ascher 1987).

TRANSACTION COSTS IN CONSTRUCTION

Winch (1989) identifies four sources of uncertainty in the construction industry. Task uncertainty derives from small batch production in which units of one to tens are typical. Task uncertainty is inherent in each construction project. New problems emerge, solutions must be found and the learning is not always transferable to the next project. Natural uncertainty also affects construction work. For example, geotechnical conditions are unknown before work commences and inclement weather can cause disruption and delay. Organisational uncertainty arises from the fact that construction projects represent temporary coalitions between functionally distinct parties. Tensions can arise and there is a period within which team members learn to work with one another effectively. Contracting uncertainty arises due to errors in estimating. Another source of contracting uncertainty is that small changes in tender success rate lead to large changes in turnover because projects represent a high proportion of total turnover for firms (Winch 1989). Given the assumption that bounded rationality applies, the uncertain nature of construction work should incur high transaction costs.

The other two sources of transaction costs, asset specificity and opportunism, are also evident in the construction industry. Asset specificity is not a significant factor prior to a contract being let because, except for specialised civil engineering or building services work, a client's ability to switch between alternative contractors is high (Winch 1989). However, once a contract has been awarded, a monopolistic situation arises because it becomes very difficult and costly for a client to change contractors (Winch 1989). This creates the potential for opportunistic behaviour, on the part of contractors, such as the use of changes in project specification to extract a high price for 'extras' (Winch 1989).

THE CONSTRUCTION MARKET

Theoretically, the existence of uncertainty and opportunism in the construction industry should increase the cost of market transactions. Despite this, outsourcing is extremely prevalent (Alsogoff and McDermott 1994). Uher and Runeson (1985) reported that over 90% of Australian construction work is outsourced.

Winch (1989) suggests that, within the transaction cost economics framework, the construction industry in the United Kingdom is a case of market failure. He asserts that the high level of market governance of transactions has brought about the situation that transaction and production costs exceed the cost of similar transactions being carried out in-house. He concludes that vertical integration would eliminate the problem of information impactedness that exists between parties to a contract. In particular, the designer/main contractor and principal contractor/specialist subcontractor interfaces could be more economically governed by a hierarchy rather than a market structure.

Examination of the components of transaction costs arising from the sources of bounded rationality, opportunism and asset specificity reveals that much of these costs are *ex-post* costs, incurred after the contract has been awarded. These costs include direct costs such as the cost of implementing elaborate surveillance and control systems, using computer-based scheduling models and cost accounting, measuring performance, implementing a quality assurance system and providing additional of layers of the managerial hierarchy (Reve and

Levitt 1984). There are also indirect costs such as the effect on motivation and alienation of workers resulting from the visible demonstration of a lack of trust. The extent to which these *ex-post* costs could be reduced by actions taken prior to the award of a contract should be investigated. It is possible that careful selection of a contractor may reduce the need for these control mechanisms and thus reduce total transaction costs.

CONTRACTOR SELECTION AND TRANSACTION COSTS

Contractor selection decisions are usually made following pre-selection activities of competition or negotiation (Smith 1986, Lower 1982). Under a competitive contractor selection process, the client will put the works to tender and interested contractors are invited to submit bids. Bidding is pursued either through open or selective tendering. Open tendering allows all interested parties the opportunity to bid for the works. In the selective tendering process, contractors are subject to prequalification. Firms are short-listed on the basis of this prequalification and only a limited number are then invited to bid (Seeley 1984, Willis and Willis 1980). In some circumstances, clients may decide to engage in negotiation with prospective contractors rather than competitive bidding. Tendering may be phased with a short-list generated after the first stage of competition. Negotiation may then be initiated between one or two firms on the short-list and the client and the final contractor selection decision, based upon this negotiation (Kwakye 1994, Mudd 1984).

Selecting a contractor is an important decision that has a significant bearing on the success and cost of a project. There is a difference between lowest initial cost and the most competitive price for a client given prevalent market conditions (Holt *et al* 1995). The selection of an adverse contractor can result in unsatisfactory outcomes such as poor quality or time overruns. Ultimately these outcomes cost clients financially. For example, in the case of construction delays, clients' invested capital is committed while the potential generation of income from the investment is postponed.

Ex-post transaction costs arising from disputes and litigation can also be high. Annual administration costs for construction claims filed against the Texas Department of Transportation are estimated to represent 2.8% of total agency payroll and for every $1 paid in claims to a contractor, $9 of public money is spent (Crowley and Hancher 1995). Crowley and Hancher (1995) argue that to reduce these costs there is a need for objective, effective evaluation and selection of contractors. Thus far, the relationship between the method of contractor selection and transaction costs has not been investigated. Different models of contractor selection are described below and their usefulness in economising on transaction costs is discussed.

COMPETITIVE BIDDING

Most construction clients favour competitive tendering (Murdoch and Hughes 1992; Dawood 1994; Holt et al 1995). Merna and Smith (1990) observe that through competitive tendering, contracts are typically awarded to the bidder with the lowest price. In the public sector, this usually happens for reasons of accountability (Rankin *et al*. 1996, Turner 1979). It is argued that using lowest price as yardstick for selecting contractors ensures that the client gets value for money through free and fair competition (Trickey 1982, Smith 1986).

However, lowest contemporaneous price cannot be guaranteed to yield the overall lowest project cost after execution (Pearson 1985, Dawood 1994, Pasquire and Collins 1997). In construction, contractors commonly implement the practice of adjusting their bid prices in an attempt to underbid fellow competitors and win contracts. Research indicates that this

practice produces unrealistically low bids in some open tenders (Kwakye 1994, Herbsman & Ellis 1992). Murdoch and Hughes (1992) caution that lowest price syndrome does not guarantee best product. Holt *et al* (1995) cite research evidence to indicate that contracts let by open competition are less successful and exhibit greater divergence between final contract value and tender value than contracts awarded by other means.

Uncertainty and bounded rationality are identified as sources of transaction costs. It is likely that competitive tendering serves to increase contracting uncertainty arising from estimating errors or the deliberate submission of an unrealistically low bid. For example the practice of contractors 'buying work' to maintain continuity of employment is known to occur. This poses a serious risk to clients since there is an increased possibility that the contractor will collapse, leaving an unfinished product and requiring that the client engage another contractor (Holt *et al* 1995). The practice of reducing a bid to the value that the contractor believes is sufficiently low to win the job also exposes clients to the risk of opportunistic behaviour such as post-contractual claims and price overruns (Crowley and Hancher 1995a). Such opportunistic behaviour is probably encouraged by the monopolistic situation whereby, once a contract has been awarded, it is difficult for a client to remove a contractor and engage another. According to transaction cost economic theory, the practice of awarding the contract to the lowest bidder should be associated with relatively high transaction costs owing to the degree of contracting uncertainty and the prospect of opportunistic behaviour. Use of this method of selecting contractors should therefore be considered in the light of its effects on the costs of the transaction.

COMPARATIVE BID EVALUATION MODELS

Bid evaluation methods of contractor selection commonly involve comparisons of price and time factors amongst bids. Gilbreath (1992) recommends the use of a fair price estimate as a means of identifying mistakes or malpractices on the part of bidders. This involves the use of an internally prepared bid estimate as a benchmark to measuring actual bids during bid evaluation. Alternatively, some owners identify a predetermined project cost range and the lowest bidder, within this pre-determined price range is then selected (Lewis 1977). Discounted cash flow (DCF) analysis is another method for identifying unethical practices at the tendering stage (Hardy *et al*. 1981). The net cash for project execution, as payable to bidders, is calculated and reduced to present day value before bids are compared (Selinger 1983; Vorster 1977; Smith 1979). Some countries, for example Taiwan and Italy, have adopted an average-bid method of awarding construction contracts (Ioannou and Leu 1993). Crowley and Hancher (1995a) developed a more sophisticated inferential statistical technique to identify discordant bids that are not in line with other bids received.

Comparative bid evaluation techniques may be useful in identifying sources of opportunistic behaviour before entering into a contract. Commonly occurring misunderstandings and errors can give rise to opportunistic practices such as the pricing of bill items so as to facilitate greater cash benefits in the event of variations (Yizhe and Youjie 1992; Teicholz and Ashley 1978). Bid evaluation techniques could assist in identifying such misunderstandings or errors that require clarification or correction. Unethical practices such as front-end loading and bidder collusion may also be identified using bid evaluation methods. According to transaction cost theory, the identification and elimination of sources opportunistic behaviour would serve to reduce the costs of a transaction.

Comparative bid evaluation techniques are based on the assumption that tendering is a rational, predictable process when in fact bidding is unpredictable and characterised by uncertainty (Green 1989). Price rates vary according to technological, economic and

organisational factors (Crowley and Hancher 1995b) and there is no unique answer as to how much each individual job component will cost (Fine 1975). Uncertainties inherent in the tendering process will probably not be greatly reduced through the use of comparative bid evaluation techniques since these techniques are based on the false assumption that tendering behaviour is rational. The effectiveness of the techniques in reducing transaction costs arising from uncertainty is therefore likely to be limited.

Bid evaluation models do not take into account parameters other than tender price. It is likely that other factors, such as the contractor's reputation, previous experience, quality and occupational health and safety performance will also give rise to uncertainty and opportunistic behaviour and will therefore affect transaction costs. Consideration of a broader range of parameters is probably needed if transaction costs are to be economised.

QUALIFICATION

Qualification relates to the assessment of contractors' competence. Qualification may occur on a project by project basis or may be an ongoing process in which clients maintain a record of contractor performance for future reference. Prequalification is the practice by which owners vet contractors prior to distributing contract documents (Rankin *et al*, 1996). This practice ensures that all contractors who are allowed to bid are competent to carry out the works and final contractor selection can focus merely on comparing and evaluating bids rather than considering contractor competence. Under the post-qualification model, there is no restriction on who may submit a bid but only those tenderers with the lowest bids will be subject to qualification or competence assessment (Rankin *et al* 1996).

Russell and Jaselskis (1992) found that contractor failure is more likely to occur when an owner spends minimal effort evaluating a contractor's competence to perform the work prior to accepting the contractor's bid. Furthermore, contractor failure significantly increases the final project cost and schedule duration.

The *ex-ante* transaction costs borne by a client would be less for post-qualification than for prequalification since, in post-qualification, only a few bidders are subject to competency assessment while prequalification requires that the competency of all prospective bidders be reviewed.

Several authors or agencies have proposed multi-parameter models for evaluating contractors' competence to meet client objectives. Existing multi-parameter models evaluate contractor's potential performance across a range of different criteria. Emphasis on different criteria varies between public and private clients (Russell *et al* 1992) and some models provide for the weighting of parameters according to individual client's needs (Herbsman and Ellis 1992).

Multi-parameter qualification models may integrate qualitative and quantitative assessment of contractors (Russell 1992). Russell proposes the development of a hybrid decision support system on the grounds that different modelling techniques are restricted in their capability and flexibility. Under Russell's model, financial stability is assessed through cash flow algorithms, ratio analyses, trend analyses, simulations and knowledge-based expert systems while technical expertise is assessed using fuzzy set modelling techniques.

Multi-parameter contractor qualification methods provide a much greater scope for reducing *ex-post* transaction costs than do bid evaluation models in that they have the capacity to address a broad range of issue that commonly give rise to opportunistic behaviour and uncertainty. Traditional time, cost and quality factors are considered alongside additional

factors such as safety, durability, security, human resource management and maintenance (National Joint Consultative Committee for Building 1989, CIDA 1993). While the *ex-ante* cost of using multi-parameter qualification methods would be relatively high owing to the need to collect and analyse a substantial amount of data for each contractor, these systems have the potential to significantly reduce *ex-post* costs incurred as a result of the transaction. For example, selecting a contractor accredited to ISO 9000 would probably reduce the requirement for a client to undertake costly quality monitoring activities.

QUANTITATIVE MODELS

Quantitative evaluation techniques utilise formulae or computer programmes in multi-parameter contractor evaluation. Quantitative evaluation models differ from each other with respect to the computational algorithms they employ. Approaches adopted include:

- the use of a multi-dimensional utility model of the contractor selection process (Diekmann 1981);
- the use of cluster analysis to identify the bid representing overall utility optimisation (Seydel and Olson 1990);
- the use of fuzzy set theory to subjectively assess and aggregate the effect of multiple criteria (Nguyen 1985);
- the use of fuzzy set theory to organise knowledge and experience of building professionals in the development of a fuzzy expert system for contractor selection (Wong and So 1995);
- the use of a linear hierarchical decision model and computerised system with in-built rules based on heuristic knowledge (Russell *et al.* 1990);
- the use of an analytical hierarchy process model for carrying out bid evaluation (Mustafa and Ryan 1990); and
- the use of performance ranking using a Likert-type scale followed by additive and multiplicative computation of data (Assaf and Jannadi 1994).

The development of reliable and valid quantitative evaluation methods for multi-parameter contractor evaluation could effectively reduce both *ex-ante* and *ex-post* transaction costs. The reliance on subjective assessment of performance in some criteria renders the application of multi-parameter contractor selection processes unwieldy and difficult to implement. Costs associated with training personnel in evaluating performance are high where subjective judgements are required. Gathering and evaluating qualitative data may also be time consuming compared to the collection and analysis of easily quantified information.

Ex-post costs could be reduced through quantitative evaluation of contractor performance since more objective, consistent and reliable results would be achieved. The likelihood of human error or bias would be minimised and contractor selection decisions would be defensible to unsuccessful tenderers who may consider challenging contractor selection decisions as being ‘arbitrary.’

DISCUSSION

Information impactedness is a source of transaction costs and thus freely available information could be expected to reduce transaction costs. However, information is only available at a cost. The cost of collecting information before entering into a contractual

relationship represents an *ex-ante* transaction cost. It is theoretically possible to gather perfect information on all prospective tenderers for the purpose of making a contractor selection decision (Holt et al 1995) but the *ex-ante* transaction costs associated with the collection of such perfect information would be very high. To collect perfect information could be expected to minimise bounded rationality and limit the likelihood of opportunistic behaviour. The minimisation of bounded rationality and opportunism should act to reduce *ex-post* costs of entering into the contract since the contractor engaged would be less likely to engage in opportunistic behaviour and the requirements for policing the contract and/or entering into costly litigation will be reduced. Thus in a situation of perfect information, *ex-ante* costs would be at a maximum but *ex-post* costs would be minimised.

On the other hand, where little information about prospective tenderers is available prior to the award of a contract, a client's bounded rationality could be expected to be high and the client would be exposed to a high risk of opportunistic behaviour on the part of contractors. *Ex-ante* transaction costs would be low in such circumstances, since little or no cost has been incurred in collecting information about prospective tenderers. However, it is likely that *ex-post* costs, associated with the need for close monitoring of contractor activities and the increased possibility of costly legal disputes and claims, will be high.

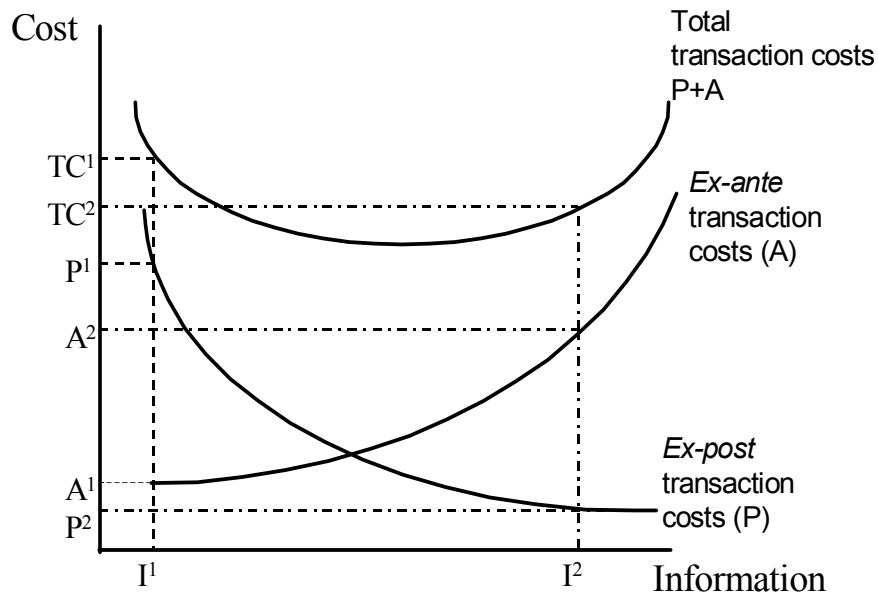

Figure 1: Theoretical model of *ex-ante* and *ex-post* transaction costs

Figure one shows a theoretical model of the relationship between *ex-ante* and *ex-post* transaction costs, information and total transaction costs. Where information about prospective contractors obtained prior to contractor selection is low (I^1), *ex-ante* costs are also low (A^1) *but ex-post* costs are high (P^1). Total transaction costs are identified as being the sum of *ex-ante* and *ex-post* costs of transactions. In Figure 1, where information obtained prior to contractor selection is low, total transaction costs would be the sum of A^1 and P^1, represented on the graph by $TC^{1.}$

Where information about prospective contractors obtained prior to the contractor selection decision is higher (I^2), *ex-ante* costs incurred in collecting this information will also be high (A^2). However, *ex-post* costs will be reduced (P^2). In Figure 1, where information obtained

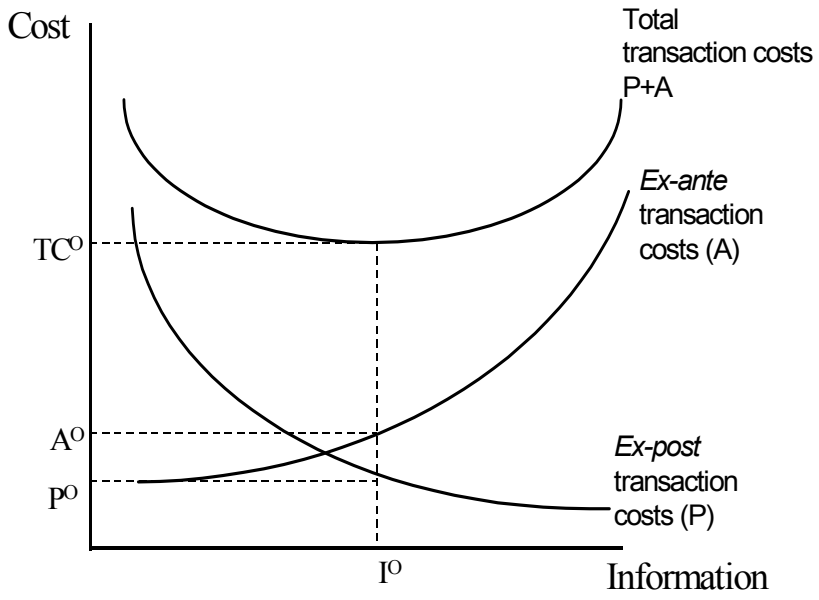

Figure 2: Theoretical model of optimum transaction costs

prior to the contractor selection is high, total transaction costs would be the sum of A^2 and P^2, represented on the graph by TC^2.

Figure 2 shows that, theoretically, transaction costs may be optimised at the lowest point in the total transaction cost curve. The optimum cost of transaction is therefore TC^O, which related to an information level of I^O, an *ex-post cost* of P^O and an *ex-ante* cost of A^O.

Different models of contractor selection will require that differing amounts of information about prospective tenderers be gathered. At one extreme, competitive tendering requires little information prior to making the contractor selection decision. Competitive tendering may be represented by level I^1 in Figure 1. The more complex the contractor selection model, the greater the information required prior to selecting a contractor. The multi-attribute and quantitative models reviewed may be represented by level I^2 in Figure 1. Theoretically, the ideal contractor selection model could be said to require an information level of I^O (Figure 2) since at this point transaction costs are at their lowest.

Most of the contractor selection literature has developed theoretical models for making the selection decision. Some authors have sought to test these models. Holt et al (1995) rated contractors according to their selection model and compared these ratings with past performance of contractors using the parameters of cost, time and quality. Crowley and Hancher (1995) applied tendering data to their statistical selection model to evaluate selection decisions made in past projects. Both the development and testing of contractor selection models conducted thus far has occurred without reference to the theory of transaction costs. The relationship between contractor selection models and transaction costs should be investigated. The transaction cost model presented in Figures 1 and 2 should be tested. If found to be valid, it would serve as a useful basis on which to compare the efficacy and usefulness of the different models of contractor selection.

FUTURE RESEARCH

Coase (1992) acknowledges that his early work was theoretical and advocates empirical research to substantiate transaction cost economics theory. Empirical research is emerging to support the transaction cost concepts (Lyons 1994, Lyons 1995, Dutta and John 1995). Winch's suggestion that the construction industry market in the United Kingdom is a case of market failure is not based upon empirical evidence (Winch 1989) and no work has been undertaken to investigate the validity of transaction cost theory in the construction industry. The extent to which this theory explains contracting (and also subcontracting) in the construction industry should be investigated. Some attempt should be made to quantify transaction costs associated with outsourcing construction work.

The contractor selection literature does not address the issue of the cost of implementing contractor selection procedures or the cost-effectiveness of these procedures. Most contractor selection models reviewed have not been implemented and rigorously evaluated. Contractor selection methods should be empirically tested. The cost of employing different selection methods should be identified and weighed against their effectiveness in reducing the *ex-post* costs of market transactions.

CONCLUSIONS

Contractor selection models may best be understood in the broader context of the business economics literature. The theory of transaction cost economics dictates that the decision to outsource production is based upon the relative costs associated with in-house production and outsourcing. The theory holds that firms will seek to economise on transaction costs. If the reason for outsourcing construction work can be explained by transaction cost economic theory, then clients should consider the impact of contractor selection on the costs of market transactions.

Within the construction field, many theorists have developed models for selecting suitable contractors. These models vary in their degree of complexity and objectivity. Multi-parameter contractor selection models offer the best scope for reduction of transaction costs because they address a broader range of sources of opportunistic behaviour and uncertainty than do comparative bid evaluation models. However, there is a need to develop and validate quantitative methods of evaluating performance in all of the parameters of such models.

Contractor selection systems should be subject to a cost-benefit analysis. The costs of having no system, such as losses incurred through poor quality, time overruns and claims, should be considered as a trade-off against evaluation and administrative costs. While it is theoretically possible to gather perfect information on all prospective tenderers for the purpose of making the best contractor selection decision, the cost of doing this is prohibitive. If transaction costs are regarded as arising primarily from information impactedness, the optimum information collection, analysis and evaluation system should be sought to economise on these costs.

Empirical research is required to evaluate the impact of contractor selection methods on transaction costs. The results of such analysis may find that contractor selection systems increase the *ex-ante* costs of transactions but are offset by reductions in monitoring requirements, claims and/or litigation costs.

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