Investigating the Relationship  
Between  
Construction Contract Documentation Incompleteness  
and  
Project Transaction Characteristics:  
Practical Considerations  

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Abstract:  
Research on Documentation Incompleteness (DI) and loss-and-expense claims (LEXs) is currently underway. As part of this research, an experiment must be designed to define the secondary relationship between DI and project transaction characteristics (Project Uncertainty and Asset Specificity) and determine the optimal level of DI for a specific type of building project construction. To maximize reliability and validity in investigating this secondary relationship, experimental design must ensure that only Uncertainty and Asset Specificity (the main independent variables of interest) are varied and consequences on DI (the dependent variable) are monitored and measured accurately. Generally, however, in construction research, it is neither practical nor possible to ensure that only one of the many independent variables affecting construction project outcomes varies in value; nor is it usually possible to isolate individual dependent variables (Fellows and Liu, 2008; Creswell, 2009). The usual approach is to devise quasi-experiments in which only the main independent variables, except the one of interest, are held approximately constant and consequences for the major dependent variable are measured.

This paper proposes a method of comparative study of the construction documentation used and transaction characteristics occurring on similar building projects, and executed around the same time, by similar firms employing similar organizational arrangements. This paper reports on the work in progress by reviewing the methodology and rationale for adoption of the methods proposed for the experiment. Consideration is given to how the method would answer the associated research questions, accomplish the research objectives, and interpret the results. Issues reviewed include: research approach and design and considerations for ensuring acquisition of high-quality, relevant data for analysis. Study limitations and strategies employed to increase confidence in the inferences drawn about the relationship between DI and project transaction characteristics are also presented.

This paper aims to raise awareness of: the nature of available building construction documentation and data on Uncertainty and Asset Specificity; practicality constraints of data acquisition; and appropriate analytical tests and techniques. It should serve as a useful guide for future researchers tasked with determining most appropriate methods for carrying out construction contract documentation research under similarly less than ideal circumstances.

Keywords:  
incomplete contract documentation, econometric analysis, transaction costs
1 Introduction

1.1 The Research Problem

Many construction industry observers and recognized conflict management researchers (Diekmann and Nelson, 1985; Hughes and Barber, 1992; Semple et al., 1994; Yogeswaran, Kumaraswamy, and Miller, 1997; Kumaraswamy, 1997; Seeley, 1997; Vidogah and Ndekugri, 1997; Vidogah and Ndekugri, 1998; Tilley, 1999; Hoxley, 2000; Jannadia et al., 2000; Abdul-Malak et al., 2002; Yates and Hardcastle, 2003; Winch, 2010; Chan and Henry, 2005; Love, 2005; Love, 2008; Love, 2009; Murdoch and Hughes, 2008; Itzer and Dikbas, 2009) note that increased commercial pressure on clients and reduced design fee levels lead to poor quality construction documentation. In turn, there is increased commercial pressure on contractors to work to tight time schedules using this poor quality documentation. Inadequate, incorrect, or incomplete construction documentation is considered to be a root cause of conflict, claims and disputes (Yates and Hardcastle, 2003). Often, poor quality documentation necessitates design changes and rework, which contributes to inefficient delays, disruption, reduced efficiencies, and cost increases, and ultimately conflict, claims, and disputes (Hughes and Barber, 1992; Yogeswaran et al., 1997; Kumaraswamy, 1997; Love, 2005). All of this contributes to the construction industry still having one of the worst public images of all British industries (Ball, 1988). A good starting point for dispelling this view of high cost, low productivity, poor quality, and chaotic working practices that has become synonymous with building work, would be at the poor quality documentation root. Through implementation of more modern and appropriate procedures to prevent situations deteriorating into destructive conflict, the image can be improved.

Repeatedly, for the UK construction industry, proposed solutions include: strategies for producing ‘improved’ quality procurement documentation and new policies (Clamp et al., 2007; Bingham, 2009; Love, 2009). Most endorsements, recommendations, and exhortations seem to use relatively arbitrary procedures for deciding documentation quality, and are largely based on subjective information and knee-jerk reactions to unpleasant experiences rather than on rigorous scientific analysis of the evidence. There are many procurement documentation policy debates across the private and public sectors (Bingham, 2009; Klein, 2009; BTET, 2009), but there seems to be no tried and tested scientific procedures for formulating sound construction procurement documentation policies. Essentially, the industry cannot truly know whether there may be project circumstances that would result in desirable outcomes (less costly, more efficient, and free of negative claim impacts) even if procured with ‘less complete’ (even if regarded as ‘less than perfect’ by some) documentation.

The many and varied experiences with documentation produced by the same combinations of documentation preparers (CDPRS) (e.g. quantity surveyors) and construction teams on different projects highlights the elusive nature of the right documentation formula to successfully eliminate unnecessary, and minimize unavoidable conflict (Whitfield, 1994; Yates and Hardcastle, 2003). Therefore, the industry should benefit from a tool designed to aid those responsible for documentation preparation in their decision-making on appropriate levels of documentation completeness to minimize claims, under the varying circumstances that different construction projects present.

The tool should consider the answer to the long-standing question:

‘What is the minimum information required in contracts so that those concerned know what is expected of them?’

(Higgin and Jessop (1965), as cited in Boyd and Wild (2003))
Also, removing documentation formulation guesswork should:
- bring more efficiency to documentation production processes;
- promote sound best practices and recommendations; and
- contribute to reducing frequencies/incidence, magnitude/costs (impacts) and negative effects of conflict, claims, and disputes.

The knowledge to be generated in developing this tool should be of interest to many members of the building industry. Clients will be able to apply a 'star rating' to the documentation that their design team professionals were commissioned to produce. Also, they will be made aware of marginal costs for improving the documentation quality and, therefore, be guided in their decisions about whether to authorize further work to improve the documentation produced. It should also be possible to use the tool for adjudication of tenders. Building team professionals should also benefit from removal of the guesswork in determining this unknown level of completeness to ensure that they are not inputting a disproportionate amount of work, aiming for an unachievable target. Essentially, the industry will gain a documentation quality assurance rating tool that can be used as a decision aid to documentation preparation policy.

Ultimately, use of this tool could lead to a better construction industry image because it would free more of project personnel time from attending to expensive and time-consuming conflict resolution activities; and allow more time to concentrate on developing modern and appropriate procedures for planning, scheduling, monitoring, controlling, and administering projects.

### 1.2 Proposed Solution to the Research Problem

Now, examining the research design behind the rating tool will contribute to the knowledge base on documentation preparation by examining the influence of project transaction characteristics on Documentation Incompleteness (DI) levels chosen by parties. Therefore, this paper takes a detailed look at the modelling processes behind the tool, details the model specification, choice of project transaction variables, and their theoretical and operational constructs. Finally, an explanation is given on how parties arrive at their contractual choice of the optimal level of DI, and how the model can be used to aid in documentation policy decisions.

Relative to other topics, there is very little coverage of inter-firm contractual relationships in the construction industry. Also, contract documentation issues do not feature prominently in the construction project management literature. This is very surprising, given that the contract documentation preparation stage is recognized as the ‘seedbed’ for claims, with nutrients essential for their development to be found in the contract documentation and the information supplied (or not supplied, as the case may be) prior to contract execution. Moreover, the greatest opportunity to prevent claims is during these early project phases, before tenders are invited and before contracts for construction of the works is let (Hughes and Barber, 1992; Smith, 2007). Yet, very few studies specifically examine levels of DI as a documentation attribute. To date, the researchers have not encountered any studies that apply econometric testing of the transactions cost economics (TCE) theoretical propositions to construction documentation. Analysis conducted in other industries has yielded encouraging results (Crocker and Reynolds, 1993; Saussier, 2000) and we draw inspiration from this work to study the contribution of DI to construction project management. The life cycle of claims could be beneficially completed by feeding back lessons learned from this study on optimal levels of construction DI and from the ongoing research on DI impacts on claims management, into the claims seedbed.
We believe our research will make a valuable contribution to understanding claims management in building projects for the following reasons. First, we are unaware of any study to test TCE propositions using data from building projects in the UK construction industry. Second, we examine the entire contract documentation package, whereas other studies usually only attempt to review contract forms. The other studies use subjective measures to assess the quality (Walker and Pryke, 2008), whereas more objective measures are to be deployed in developing this tool. Moreover, direct measures of project transaction Uncertainty and Asset Specificity will be used. Such improvements enable testing of a structural form of the relationship between primitive construction project transaction characteristics and DI. These improvements also facilitate the modelling DI as an endogenous choice by parties aiming to minimize transaction costs (Masten and Saussier, 2000).

1.3 Outline of Paper
The paper is organized as follows. First, we will look at the theories providing a basis for the modelling work. Next, there will be discussion how the philosophical worldview influences research design. Then we will explore the practical considerations in designing the model and developing its constructs, and finally, the econometric analysis methodology for analyzing the problem that prompted the design of the tool. We conclude with a discussion of the contributions that this research will make to the body of knowledge and understanding on DI. Recommendations for future research are also provided. A list of abbreviations of abbreviations used throughout this paper is provided in Section 5.

2 The Theories Providing A Basis For the Work
To enable better appreciation of the importance of the issues motivating this study, the research problem is identified and placed within the larger context of the literature on the topic. The literature was consulted to determine the theories to be used to explore the research question. The law and economics literature on contract theory and (TCE) proved instructive. From here, a better understanding of the incomplete contract documentation topic, and of the most commonly-invoked frameworks for analysis, was developed. Review of these and other closely-related theories also enabled better appreciation of the genealogy of methods for resolution, which informed this study design.

2.1 Incomplete Contract Theory vs Transaction Cost Economics
Initially, theorists used Incomplete Contract Theory (ICT) to develop models for exploring their questions about documentation completeness; and to illustrate and aid thinking on reasons for contractual incompleteness. Under the ICT modelling framework, parties sign incomplete contracts (ICs) because they would like to add contingent clauses, but are unable to because states cannot be verified or because they are too expensive to describe \textit{ex ante} (Hart, 1995). Though theorists were generally satisfied with the ability of ICT to explain motivations for ICs, they deemed the ICT framework models to be oversimplifications of real-life contracting problems. ICT does not contemplate contract drafting costs, legal system constraints for enforcement, and the fact that parties cannot instantly determine complex optimal long-term contracts (Salanié, 2005; Bolton and Dewatripont, 2005). Because of Bounded Rationality (BR) ((parties not knowing precise conditions
under which contracts will be executed (Winch, 2010), contracting parties must determine some transactions and decisions later. In criticizing efforts to model incompleteness level problems within the ICT framework, Saussier (2000) explained that ICT models generally make the following simplifying assumptions:

- information symmetry exists between contracting parties;
- contractual incompleteness is due to external constraints; and
- incompleteness is assumed as a basis for reasoning, rather than actually explained.

The concern is that these assumptions are not entirely satisfied in practice and, the difficult to formalize, BR concept is excluded from ICT analysis. Some theorists, therefore, turned to TCE for analysis of contractual choice. Under TCE, ICs are modelled as transaction governance mechanisms wherein construction project attributes are evaluated and governance instruments combined to minimize transaction costs (Williamson, 1985).

### 2.2 Transaction Cost Economics

Before proceeding with the explanation of the application of TCE to solve the research problem, it would be helpful to introduce the TCE theory. The TCE conceptual framework applied in this study was derived from institutional economics, and the work of Oliver Williamson, in particular. Winch (2010) further developed the TCE theory for application to construction project transactions. Williamson’s basic proposition, according to Winch (2010), is that total costs of supply are derived from two main components – production costs and supply costs. Production costs are associated with efficient transformation of inputs into outputs and prices are used to signal the most efficient choice of technology. Transaction costs are the costs of coordinating any complex production process and occur when a good crosses a ‘technologically separable interface’. For example, in the supply of concrete structures, manufacturing concrete and placing formwork are technologically separable. As the first half of a concrete pour is not technologically separable from the second half, the choice of the most efficient method for pouring is a production cost problem. On the other hand, the choice of the most efficient method for placing formwork – readying it to receive the separately-manufactured concrete is a transaction cost problem.

#### 2.2.1 Transaction Cost Economics and Contract Governance

Winch (2010) conceptualizes contracts for the supply of construction services (usually relational contracts) as transactions and outlines procedures, based on TCE, for determining the most efficient governance mode for construction project transactions. Here the assumption is that the most appropriate mode of project governance is determined within a 3-dimensional space (see Figure 1), based on the three main transaction characteristics: Uncertainty, Asset Specificity, and Frequency (Williamson, 1985).

### 2.3 Transaction Characteristics

#### 2.3.1 Uncertainty

Winch (2010) defines Uncertainty as the lack of information required to take a decision at a given time and attributes Uncertainty to two sources, namely:

- **Complexity** – the condition where information is, in principle, available, but too costly or time-consuming to collect and analyze; and
- **Predictability** - the condition where the past is not a reliable guide to the future.
Uncertainty affects transactions because it creates BR. BR forces parties to neglect some variables for which the effect on the relationship is difficult to evaluate and makes it impossible to fully measure documentation performance.

2.3.2 Asset Specificity

According to Winch (2010), Asset Specificity is the condition where either the client or contractor is limited in their choice of transaction partner because of the specific nature or resources to be supplied. On construction projects, Asset Specificity often takes the form of withholding information from the other party. This Asset Specificity may be: generated \textit{ex ante}, in which case, the problem is one of monopoly or monopsony in the market; or it may be generated \textit{ex post}, because contract-specific investments are made by one or more of the parties. Asset Specificity generates the possibility of Opportunism, as one party may try to exploit the other’s disadvantage. For construction projects, specific assets supplied could be: physical; site-specific investments; human; dedicated assets that cannot be redeployed because of the market size; brand name/reputation capital; or temporal specificity (Williamson, 1985; Masten, Meehan, and Snyder, 1991; Yates and Hardcastle, 2003; Winch, 2010).

2.3.3 Frequency

Frequency is considered to be a transaction characteristic because repeated transactions allow learning about the behaviour of the other party, and therefore generation of trust in them as a transaction partner. One-off transactions offer no such learning opportunities.

Yates and Hardcastle (2003) also explained the relevance of transaction Frequency and used investments in markets of varying sizes to illustrate their discussion of Frequency and transaction costs. They state that: due to potential difficulty in recovering specialized asset costs in small markets (as compared with large markets), one would expect to observe general purpose investments in small markets. Applying similar reasoning to the study of transaction costs, they point out that the benefits of specialized governance structures are expected to be greatest for transactions that are supported by significant investment in transaction-specific assets (nonstandard transactions) (Williamson, 1985). The expectation is for the cost of specialized governance
structures to be more easily recoverable for large transactions of a recurring kind. However, specialized governance structures come at a great cost and these additional costs should therefore, be justified through consideration of whether the transaction volume processed through a specialized governance structure utilizes the specialized structure to capacity.

Although recent construction clients have been making changes to increase Frequencies (through initiatives such as partnering and prime contracting) to achieve learning benefits, typically, transaction Frequency is low in construction - often effectively, unity for most client/contractor relationships (Winch, 2010). Also, in construction the different options for governance structures is manifested in the various procurement routes (e.g. traditional, construction management, design-and-build) and project performance comparisons can be made both within the routes and across routes. For this study, comparisons would be between routes. In this study, analysis based only on levels of Uncertainty and \textit{ex post} Asset Specificities under which the transaction is made. Frequency is not considered for this study.

### 2.4 TCE and Documentation Incompleteness

The literature also demonstrates the usefulness of the TCE theory in understanding the diversity of DI levels used to govern inter-firm relational contracts in the construction industry.

Here, BR is invoked to explain the thought processes involved in documentation preparation for ICs. Now, negotiating construction projects is costly, engaging managers and lawyers. At some point during negotiations, costs of contemplating specific arrangements to cover unlikely contingencies outweigh benefits. Also inability/unwillingness of courts and third parties to verify \textit{ex post} values of certain observed variables is costly. Therefore, parties decide on a level of incompleteness for the contract documentation (the legal basis of the relationship) that would minimize these costs (Salanié, 2005).

The TCE view also assumes that there are alternative governance mechanisms and behaviour prescription. These alternative governance mechanisms and behaviour prescription capture interpersonal and inter-organizational aspects of transaction governance arrangements by considering issues such as trust and perceived equity in governance. Alternative governance mechanisms include implicit social conventions and the parties adapt their performance to contingencies that actually arise during the life of the contract. Baum and Oliver (1991) observed this alternative governance phenomenon for childcare service organizations in Metropolitan Toronto, Canada between 1971 and 1987. To use a construction industry example: In a close-knit community, a contractor may be reluctant to act opportunistically in pursuing a claim against the client of a school that his child attends. Al-Najjar (1995) illustrates the TCE view of the contractual arrangement.

The boundaries will vary across transactions to reflect differences in project characteristics. Boundaries will also change in response to the changing environments (e.g. market conditions, technical innovations, etc.) Therefore, differences in the incompleteness levels that can be observed from project transaction to project transaction represents different combinations of governance mechanisms (See Figure 2). The chosen governance mechanisms take the transaction characteristics into consideration and are combined in such a way as to minimize overall transaction costs. (See Walker and Pryke (2009) for a more detailed treatment).
2.5 Modelling the Documentation Incompleteness Choice Using TCE

We now return to the discussion of the use of TCE in determination of the optimal level of DI for construction building projects. Because the principal investigator (PRI) holds a pragmatic worldview, the research problem, was emphasized and a search was carried out for all available approaches to understand the problem. Two empirical studies (Crocker and Reynolds, 1993; Saussier, 2000) were found to provide the best application of the TCE framework from which knowledge of the research problem could be derived. In these studies, the choice of the efficient level of DI is represented as an endogenous trade-off of costs and benefits in transactions between parties aiming to minimize transaction governance costs. There was one main shortcoming in both studies when they were considered for use as a guide to the research problem. Specifically, these studies were used to analyze only the contract forms whereas our research problem examines entire documentation packages, including the contract forms. Nevertheless, the studies were still deemed instructive because the principles are still seen as being applicable to entire documentation packages. This is because it is, in fact, the entire documentation package that is used to govern the legal basis of the relationships in the construction industry and more often than not, contractual effect is generally given to all of the contract documents in the package (Hughes and Barber, 1992). Moreover, documents are chosen simultaneously and may interact, so empirical studies should, ideally estimate all of the contractual provisions (Saussier, 2000) Therefore no modifications should be necessary to extend them to this study, which forms part of a larger mixed methods design. Saussier (2000) was deemed the better guide for this study of construction documentation packages because Crocker and Reynolds (1993) recommended the use of contractor opportunism as a proxy for the Asset Specificity project characteristic and only focused on price provisions in contracts. Moreover, Crocker and Reynolds (1993) modelled DI as an exogenous choice, which is not the preferred approach for this study. Saussier (2000) was considered an improvement upon the concepts introduced by Crocker and Reynolds (1993) because DI was modelled as an endogenous choice, direct measures of Asset Specificity were employed and the entire contract form was reviewed for the analysis.
Both approaches proposed a quantitative method – econometric analysis using (Ordinary Least Squares Regression) (OLSRA) for data collection, analysis and interpretation. A single equation model is used to allow empirical verification of the hypothesized (mathematical) relationship between transaction characteristics and DI. The quantitative method was seen as appropriate for this study because the TCE paradigm translates the research problem into one of understanding the relationship between project transaction characteristics and DI. Essentially, the focus is on the relationship between DI, as the dependent variable, and Uncertainty and Asset Specificity as independent variables. The TCE theory propositions were reassessed to come up with hypothesized relationships between the variables. In keeping with the advice for when quantitative methods are chosen (Creswell, 2009), specifying this relationship then became central to answering the research question. The aim here was to enable generalization of the findings to a population of the specific type of building project that will be identified for the larger study.

The research problem was then restated for solution within the TCE framework using this quantitative approach. When clients and contractors decide to collaborate on any project of modest size, usually they prepare documentation to create a contractual interface, to guide the transaction (Hughes and Barber, 1992; Ramus et al., 2008; Smith, 2007). The purpose of this documentation is to create legally-enforceable agreements defining rights, obligations, and procedures for project contributors (Abdul-Malak et al., 2002; Semple et al., 1994; Furlotti, 2007). Ability to clearly and fairly apportion and assign risks between parties is also a measure of contractual efficiency (Hughes and Barber, 1992; Hartman and Snelgrove, 1996; Furlotti, 2007). Additionally, construction documentation should provide incentives to effectively motivate the contractor to make full use of his expertise and overcome difficulties expeditiously. According to Saussier (2000), contract documentation is designed to facilitate transactions between parties, and the documentation achieves its purpose to the extent that it:

- aligns parties’ expectations with regard to the other’s obligations under agreement;
- provides incentives for parties to fulfill these obligations;
- prevents costly disputes from arising; and
- provides a basis for resolving disputes that arise despite best efforts, whether the disputes arise from opportunism or from honest misunderstandings.

The documentation must be correctly designed and adequately prepared in order to maximize the gains from the project transaction. The level of DI required is difficult to evaluate and, therefore, some contracting parties deliberately prepare incomplete documentation with provisions that are vague or unspecified. To answer the research question:

‘What is the minimum information required in contracts so that those concerned know what is expected of them?’

(Higgin and Jessop (1965), as cited in Boyd and Wild (2003)),

the TCE presentation tests the theory that this deliberate incompleteness reflects the parties’ aim to minimize the project transaction costs.

Those adopting a TCE view of contractual choice (Crocker and Masten, 1991; Crocker and Reynolds, 1993; Saussier, 2000) explain that if contracting were costless, it would be, in principle, possible to design arrangements complete enough to circumscribe all surplus-eroding redistributive tactics and intricate enough to mitigate investment distortions. In practice, however, the costs of identifying contingencies and devising responses increase rapidly in complex or uncertain environments, placing economic limits on abilities to draft and implement elaborate contractual agreements.
When designing a contract, the parties mitigate *ex post* opportunism and investment distortions by using more complete documentation, but at the cost of increased resources dedicated to crafting the documents *a priori*. As a consequence, transaction characteristics that generate increased contracting costs should result in efficient contract documentation being less complete, whereas conditions that exacerbate the potential for *ex post* inefficiencies should lead to more exhaustive agreements (See Figure 3).

In keeping with the theoretical principles identified to guide this study, clients and contractors were regarded as being confronted with a trade-off between *ex ante* costs of crafting more complete documentation and *ex post* inefficiencies associated with less exhaustive arrangements. (See Figure 3) This lead to testable implications about an efficient level of project documentation. To test these implications, this study will examine a panel dataset consisting of a specific type of publicly-procured building projects to determine whether to accept or reject the reassessed TCE theoretical propositions as hypotheses, and determine whether the degree of contractual incompleteness actually chosen by the parties in practice, reflects a desire to minimize the cost of contractual exchange. The TCE theory propositions were will be tested econometrically, using a building contract documentation database for projects procured by a single UK public sector client. The level of completeness will then be analyzed as an endogenous choice of clients and contractors.
3 Research Strategy

3.1 Data Requirements

3.1.1 Contract Documentation Package Dataset
The guiding studies (Crocker and Reynolds, 1993; Saussier, 2000) employ a panel dataset to gain better insight into the dynamics of documentation development processes for a single client (Dougherty, 2007; Gujarati and Porter, 2009). Efforts will be made to assemble a panel dataset for analysis. Because the success of the study depends on acceptable participation rates, efforts will be made to maximize these rates. In this light, Saussier (2000) recommended that the following be taken into consideration in choosing the projects for the study:
- Public sector client levels of interest in the study of DI in regard of TCE;
- Projects that engage the services of private-sector contractors are favoured because the assumption is that such transactions are more likely to be driven by cost minimization.

3.1.2 Sample Size
It will be necessary to make statistical inferences about the population of construction documentation packages, from the results obtained from the sample. Sample sizes need to be large enough to predict the behaviour of the population as accurately as possible. An effort will be made to choose a dataset with a wide enough variety of projects, to achieve heterogeneity in levels of Uncertainty and Asset Specificity (transaction characteristics) to yield an adequate modelling solution.

3.1.3 Scope
Also, it is generally considered good practice to restrict research studies so that adequate depth and rigour of investigation of the topic can be undertaken. Therefore, a number of measures can be adopted to limit the scope of the research to reasonable bounds and ensure a homogenous sample of construction documentation packages (as the unit of analysis) to allow analysis of only DI as the only independent variable (Fellows and Liu, 2008; Creswell, 2009). Some of these measures are outlined below.

3.1.4 A Specific Time Period
Because the dataset will be made up of past completed projects, accurate results will depend on memories of those contributing to the study. Therefore, only projects commenced up to a maximum of three years prior to the start date of the research date will be reviewed.

3.1.5 A Specific Construction Industry Sector
Preliminary studies will be carried out determine which sectors experienced higher volumes of construction activity. Experienced industry professionals can be consulted to seek their views on construction activity across the different sectors. Also, companies providing procurement services to the construction industry will be approached for assistance in this exercise. Construction economics and statistics data may also provide some insight into construction activity in the recent past.
3.1.6 A Specific Procurement System (Governance Structure)

Contract documentation packages chosen will be from projects where the traditional procurement route was used. By this route, design is virtually complete before calling tenders (Clamp et al., 2007). In this way, the degree of *ex ante* DI will be limited. There will be some degree of *ex post* flexibility and provision for this will be made by way of monetary, and presumably, time contingency in schedules. Any such tendencies should be observable in the documentation. Projects procured using JCT forms with Quantities will be reviewed because these are used on the greatest number of projects procured in the UK (RICS, 2010). The entire documentation package (as opposed to only the contract form, which is the case in the guiding studies) will be examined, as this is seen as representing the contract governance agreement. Focusing on this group should ensure a large pool from which to draw a sample of projects for analysis.

3.1.7 Client Documentation

This research for the UK construction industry will be developed within the scope of Williamson’s (1975) conceptual framework, as presented by Winch (2001), Winch (2010), and Yates and Hardcastle (2003). Only data and information from projects governed in the vertical dimension will be reviewed. Also, although many contributors to the building process should be able to gain insight from using the model, that will be developed for use by public sector clients.

3.1.8 Project Size

The right balance must be struck here. Project values cannot be too large nor too small. It is believed that projects of approximately £5mn in value would provide generate the type of issues and consideration that would be of interest for this study and lend them selves to the analytical methods chosen.

3.1.9 Project Claims

This study is part of a larger research project that focuses on impacts of DI on management of claims advanced by the main contractor against the client. Therefore, it would also be wise to focus on documentation for projects where claims were a major issue. Loss-and-expense is one of the more frequently-recurring subject of claims advanced by contractors against clients (Kennedy and Milligan, 2005) Also, LEXs can be directly linked to poor quality documentation (Hughes and Barber, 1992; Love, 2005; Love, 2009), which make them a good gauge of documentation performance.

3.2 Quasi-Experimentation

Because this is a construction project-based experiment, it will not be possible to allow only the project transaction characteristics (Uncertainty and Asset Specificity) to vary in value. Also, in reality it would not be possible to only restrict effects of any treatments to Uncertainty and Asset Specificity, nor on DI Levels. In other words, many unwanted, external effects are likely to impact on the data and it will be impossible to control them, or, even if identified, allow for them adequately in the analysis. Hence, a comparative study on similar projects, executed at about the same time, by similar firms employing similar organizational arrangements, will be carried out. This is in an effort to ensure that all other variables, except Uncertainty and Asset Specificity, that could impact on DI will be held approximately constant. Then the consequences for DI will be measured.
For this quasi-experiment, the aim is to determine whether varying the levels of Uncertainty and Asset Specificity influences DI choice. Also, the aim is to estimate and/or predict the population mean value of Uncertainty and Asset Specificity in terms of optimal level of DI for the specific type of building project.

Therefore, for each project transaction in the dataset, the variables in this study are:
- Marginal Transaction Costs associated with the level of documentation completeness;
- Marginal Gains accruing from establishing the level of documentation completeness;
- Project Uncertainty;
- Asset Specificity; and
- Level of Documentation Incompleteness.

### 3.3 Theoretical and Operational Constructs

#### 3.3.1 Transaction Costs associated with the level of Documentation Incompleteness

According to Crocker and Reynolds (1993) and Saussier (2000), the primary costs associated with preparing more complete documentation are:
- cost of writing the agreement
- information costs - difficulties of identifying feasible contingencies
- negotiation costs to arrive at mutually-acceptable responses
- potential maladaptation/renegotiation cost of being trapped in a bad contract (costs of resolving claims)

Marginal costs \( (MC) \) are defined as: the additional cost of one more unit of service (McPake and Normand, 2008). For this study, they will be measured by subtracting the costs of preparing documentation rated at level \( (DCOMP_i) \), from the preparation costs of producing documentation that has been rated at the level \( (DCOMP_{i+1}) \). These documentation ratings will be obtained by using the DI rating instrument described in Walker and Pryke (2009) (WPM). \( MC \) can also be computed by plotting total costs for preparing documentation to level \( DCOMP_i \), against corresponding completeness levels calculated by the WPM and then taking the slope of the total costs curve at the level of DI in question.

Crocker and Reynolds (1993) and Saussier (2000) also explained the effect of project Uncertainty on costs of preparing complete documentation. While this may be fairly straightforward in simple environments, with proximate dates of contract execution, the task becomes more daunting when possibilities are more numerous and the time to performance remote. This is because remote times to performance means greater uncertainty transaction levels, which translates to more difficulty, expense and riskiness in preparing more complete documentation (particularly because of the costs of being trapped in a bad contract). Moreover, holding environmental complexity constant, parties are likely to face increasing costs of crafting more complete agreements as the additional contingencies become more hypothetical. This is because contingencies are more expensive to add to more complete contracts. Also, more precise documentation lessens the importance of unaccounted-for contingencies and make it harder to evaluate unaccounted-for contingencies, because of the lack of experienced parties. Accordingly, the marginal cost of preparing more precise documentation is assumed to be increasing in the degree of contractual completeness and in the level of environmental complexity, \( \omega \).
From the foregoing, we arrive at Proposition 1, adapted from Saussier (1990). For this study, we test Proposition 1:

The marginal cost of documentation that aims for completeness increases with the level of transaction uncertainty and the level of documentation completeness.

3.3.2 Gains from preparing more complete documentation

The principal gains accruing from preparing more complete documentation are:

- for contractants who have developed specific assets, a reduced exposure to opportunism of the other party; and
- savings on repeated negotiation costs (Crocker and Reynolds, 1993; Saussier, 2000).

Marginal gains (MB) are defined as: the reduction in gain accrued by producing one more unit of service (McPake and Normand, 2008). For this study, they are measured by subtracting the total benefits of using documentation rated at level (DCOMP_i), from the total benefits accruing from using documentation that has been rated at the level (DCOMP_{i+1}), by the WPM. To our knowledge, there is no practical measure of MB for building construction project transactions. Therefore, for a project rated at DCOMP_i, we propose that MB be computed from the difference of the total project costs anticipated by the parties and actual realized costs for a project rated at DCOMP_{i+1}. This is based on the approach used in Bajari et al. (2007), which compares the costs of rigid and more flexible contracts. Similarly to MC, MB can also be theoretically computed by plotting total benefits derived from using documentation prepared to completeness level DCOMP_i against corresponding completeness levels calculated by the WPM and then taking the slope of the MB curve at the level of documentation completeness in question.

Now, tighter agreements reduce parties’ abilities to engage in efforts designed to effect privately-favourable distributions of the ex post contractual surplus (Williamson, 1985; Goldberg, 1985; Masten, 1988). Such restrictions benefit the parties when the available redistributive tactics consume resources. For example, for contingencies not expressly covered by the documentation, the parties incur the resource cost of bargaining. (denoted by the increasing function \( B(SPE) \), where \( SPE \) indicates the level of Asset Specificity (SPE) in the transaction. In this case, the expected bargaining costs would be \( pB(SPE) \), and the marginal benefit of increased completeness, \( B(SPE) \) is the reduction of resource costs associated with bargaining.

In addition to the direct costs of redistributive activities, the possibility of unconstrained renegotiation raised by DI generates potential inefficiencies by discouraging ex ante investment (Tirole, 1986; Hart and Moore, 1988). This problem arises because of the parties’ inability to precommit to an enforceable division of the contract surplus in all future states (complex allocation rules). Investors recognize that part of the benefits from their efforts may accrue, as a consequence of future redistributive activities, to the other party. In such scenarios, MB for a more complete contract is a reduction in the magnitude of investment externality (a side effect of consumption or production which is not traded on the market or taken into account in setting a price (McPake and Normand, 2008)), which is also directly proportional to the Asset Specificity at stake in the transaction. The probability of ex post renegotiation is expected to be lower in contracts aiming for completeness (Grossman and Hart (1986), Saussier, 2000). This is very uncomfortable for parties who have developed specific assets.

Therefore, where the transaction involves specific assets, the more the contract specifies the transaction, the smaller the probability that the contract will be renegotiated. This increases ex ante investment incentives. Investment incentives are directly linked to the presence of specific assets that generate quasi-rent (Klein et al., 1978, as cited in Saussier, 2000). For more specific assets, the assumption is that the marginal gain from more complete documentation decreases with the level of
completeness because the final contingencies are less probable and exert a lesser incentive effect on investment decisions. Consequently, under the assumption that investment incentives decrease as contracts become more complete, the MB from contractual completeness is a decreasing function, as depicted in Figure 1.

From the foregoing, we arrive at Proposition 2, adapted from Saussier (1990). For this study, we test Proposition 2:

The marginal gain from documentation that aims for completeness increases with the appropriable quasi-rent at stake in the transaction and decreases with documentation completeness.

3.3.3 Project Transaction Uncertainty and Asset Specificity Variables Uncertainty

From descriptions of pre-tender phase activities described in project management texts (Hughes and Barber, 1992; Smith, 2007; Ramus et al., 2008), it is clear that this phase is characterized by high levels of Uncertainty (Mission Uncertainty and Dynamic Uncertainty).

A dataset that is heterogenous in Uncertainty, could include projects that vary in one or more ways, such as and including: times to project construction phase; physical complexities of project sites on which construction will be procured; requirements for new technologies to solve the particular problems posed by the project at hand; extents to which the new building proposed is a copy of existing ones; extents to which standardized components can be used; extent of design ambiguities in documentation; levels of detail in geotechnical surveys; acquisition of regulatory approvals; number of shop drawings provided by component suppliers (Yates and Hardcastle, 2003; Winch, 2010).

3.3.4 Asset Specificity

In keeping with Saussier’s (2000) approach, for this study, the level of Asset Specificity measured is a direct assessment of the amount of specific resources that the main contractor supplies to the project. Recalling possible specific assets listed in Section 2.3.2 a dataset that is heterogenous in Asset Specificity could include projects with varying levels of site-specific investments made by the contractor for each project.

Accurate measures of the level of Uncertainty and Asset Specificity in each project transaction in the dataset will be obtained for testing the TCE Propositions through, a series of semi-directed interviews with the professionals who contributed to the project in question. During these interviews, guidance will be sought from project personnel in charge of negotiation and monitoring to devise measures of Uncertainty (UNC) and Asset Specificity (SPE) in each building project transaction. Also, there will be reviews of each contract documentation package in the dataset to determine the variability in UNC and SPE across the dataset; upper and lower bounds for UNC and SPE, and gradations of UNC and SPE.

3.3.5 The Level of Documentation Completeness

The definition of documentation completeness adopted for this research is based on that proposed by Saussier (2000). Basically, one documentation package is more complete than the another if it gives a more precise definition of the transaction, outlines adequate risk-sharing, includes appropriate incentives to motivate expeditious resolution of difficulties, and the means to carry out all of this. Many different types of documentation exist, but the level of DI chosen by the parties reflects are desire to save transaction costs.
In order to econometrically test DI levels for the dataset, the documentation levels must be classified according to their levels of completeness. This is achieved by deploying the methodology, proposed in Walker and Pryke (2009), for evaluating the level of completeness for a documentation package (i.e. contract form and all production information (PI)). This approach is based on a TCE view of ICs, which contemplates BR. (See Section 2.1). Applying this definition of ICs enables a feasible upper bound for documentation completeness to be determined through a measure that considers all completeness dimensions (complexity, contingency planning, and contractual ambiguity/specificity).

The Walker and Pryke (2009) methodology draws inspiration from best practice recommendations for preparing production information (PI) (Drawings, Specifications, and Bills of Quantities (BoQs)) and contract formulation, combining them into one uniquely comprehensive methodology for assessing construction documentation completeness.

From the literature, contract completeness is made up of multiple dimensions, namely:

- Ambiguity/Specificity of the provisions in the documentation (ASD);
- Complexity of the contractual governance apparatus employed to inflict penalties for uncooperative or violative behaviours (CD); and
- Contingency Planning strategies to achieve efficient adaptation (CP).

To devise the rating instrument for assessing documentation completeness (WPM), those knowledgeable of contract formulation processes, such as lawyers, client and contractor executives and personnel, will be consulted, through interviews, to obtain more detailed knowledge of project conditions; provide greater insight into contract formulation; and confirm and/or supplement literature findings. Also, these individuals will be consulted to assist with dimension coding for the final rating instrument.

Next, using the WPM, the documentation package for each building project (the unit of analysis) in the dataset will be reviewed to assign a DI score, $D_{COMP}$, that will contemplate: completeness dimensions (complexity, contingency planning, ambiguity/specificity); risk sharing; inclusion of adequate incentives to motivate expeditious resolution of difficulties; and completeness of PI. (See Walker and Pryke, (2009) for a detailed treatment of the methodologies for operationalizing each completeness dimension.) Application of the WPM should add content to the chosen construction industry subsector.

### 3.4 Model Development

Econometric analysis will be used to analyze the problem of determining the optimum level of DI for the chosen building type to be procured by a public sector client.

Econometric analysis will proceed in accordance with the traditional econometric methodology, which involves:

i) Statement of the hypotheses;
ii) Specifying the mathematical model;
iii) Specifying the econometric model;
iv) Obtaining the data;
v) Estimating the model;
vi) Testing the hypotheses;
vii) Forecasting/predicting the values of DI on the basis of known or future expected values of project transaction Uncertainty and Asset Specificity; and
viii) Using the model for control or policy formulation purposes.
3.4.1 Statement of the hypotheses

From Sections 3.3.1 and 3.3.2, recall the hypotheses:

**Proposition 1:**
The marginal cost of documentation that aims for completeness increases with the level of transaction uncertainty and the level of documentation completeness.

**Proposition 2:**
The marginal gain from documentation that aims for completeness increases with the appropriable quasi-rent at stake in the transaction and decreases with documentation completeness.

3.4.2 Specifying the Econometric Model; and Obtaining the Data

$DCOMP$ represents the DI level decision, with $DCOMP \in (0,1)$. For totally complete documentation, $DCOMP = 1$, and there will be no opportunities for ex post bargaining. For totally incomplete documentation, $DCOMP = 0$, and there are no strictures on all the terms under which future trade may be effected. Thus, the choice of DI is illustrated as shown in Figure 3.

For each building project transaction, at the time of contract negotiations, parties will have perceptions of the current level of project transaction Uncertainty, $\omega$ and the current level of asset specificity, $SPE$. Parties face a trade-off between costs and gains of $DCOMP$ and will choose a level of incompleteness that equates marginal costs and marginal gain. On one hand, variables leading to increased $\omega$, should shift $MC$ upward, resulting in less exhaustive documentation. On the other hand, variables increasing $SPE$ should shift $MB$ upward, making more structured agreements attractive.

This study proposes that parties, without carrying out complex cost-benefit analyses, are, nevertheless, guided by this calculus approach that is reflected by the trade-off described in the foregoing. This study employs Ordinary Least Squares Regression Analysis (OLSRA) to test these Propositions as hypotheses, using a panel dataset from a sample of construction projects (of the chosen building type), by estimating the structural form relationship (a function of variables that shifts the benefit and gains schedules).

$DCOMP_{it} = \alpha_i + \beta \omega_{it} + \gamma SPE_{it} + \epsilon_{it}$

where

$DCOMP$ - is the measured level of documentation incompleteness for the documentation in the contract signed with contractor $i$, at date $t$.

$\omega_{it}$ - are the variables affecting MC when contracting with contractor $i$ at date $t$.

$SPE_{it}$ - are the variables affecting MB when contracting with contractor $i$ at date $t$.

$\alpha_i$ - is a contractor-specific effect

$\beta, \gamma$ - are slope coefficients/model parameters

$\epsilon_{it}$ - is the independent and identically-distributed error terms (disturbance) with zero mean and constant variance $\sigma^2$.

The error term represents all the factors that affect Documentation Incompleteness, but not taken into account explicitly.

This specification of the Relationship suggests that there is a linear relationship between $DCOMP$ and the project transaction characteristics (Uncertainty and Asset Specificity).
3.4.3 Estimating the Model

Estimating the econometric model involves obtaining the numerical values of $\beta$ and $\gamma$ (Gujarati and Porter, 2009). These numerical estimates of the parameters give empirical content to the function defining the relationship. The contract documentation package panel dataset will be used to estimate the parameters of the relationship between Uncertainty and Asset Specificity (independent variables) and Documentation Completeness (dependent variable). OLSRA, a statistical technique is the main tool that will be used to obtain these parameter estimates.

3.4.4 Testing the Hypotheses

Hypothesis testing (statistical inference) will determine the reliability of the parameter estimates obtained. In other words, the hypothesis testing should provide confidence that the numerical results for the parameter estimates were not likely to have occurred by chance (Dougherty, 2007).

Assuming that the fitted model is a reasonably good approximation of the real relationship, suitable criteria must be developed to determine whether the parameter estimates obtained are in accordance with the expectations of the theory being tested. From the theoretical descriptions of the relationships, the expectation is that straightforward estimates of the empirical relationship using OLSRA, will result in $\beta$ having a negative sign, and $\gamma$ having a positive sign. This would suggest that: as measured project transaction Uncertainty ($UNC$) increases, this will result in less complete contract documentation (decreased $DCOMP$), while an increase in measured project transaction Asset Specificity ($SPE$) will result in more complete contract documentation (increased $DCOMP$).

3.4.5 Model Verification

Model verification is, essentially, a post-mortem, carried out to find out if the results from the model accord with a priori expectations (Creswell, 2009). Because assumptions were made to specify the model, verification checks to see whether the model implements assumptions correctly and does what it was intended to do. In other words, it asks the question: ‘Is the model doing the thing right?’ (Forrester, 1999).

After specifying the econometric model, the project transaction data from projects in the dataset that were not used for model construction will be used to determine whether the model structure is correct. This will be achieved by testing the model through examining the outputs resulting from the model under a given set of inputs. If outputs are inappropriate (i.e. they do not approximate to expectations of what a good model of the reality would yield), then the model will be reassessed through a ‘debugging’ process to see whether variables were coded correctly. The necessary corrections will be made and the model will be re-verified. The process will iterate through these steps of reassessment and re-verification until when outputs are appropriate. When outputs are appropriate, then the model will be deemed verified. Should the model be deemed verified it will then be validated.

3.4.6 Model Validation

Validation checks to see whether the (unbiased, consistency, and efficiency) assumptions made in estimating the model parameters are reasonable, with respect to the real system. The aim of validation is to demonstrate whether the model is a reasonable representation of the actual system. According to Forrester (1999), validation asks the question: ‘Is the model doing the right thing?’
Verification techniques are more general in comparison with validation techniques, which are more specific to the model in question.

Therefore, after constructing the model, its performance will be scrutinized to determine whether it is suitable for the stated objective, which, for this study, is to determine the optimal level of DI for the chosen building type. In validating the model, its output resulting from known inputs will be compared with realizations of the reality, such as an ex post forecast of DI by quantity surveyors who are very experienced in authoring documentation packages for the chosen building type. To examine model consistency over a range of conditions (preferably including extremes), an effort will be made to carry out this type of validatory testing for several sets of inputs and known outputs of the reality.

3.4.7 Forecasting/predicting the values of Documentation Completeness on the basis of known or future expected values of project transaction Uncertainty and Asset Specificity

The OLSRA used during the econometric analysis will produce descriptive statistics calculated for observations and measures made during the experiment. These statistics are means, standard deviations, and ranges, and from these results, the optimal level of DI can be obtained. This optimal level will correspond to the intersection point of MB and MC. (See Figure 3 for a graphic representation for the theoretical model). The results from this study will also inform a later stage of the ongoing study that examines how deviation from this optimal level of completeness will affect LEXs management. CDPRs will then be able to use this information as a guide to the level of DI to which they would like to aspire for this chosen building type for this client. From the MB and MC information, not only will the client have a measure of the documentation quality produced, but they can be guided in sanctioning further work to improve documentation quality.

The empirical results can also be used to gain insight in interpreting the chosen client’s documentation record for the chosen building type. Once the parameters have been estimated, this will enable statements to be made about how much DI will go up or down as a result of certain changes in the transaction characteristics. This would be akin to conducting sensitivity analyses on contract documentation package incompleteness levels.

3.4.8 Using the model for control or policy formulation purposes

Also, it should be possible to use the model as an aid to control or policy formulation procedures in public sector organizations. For example, the chosen public sector client could be guided in their choice of projects (and therefore, project transaction characteristics) in order to guarantee a desired outcome, in terms of DI levels.

The results will have implications for procurement policy, more generally. For example, there is currently much promotion of the NEC as the solution to all contracting problems in the construction industry. The Latham Report (1998), as cited by Morton and Ross (2008), suggested that the NEC came closest to meeting the thirteen ideal principles of a ‘modern contract’. While aim for more comprehensive contracts to meet this ideal may suffice to mitigate ex post inefficiencies that the documentation was designed to take care of, this type of analysis will indicate whether such benefits may be dwarfed by the costs of preparing truly ‘modern contracts’ (that may be more ‘complete’ than the optimal), for projects with particularly complex transaction characteristics. With this tool it would be possible to carry out similar analyses for documentation that includes any contract form. Comparative studies can then be used to settle debates such as that described by BTET (2009) about the most economical choice.
Secondly, Crocker and Reynolds (1993) are of the view that procurement officers should be granted the latitude to craft agreements on a case-by-case basis, where the design of particular documentation packages would depend on the specifics of both the product and the contractor investment. They state that policies attempting to impose homogeneity in contract design, either across contractors, or over time would be misguided, and likely to significantly raise the costs of effecting contractual exchanges for projects. This tool will allow this kind of latitude in crafting agreements and aid the decision-making process on whether to implement homogeneous or heterogeneous contract design policies.

Finally, the potential benefits of arrangements such as Framework agreements can be examined. Proponents suggest that much benefit will accrue to clients through aggregation of demand and delivery through frameworks. Skeptics remain unconvinced and cleave to market economics, providing the driver for production efficiency and suggest that Frameworks are an artificial intervention to yield transactional efficiencies (Morton and Ross, 2008). Now, (Crocker and Reynolds, 1993) have shown that sourcing from multiple suppliers of construction services may generate resource savings for documentation preparation by permitting the implementation of less complete agreements. They suggest that this might due to the discipline provided by the existence of an alternative supplier, which mitigates the necessity for complete and costly contract documentation to constrain future contractor behaviour. This tool proposed will allow examination of the ability of split awards under arrangements such as Framework agreements to provide their administrative and pricing benefits.

4 Conclusion

There are a number of ICT models in the economics literature that show how contractual completeness may influence parties’ incentives to invest in order to realize a transaction. They usually show ex ante investments are distorted by such contracts. Also, these ICT models assume that the motivation for signing ICs is because parties are unable to add the contingent clauses that they would like to because states cannot be verified or because they are too expensive to describe ex ante. Therefore, in those models, level of documentation completeness is usually given and contractual incompleteness is modelled as an exogenous variable (Crocker and Reynolds, 1993; Saussier, 2000).

In this paper, the less frequently-encountered TCE approach to the problem is reviewed and its application in a construction contracting context is proposed. Special emphasis has been placed on econometric analysis in general, and more specifically, how to test TCE propositions. For the proposed study, Documentation Incompleteness is not taken as a given, nor is it used as a basis for reasoning. Rather, BR is invoked to explain the thought processes involved in documentation preparation for ICs. Also, contractual incompleteness observed in response to different transaction characteristics is explained as resultant combinations of the legal basis for relationships and alternative governance structures devised for governing the transactions. Therefore, the study proposes that incompleteness be modelled endogenously as the result of parties’ willingness to minimize the costs of governing transactions. Our literature search for the larger study revealed that there is a paucity of studies covering contractual documentation for inter-firm relationships. Even fewer relate to the parties’ choice of the level of contractual completeness, and still fewer are based on sample contracts suitable for econometric testing of the proposals derived from TCE theory. No such studies have been encountered in the UK construction industry context. In this light, we believe that the proposed study described in this paper would represent a contribution to the body of knowledge and understanding of TCE principles and their application to inter-firm contractual
relationships in the UK construction industry. It should also produce valuable documentation preparation information to be fed to the seedbed for claims so that the situation can be improved.

The proposed study also demonstrates deployment of a uniquely comprehensive methodology for measuring Documentation Incompleteness by rating entire documentation packages. This represents simultaneous estimation of all contract provisions, which would enable automatic consideration the possible linkages between all the provisions in the documentation; and allow analysis of linkages between Documentation Incompleteness and other contract dimensions, such as contract duration. Carrying out this study would respond to the research need for empirical studies to estimate complete contract provisions as proposed by Saussier (2000). Therefore, we believe this paper to be a contribution, not only to understanding simultaneous estimation of contract documentation provisions and the law and economics literature, but it also adds specific dimension to analysis of construction industry documentation. This is because studies of this type are generally addressed to the economics audience. By demonstrating application within a construction context, it presents these analytical techniques to an audience that may have been unaware of the potential benefits of alternative approaches to addressing construction documentation concerns.

Notwithstanding the contribution to econometrics and TCE outlined above, we consider that more empirical tests should be developed and refined to permit inclusion of the Frequency transaction characteristic for analysis for general application, and in a construction context. Frequency was not included in the two main studies that were used to guide this proposed study. Review of the literature (Furlotti, 2007) and discussions with other academics revealed that there is still a lack of confidence in interpreting Frequency, as a driver of transaction costs. There have been observations of increases in transaction costs in repeat transactions due increased costs of specifying contingencies in response to histories of friction in past relationships (Argyres et al., 2007). At the same time, observations of decreases in transaction costs due to parties learning about each other and of development of trust, have been reported (Mayer and Bercovitz, 2008). We are optimistic that future research will meet this challenge. Hopefully, this paper will provide a stepping stone in this direction.
5 List of Abbreviations

AEO - A measure of the Ambiguities, Errors or Omissions in the documentation package
ASD - Ambiguity/Specificity Dimension
BoQs - Bills of Quantities
BR - Bounded Rationality
CC - Complete Contracts
CCC - Complete Contingent Contracts
CD - Complexity Dimension
CDPRS - Contract Documentation Preparers (such as quantity surveyors).
CP - Contingency Planning Dimension
DCV - Documentation Completeness Variable
DI - Documentation Incompleteness
ICE - Institution of Civil Engineers
ICs - Incomplete Contracts
ICT - Incomplete Contracts Theory
JCT - Joint Contracts Tribunal
JCTSBCs - Joint Contracts Tribunal Standard Building Contracts
LEXs - Loss-and-expense claims
MB - Marginal Benefits
MC - Marginal Costs
NEC - New Engineering Contract
OLSRA - Ordinary Least Squares Regression Analysis
PI - Production Information
PRI - Principal Investigator
SEM - Structural Equation Modelling
SPE - Asset Specificity measured from dataset documentation
TCE - Transaction Cost Economics
UNC - Uncertainty measured from dataset documentation
WPM - Documentation completeness rating methodology described in Walker and Pryke (2009).
6 References


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