Determining the magnitude of transaction costs in construction procurement systems: An exploratory study

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Abstract

Transaction cost economics (TCE) has traditionally examined customer-supplier relationships in the context of contractual arrangements. This enables the development of appropriate strategies, such as long-term agreements and alliances, to eliminate the risk associated with contracting uncertainty, limiting the number of instances of bargaining or opportunism and asset specificity. In the context of construction procurement decisions, TCE could generate a valuable understanding of the costs associated with coordination, inspection, translation, incentives, transactions, and other interactions. This paper therefore reports on an exploratory effort to capture the transaction costs (TCs) of different procurement systems used in construction projects. Specifically determining the relative values of TCs for Traditional and Design - Build systems for the purpose of comparison.

The paper involves a meta-study of construction procurement systems and TCE. It reviews the approach to the development of a conceptual framework that could enable the selection of appropriate procurement systems and/or make-or-buy decisions that could minimise TCs and therefore enhance the performance of the construction industry.

The study is an aspect of a doctoral research study on determining appropriate construction procurement systems based on rational evaluative tools (TCE being one such tool). An outline of the larger study programme that forms the basis of the current paper is presented to demonstrate the benefits of the research investigation to construction clients and the construction industry as a whole.

Keywords: Transaction costs, Procurement systems, Construction.

1. Introduction

Operational performance continues to generate interest in construction. For example the procurement process provides opportunities for cost reduction and value enhancement to project owners. The selection of appropriate procurement systems for a construction project may influence its success or failure. Merrow (2011) contends that procurement systems make a difference in project execution, while poorly managed project relationships

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negatively impact project performance (Meng et al. 2012, Merrow 2011). In fact Meng et al. (2012) has shown that poor supply chain relationships significantly impact the occurrence of cost overruns than time delays.

Relationships in the form of buyer-supplier relationships have been the object of several investigations in construction (Al-Najjar 1995, Artz 1999, Bajari et al. 2009, Kajewski et al. 2010, Eriksson 2007, Hughes et al. 2006, Love et al. 2009). However for the purpose of this paper, the costs associated with customer-supplier relationship in the context of contractual arrangements is the primary focus. TCE focuses on economic actors' behavioural assumptions (opportunism and bounded rationality) and transaction characteristics; i.e. asset specificity, uncertainty, frequency, complexity, and contestability (Williamson 1985, Williamson 2005, Williamson 2010b). Heide and John (1990) contend that TCE provides a useful framework for the selection of the most suitable procurement system for projects.

Eriksson (2007) argue that the procurement selection decisions are always judgmental, subject to bias, and heavily affected by individual experiences of a particular procurement system. Given that TCE is such a significant component of construction procurement, and that the procurement decision is highly cost sensitive, it seems apparent that there is a need to better evaluate TCs in construction. As early as 1985, Williamson (1985) suggested that the comparative costs of planning, adapting, and monitoring task completion under alternative procurement systems should be examined. Moreover, Turner (1997) expanded the notion to contemplate other important factors such as engineering, economic, environmental, and social factors, in the procurement selection process (Turner 1997). Therefore, theoretical elucidation is required to enhance the development of practical concepts and techniques, and to assess the circumstances under which they are suitable for a certain purpose (Cox et al. 1998). Theoretical concepts of TCE are supported by several empirical studies (Artz 1999, Heide and Stump 1995, Melese and Franck 2005) and will be discussed later in this paper. Researchers within the TCE field suggest the applicability of transaction costs theory (TCT) although some have employed imperfect proxies for key variables. TCT contends that there are costs to conducting transactions through the market, which can be reduced through certain mechanisms (Coase 1988, Williamson 1971). Specifically, these costs relate to drafting, negotiating, and safeguarding and exchange that could impede smooth transactions (Williamson 1985). Further, changes in design and information requirements for procurement are significant to TCs in construction (Wenan and Mengjun 2010).

This paper aims to investigate the linkage between procurement systems selection and TCs, using TCE methodologies. The paper presents a conceptual model that is developed, for the selection of the most economic procurement system that could achieve project success. The model of procurement selection so informed could help to reduce costs, enhance productivity, and increase quality performance and customer satisfaction.

2. Literature Review

2.1 Transaction cost

Ronald Coase first introduced the concept of TCs in 1937 (Jacobides 2008). He subsequently further investigated pricing mechanisms and concluded that there are costs related to searching for relevant prices, negotiating, and making a contract (Coase 1992, Coase 1988, Coase 1960). Williamson (1985) developed the theory of TCE by focusing on the economic actors' behavioral assumptions (opportunism and bounded rationality) and transaction characteristics; i.e. asset specificity, uncertainty, frequency, complexity, and contestability (Williamson 2005, Williamson 2010a, Williamson 1985). Economic actors behaving opportunistically with bounded rationality and uncertainties dominate contracts, which partially accounts for contingencies. Importantly TCE has traditionally examined the customer-supplier relationship in the context of a contractual arrangement. This relationship is associated with TCs including; costs of information, negotiation, competitive advantage, contract administration and management, market structure, enforcement, and measuring/monitoring performance (Melese and Franck 2005, Artz 1999, Heide and Stump 1995).

TCs perspective has received considerable attention by researchers and academics and has been applied to a variety of construction topics. The rationale behind applying TCs in construction is to understand the cooperation and motivation among project stakeholders. Eccles (1981) conducted an investigation on the impact of asset specificity and uncertainty in the governance form of construction firms (Eccles 1981). Eccles adopted the hybrid contract (the quasi-firm) for examining the relationship between contractor and sub-contractor. Winch (1989, 2008) investigated the relationship of socio-technical systems, organization and environment, and project management in construction. Winch believes that the three perspectives do not fully elucidate the differentiation and integration of market governance. This means the transaction between firms in using the market governance model does not fully examine the relationships between firms (Winch 1989, 2008). Hence, Winch adopted the TCs perspective as an alternative approach in systematically handling the relationships within and between firms. The significance of his study was in specifying the sources of uncertainty, complexity, and number of these situations facing construction firms.

Reve and Levitt (1984) examined the effect of applying transaction cost framework in explaining contractual uncertainties in construction using the project as a unit of analysis in determining resource allocation uncertainties. However, construction project does not of itself allocate resources. Resources (land, labour, and capital) are allocated by individual firm involved in the delivery of the project. This in turn is dictated by the requirements of the client. Alsagoff and McDermott (1994) discussed applying TCE theory to explore the causes of disputes between clients, contractors, and subcontractors in the construction industry (Alsagoff and McDermott 1994). They concluded that contractual incompleteness and opportunism are the root causes of conflicts and disputes between firms. Therefore, they introduced the relational contracts as alternative contractual approach in resolving conflicts among contractual parties.

Walker and Wing (1999) developed a framework that explains the possibility of integrating project management theory (PMT) and TCE theory (Walker and Wing 1999). They tried to delineate the relationship between these approaches and the benefits of merging the two approaches in improving construction management theory. Therefore, they made a comparison of a traditional organization structure and a design-build structure to illustrate this relationship. By doing so they tried to answer why design and construction processes are separated in the traditional system. Walker believes TCE theory is providing an alternative theoretical basis, which can be integrated with the project management perspective and correlated models of organization. The strength of this study in underpinning the behavioural assumptions of TCE theory, such as opportunism, moral hazard, and shirking that the management theory could not cover.

Chang and Ive (2000, 2007) in their study proposed modifications to TCE methodology to make it applicable in dealing with construction (Chang and Ive 2000, 2007). They developed the direct measurement approach (DMA) and indirect measure approach (IMA) to predict theoretically the amount of TCs incurred. The DMA based on the identification and measurement of TCs elements, while, the IMA explained the relative effectiveness of governance structures in terms of TCs. Moreover, they tried to quantitatively analyze TCs elements to explore the link between these costs and procurement routes during construction. The weakness of this study is in dealing with theory for measuring TCs. Thus, the distinction between production costs and TCs became less clear.

Jin and Zhang (2011) developed a framework for risk allocation strategy for public private partnership (PPP) based on TCs characters. In this framework, the determinants of efficient risk allocation were identified based on TCE theory. As a result, the buy-or-make decision can be taken based on the risk response evaluation for adopting certain strategy. Using a proper risk allocation strategy can significantly reduce TCs. This is because risk allocation has been judged on a cost benefit basis. Therefore, improper risk allocated strategy might incurred costs such as; higher contingency costs, more resources to monitor risk, quality costs, safeguarding costs, enforcement costs, and legal costs.

In General studies applying TCs perspective in construction are not fully reliable with the suggestions of TCT; others employed imperfect proxies for key variables. Moreover some developed models have not directly tested the parameters of TCT. Nevertheless four key characteristics of transactions can make them more costly: complexity, uncertainty, frequency, and asset specificity (Williamson 2010a). Therefore, understanding the key characteristics of a transaction can help decision-makers improve the design of contracts, organizations, and other governance structures that could reduce TCs and improve the gains from an exchange between buyers and sellers (Williamson 2008). This research contemplates the gaps of these researches through developing a model that sets the mechanisms in selecting the most appropriate procurement system based on TCs. Further, a comparison of the results will be shown in a graph that illustrates the amount of different TCs for two procurement systems; the Traditional and Design – Build.

2.2 The linkage between Procurement system and TCs

The relationships between procurement strategies, contractual arrangements, and tendering procedures are not well articulated in the construction industry, whereas contractual arrangements are often dictated by the procurement strategy (Hackett et al. 2007, Hughes et al. 2006, Murdoch and Hughes 2008). Dudkin and Valila's (2006) study in the UK construction industry shows that the private/public partnership projects (PPPs) in the UK are continually affected by significant costs related to the procurement phase of PPPs. Currently this amounts to an average 10% of the capital value of the projects that erodes the potential savings achieved within partnership projects (Dudkin and Valila 2005). There are other TCs that affect the performance of PPPs that are not easily assessed, for example the opportunity costs as a result of renegotiation and delays to the completion of the project (Ho and Tsui 2009), which may significantly undermine expected benefits. Frank et al. (2007) also found that outsourcing relationships could involve extra TCs such as negotiation, measuring, and monitoring costs that can quickly overwhelm a 10% production cost advantage (Frank et al. 2007). It would therefore seem that TCs are highly significant in the overall cost of construction on any project.

There is a current and pressing need to examine the relationship between the procurement system and TCs in the New Zealand construction industry. Recent studies have shown generally that the New Zealand construction industry has poor productivity (Tran and Tookey 2011). More broadly, this recognition has led to extensive efforts to achieve a 20% increase in productivity by 2020 (see www.buildingvalue.co.nz). Since productivity is a function of cost versus revenues, developing and improved the understanding of the basis of costs offers significant potential to affect construction productivity.

With an appropriate TCE-based framework, acquisition management practices could be improved by evaluating the largely hidden costs of managing contractual relationships. TCE offers useful insights on appropriate contract types, provides useful predictions about how contracting relationships evolve over the project's life, and highlights the crucial issue of resource ownership and the associated problem of asset specificity. The procurement selection process is associated with the degree of defined contract specifications and the value of transactions. With TC analysis, emphasis could be placed on developing formalized governance mechanisms (i.e. formal contracts, rules and regulations, reputation mechanisms, termination agreements, warranties, etc.) and suitable strategies, such as long-term agreements and alliances. This way it would be possible to eliminate the risk associated with procurement uncertainties, limiting the number of instances of bargaining or opportunism and any asset specificity issues. According to Angelis et al. (2008) the reasoning behind such strategies is the elimination of coordination and motivation cost which ultimately reduces TCs (Angelis et al. 2008). Thus a TCE perspective could improve the procurement phase through: firstly, developing a service strategy by improving risk profile; secondly, identifying the service goals, objectives, and priorities through better contractual agreements; thirdly, identifying the capacity development requirements through enhanced long-term strategies; fourthly, ensuring adequate funding through improved cost estimation, and finally, defining the most feasible contractual approach.

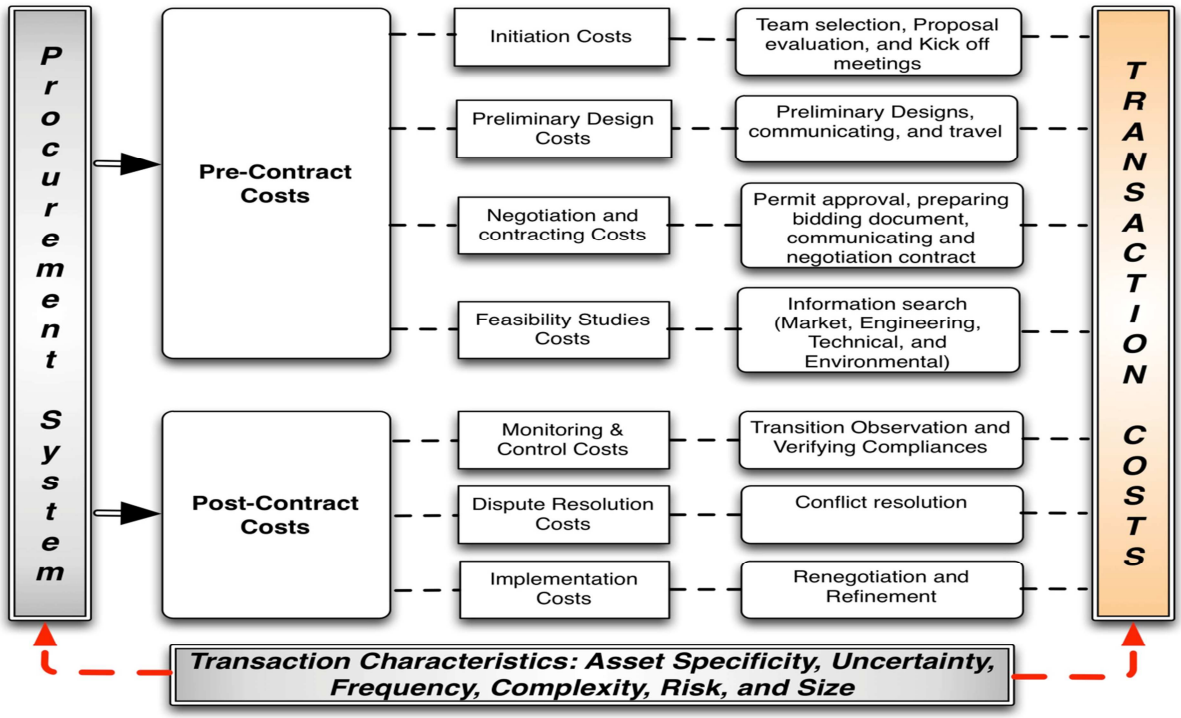

Figure 1: Delineation of TC activities in construction procurement systems

The larger study on which this paper is based determines the magnitude of TCs associated with procurement processes, for Traditional and Design - Build systems. Relative cost centers such as coordination, inspection, translation, incentives, transactions, and elimination of interactions are captured. In addition, the study attempts to define processes and identify the time and cost importance of procurement activities and processes. The study posits that any mechanism that can determine the magnitude of TCs will allow contractors to make more appropriate procurement decisions. Figure 1 illustrates the key cost elements within procurement systems that the TCE-based framework could focus on. Procurement systems implemented on any project have a significant impact on the TCs associated with the pre-contract and post-contract phases. Pre-contract costs relate to activities carried out during initiation, preliminary design, negotiation and contracting, and feasibility studies; while post-contract costs are commonly associated with monitoring and control, dispute resolution, and implementation activities for projects. These costs could be measured by evaluating the time- spent daily by professionals on these respective procurement activities relative to other project activities.

Common procurement systems are the Traditional, Design - Build (DB), Management, Alliance, Build Operate and Transfer (BOT), and PPP (Brook 2008, Murdoch and Hughes 2008). In the traditional procurement system the design is very often completed (or near completion) before construction begins, thus the certainty of a tender price is higher because the project scope is defined. In terms of TCs one could hypothesize that relative to other procurement systems its pre-contract costs are likely to be higher because of the time spent in defining the project scope before construction begins. With systems such as DB, BOT, and Management, it is more usual to commence construction before designs are completed. According to Brook (2008) such systems (DB, BOT, and Management) could benefit from speedy construction because the design and construction phases have been integrated,

although incomplete documentation is often a source of uncertainty and could pose difficulties to cost prediction and estimation, TCs for these integrated systems may be comparatively lower at the pre-contract phase but higher if and when implementation problems occur as a consequence of incomplete designs. Conversely with Alliance procurement systems, TCs at the pre-contract phase could comparatively be the highest because of the level of preparatory activities involved in setting up alliances.

2.3 Procurement selection: the model

Researchers have developed several theoretical models for the procurement selection process in construction (Skitmore and Marsden 1988, Chan et al. 2001, Kumaraswamy and Dissanayaka 1998, NEDO 1985, Singh 1990, Cheung et al. 2001, Alhazmi and McCaffer 2000, Franks 1990). However, these models generally do not address the environmental factors (internal and external) affecting firms in the procurement selection process. As mentioned previously, procurement system selection is very often subjective. This paper aims to address these weaknesses by adopting a more strategic approach that combines cost evaluation criteria with environmental (contextual) factors. Figure 2 depicts a comprehensive framework of criteria for procurement selection. The figure depicts a combination of project constraints, objectives, and environmental forces that could influence procurement system decisions. The framework is developed in line with Williamson (1991, 1998) wherein human and environmental forces were considered the most important contributory factors to TCs. In this case, environmental forces represent external forces (i.e. threats and opportunities) and internal forces (i.e. weaknesses and strengths) of the procuring party (project owner).

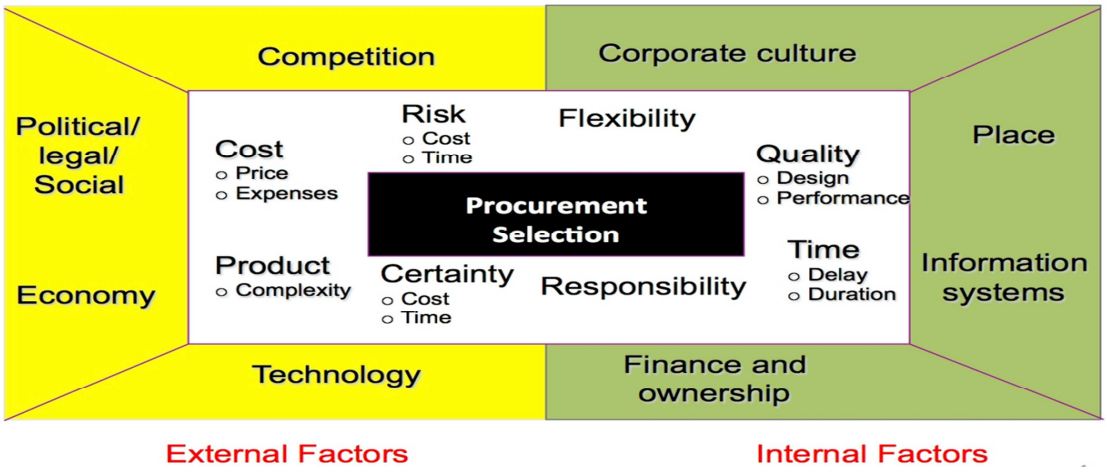

Figure 2: The determinants of procurement systems

Political, legal, and social factors play a crucial role in procurement selection decisions. For example Duncan (Duncan 2009) posits that lump-sum competitive tendering and cost reimbursement systems was the procurement trend in the era of post-war regeneration (1946-1969). During the 1970-1979 period of high inflation in much of the developed world, an increasing preponderance of clients started to use management contracting in the hope of saving some money by ‘smart’ letting of contracts. That said, it is well documented that the management form of contract should be kept in the preserve of ‘experienced clients’ (Masterman and Gameson 1994). Indeed the management route has been cited as a

significant contributor to the cost escalation of such projects as the Scottish Parliament building in the UK (Fraser 2004). Meanwhile the sub-prime mortgage market collapse in 2009 was reported to have caused a shift in procurement trend to design and build (Duncan 2009). Brochner (1990) suggested that procurement selection could be influenced by the level of information system (IT) usage and availability. IT improves coordination between team members, quality control/product inspection, and translation of client needs. Other determinants of procurement systems include: corporate culture (Wright and Race 2004), market competition (Duncan 2009), technology (Duncan 2009, Schermerhorn et al. 2002), project location (Hughes et al. 2006), finance situations and project ownership. These factors are depicted in Figure 2.

3. The research

As earlier alluded to, the current study is a part of a larger research (doctoral) programme that determines suitable construction procurement systems based on TCE tools. Key information in this larger study is outlined under the following subheadings.

3.1 The research questions

The research questions were developed based on the literature reviewed. Clearly there is a current need to investigate the linkage between procurement systems and TCs and to determine how this information could be useful in the procurement selection process. The study therefore will attempt to answer the following key questions:

1. What is the linkage between procurement systems adopted and the magnitude of TCs?

2. How could TCs evaluation help in the selection of appropriate procurement systems for construction projects?

3. How could client's procurement selection procedures be improved?

Addressing these research questions could help to improve procurement selection practices in the construction industry, and subsequently reduce the costs associated with the project administration.

3.2 The research objectives

1. To identify and categorize TCs for two procurement systems, the Traditional and Design-Build in New Zealand construction projects during the pre-contract phase and post-contract phase.

2. To investigate the linkage between the procurement systems adopted and the TCs incurred with this adoption. This objective could be achieved by evaluating the cost of search and information, procurement, and monitoring and control cost.

3. To develop a model for the procurement selection process based on TCs.

4. To provide guidance for the client undertaking the construction and procurement selection process.

3.3 The research design

In pursuit of the goals and objectives of this research, a framework was developed and this is presented in figure 3. This framework contains four sequential phases. The first phase covers problem recognition and research scope. This will be achieved by an extensive review of relevant literature to articulate the research questions and objectives.

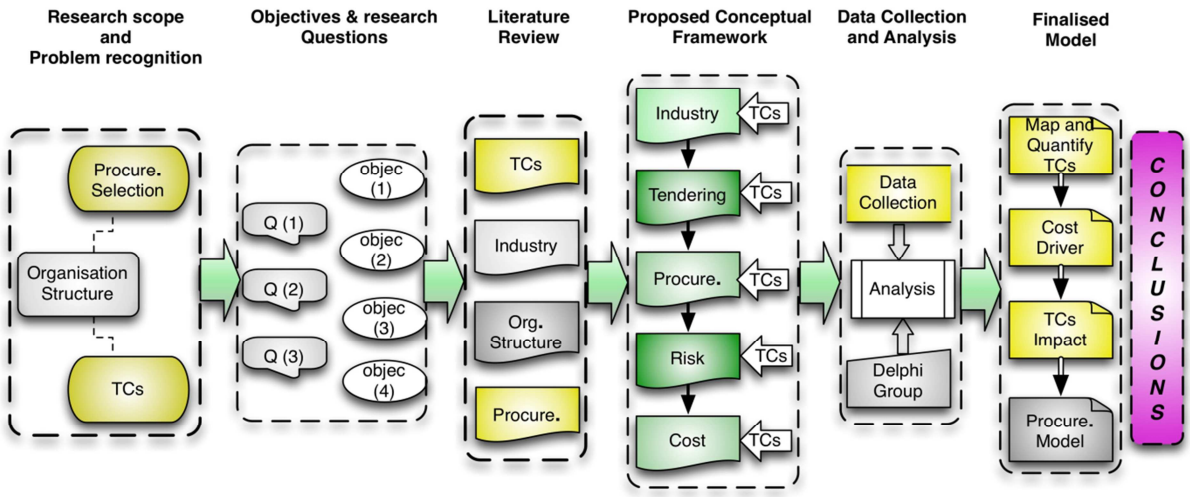

Figure 3: The research design

The second phase involves data collection and analysis. Two data collection tools will be developed to collect information from two key research participants. The first set of information will be obtained through the administration of a pilot questionnaire (using Delphi techniques) to an expert group, to validate the proposed survey questions. The second set of information will be procured through the administration of a semi-structured questionnaire to key construction professionals (at both managerial and operational levels). These professionals (project design consultants, contractors, suppliers) involved in project procurement activities would define processes and identify the time and cost importance of activities within respective processes. Data will be analyzed using structured data analysis techniques. It is envisaged that a verification exercise involving subject matter experts will be conducted to validate the results emerging from these analyses.

The third phase will involve the synthesis of the research findings. This will include a comparison among alternative procurement processes to evaluate the TCs associated with each one. Simple interpretive and descriptive methods of presentation will be adopted so that the findings will be communicative and understandable. This could be achieved using matrices that will indicate the variability of time, resource and technology sensitive costs across the range of activities involved in different procurement systems.

The final phase will conclude the research and proffer necessary recommendations based on the TCE of different procurement systems. It will provide decision makers with guidelines

for the selection of the most applicable procurement systems under a range of project circumstances.

At present the design of the study is largely evolved and the next step will be the collection of data. This is anticipated to be well advanced by mid-2013, with preliminary findings anticipated to be available from that time.

3.4 Potential benefits of the research

Generally, this research will benefit the wider construction industry through enhanced performance by eliminating non-adding value activities throughout project procurement processes. Some other direct benefits include:

1. Enhanced project performance - TCs are very often borne by the construction client as contractors (through submitted bids) and other project parties (through service invoices) pass this on. Eliminating TCs associated with non-value adding procurement activities would ultimately improve construction project performance.

2. Improved operational practice - In construction risks are generated at different levels of the supply-chain such as design and construction risk, financial risk, and market risk. The decision to outsource construction activity is made to reduce TCs through offsetting and/or mitigating risks and reducing capital employed in specialized sub-trades. Therefore improve operational practice, for example procurement practice will improve risk mitigation that inherently improves performance.

3. Reduced coordination and motivation costs - This could be achieved by applying proper strategies such as long-term agreements and alliances, which reduce TCs of writing formal contracts, termination agreements, warranties, etc. These strategies also reduce the risk associated with uncertainty, bargaining and opportunism, and asset specificity.

4. Conclusion

This paper introduced the potential for the use of TCE for determining the magnitude of TCs for different procurement systems in construction. It reviewed TCE, procurement systems and the linkages between them to show how procurement systems selection could benefit from this rational deterministic exercise. It is anticipated that these mechanisms may contribute to a reduction in TCs that may in turn reduce construction prices and/or increase profitability and productivity on construction projects. Further TCE could help to improve the procurement phase through: firstly, developing a service strategy by improving risk profile; secondly, identifying the service goals, objectives and priorities through better contractual agreements; thirdly, identifying capacity development requirements through enhanced long-term strategic procurement approaches; fourthly, ensuring adequate funding through improved cost estimation; and finally, defining the most feasible contractual approach under certain circumstances. This is achievable through discerning the costs associated with activities such as: coordination, inspection, translation, incentivising, and elimination of wasteful interactions.

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