THE MANAGEMENT OF DISPUTES AS AN ELEMENT OF CONSTRUCTION TRANSACTION COSTS: AN EMPIRICAL STUDY

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The process of delivering construction projects is characterised by a multiplicity of transactions between individual organisations whose integration is vital yet problematic. The premise of this paper is that the management and resolution of contractual disputes between these organisations represent a substantial element of their transaction costs. The argument is set in the context of Transaction Cost Economics (TCE) theory, according to which the concepts of bounded rationality, uncertainty, information asymmetry, and opportunistic behaviour together present serious problems for transaction efficiency. The work presented here is part of a wider study examining the impact of advances in information technology (specifically, the availability of information-rich building models) on the more efficient resolution (or even avoidance) of contractual disputes. We argue that there is a prima facie case for this, and therefore for the reduction of transaction costs, by exploiting the potential of digital building models. However, the operationalisation and measurement of transaction costs, especially in the construction context, has proved an intractable barrier to the empirical testing of the applicability of TCE theory. To address this, the initial stage of the work, reported here, is concerned with defining and measuring the resources currently required for the management of certain types of contractual dispute. Data were collected from three selected project case studies and the time spent by delay analysts was categorised. Up to 70% of the time spent on delay analysis was concerned with searching for and establishing supposedly factually based information that could ideally have been automatically captured. The implications of these inefficiencies are considered, and a case is made for the exploitation of information technology, thereby reducing costs.

Keywords: case studies, contractual disputes, IT, Transaction Cost Economics

INTRODUCTION

Delays to construction projects are persistent, perhaps even endemic (Adam, *et al.,* 2017; Ansah, *et al.,* 2018; Durdyev and Hosseini, 2019; Larsen, *et al.,* 2016) and result in claims and disputes that are time consuming and costly (Arcadis, 2019). The work presented in this paper focuses on time-related disputes as a facet of the transaction costs of construction. The theory of Transaction Cost Economics (TCE),

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initiated in 1937 by Coase and refined by Williamson (1979) has long appealed to commentators seeking to explain construction industry inefficiencies. However, the operationalisation of the elements of TCE theory has proved controversial. Here our three propositions are: (1) that contractual disputes offer a striking example of unnecessary transaction costs; (2) that, following TCE theory, they are fuelled by information deficiency or asymmetry; and (3) that this effect can be mitigated by advances in the use of information technology within the industry. The empirical work reported here comes from three project case studies and addresses the first of these propositions by defining and measuring the effort currently required for the management of contractual disputes. First, the contextual background is presented, and this brings together two aspects of the relevant literature: (i) construction delay disputes and how they are managed; and(ii) a resumé of TCE theory. The methodology describes a case study approach to data collection, the results of which are analysed for insights into what certain components of transaction costs can amount to. Finally, and with a view to the larger body of work that this study forms part of, we consider how advances in information technology can be exploited to mitigate or eliminate these costs and enable the more efficient resolution (or even avoidance) of contractual disputes.

Project Disputes as Transaction Costs

A 2019 Global Construction Disputes report (Arcadis, 2019:8) calculates the average dispute to be US$33 million- and 17-months' duration. The proportion relating to delay claims is not identified but it is reasonable to suggest it represents a significant proportion of the total.

Time-related construction disputes

As noted by Pickavance (2010) the word 'delay' itself is open to differing interpretations. It is not defined in most standard form contracts but is generally understood to relate "to the works being affected by events that have a critical effect on the progress of the works" (Lexis Library, 2020). Project delays can result in losses for all parties involved and contract drafting bodies apportion the risks through mechanisms such as liquidated and ascertained damages and extensions of time. However, such contractual provisions are, of necessity, general and can prove ineffective in preventing disputes. Despite attempts to establish more detailed agreed procedures such as those by the Society of Construction Law (S.C.L., 2002; 2017) the complexity of these disputes combined with a lack of supporting information (Love, *et al.,* 2008) and inherent tendencies towards escalation (see Loosemore, 1999) drive the parties towards disputes that require resolution (Clay and Dennys, 2018).

Forensic delay analysis

As noted by Kumaraswamy (1997: 95) the intricacy and value of construction disputes has created opportunities for claims management and dispute resolution consultants who specialise in 'Forensic Delay Analysis' (FDA). The relative merits of different FDA techniques has been discussed in the literature (e.g. Kraiem and Diekmann, 1987; Braimah, 2013; Society of Construction Law, 2002, 2017; Scott *et al.,* 2004; American Association of Cost Engineering, 2011) but underlying them all is a comparison of 'as-planned' and 'as-built' versions of the project programme/schedule. Quantification of project delays is usually supported by critical path analysis (CPA) and is reliant upon the availability of validated programmes. If the project records required to validate construction programmes are unavailable (as they often are) the CPA can be highly speculative and subjective. The role of the FD analyst may be to assist a party or its legal team in building a case or to act as an independent expert in dispute resolution proceedings (adjudication, expert determination, arbitration or litigation). Before this a "vast number of documents to be reviewed and people to be interviewed" (Carmichael and Murray, 2006:1008) and Alkass *et al.,* (1995) estimated that information search and verification accounts for around 70% of the effort in building a case. Indeed, the 2017 SCL Delay and Disruption Protocol (Society of Construction Law, 2017: 13) recognises that any FDA method adopted must depend on "the nature extent and quality" of both the programme information and records available. We will argue that the management and resolution of construction disputes exemplified by FDA are palpable examples of transaction costs and so contribute to operationalising TCE theory and understanding how greater efficiencies can be achieved. The next section briefly summarises the key literature on TCE theory and attempts to apply it to Construction.

The theory of transaction costs
According to the theory's originator the "costs of organizing transactions" arise from efforts "to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms are being observed, and so on" (Coase,1960: 22). Dahlman (1979:148) identified "search and information costs, bargaining and decision costs, policing and enforcement costs" and added that "fundamentally [these] reduce to… resource losses due to lack of information". Williamson (1975: 8) recognises two factors that influence these costs as "the characteristics of the human decision makers … on the one hand and the objective properties of the market on the other". Eccles (1981:341) following Williamson, described two influential pairings of these factors as (1) bounded rationality and uncertainty/complexity and (2) opportunism and small numbers. TCE theory has its critics; the most cited being Simon (1991) who claimed they have "no empirical support" and Ghoshal and Moran (1996) who regarded TCE as "not only wrong but also dangerous …". These criticisms have themselves been refuted; by Masten (1996) in the former case, and by Williamson (1996), in the latter. David and Han (2004:52) describe a "significant variation in support for the theory's predictions". This debate has continued. Recent examples include Lacity and Khan (2016) who conclude that TCE theory only applies "to specific contexts"; Schermann, *et al.,* (2016) with evidence that both supports and negates TCE theory; and Haaskjold *et al. (*2019) who see a general association between collaboration and reduced transaction costs but support a more restricted context-specific view of TCE applicability.

Transaction costs and construction projects
Many authors have employed a 'TCE-lens' on construction organisations and projects. It is at this point that Williamson's (1989) division of a TC approach into a "a governance branch and a measurement branch" should be invoked. Some authors (e.g. Reve and Levitt,1984; Winch, 1989, 2015; Walker and Wing, 1999; Lai, 2000; Bridge and Tisdell, 2004; and Bygballe, *et al.,* 2013) have studied the governance branch and followed Eccles' approach of using TCE theory to account for the 'boundaries' of construction firms and how their businesses or projects are organised. Others have followed the latter and used TCE constructs to explain project performance and other outcomes, such as the behaviour of participants. Yates and Hardcastle (2003) examined how bounded rationality and opportunistic behaviour might relate to conflict and disputes in projects and Greenwood and Yates (2006) supported this approach with evidence from a partnering case study. Empirical studies by Li *et al.,* (2012; 2013; 2014; 2015) and You *et al.,* (2018) identified pre-

and post-contract transaction costs and their implications for choosing project delivery systems and type of contract.

METHODOLOGY AND DATA COLLECTION

Here we are concerned with (i) identifying the processes and resources currently required for analysing delay disputes; (ii) categorising them using TCE ‘language’ and aligning them with components of transaction costs (as discussed above); and (iii) operationalizing and measuring these costs by examining data collected from three project case studies. For ethical reasons cases have been anonymised and described by their function (i.e. 1: Infrastructure Design; 2: Panel Manufacturing Plant; and 3: Bridge Construction). The methodological approach is primarily archival and based upon analysis of the records of three case study projects chosen from an initial sample of 60. In common with many types of consultant, the FD analysts’ activity records are kept for payroll, project accounting and client billing purposes. These provided a rich source of data for identifying, categorising and quantifying the FDA process and the resources required to sustain it.

The selection of cases was based on four criteria. The first was that each involved a delay or delays upon which the parties were unable to reach agreement under the terms of the contract (hence escalated to a dispute). The second criterion was recency: the case studies were selected from the period between January 2016 and January 2019. Projects started before this timeframe or incomplete by the end of it were eliminated. The third criterion was representativeness: the case studies must as far as possible, be reasonably representative of the range of projects dealt with. Finally, the fourth criterion, in order to secure the accessibility and consistency of collected data, was that the entire delay analysis process had been undertaken ‘in-house’ by a single FDA consultant. This is a significant filter, as projects are often completed by a network of analysts in different international locations. Based on the above criteria three projects were identified for further analysis.

Case study 1: Infrastructure design
The scheme was to provide road-widening improvements to 40km of dual carriageway encountered complications that included work alongside live traffic and environmental sensitivities. Construction started in 2015 with a planned completion date of 2018, later adjusted to the autumn of 2019. Negotiation over delays was unsuccessful and escalated to adjudication. The FDA consultant was instructed to defend the designer (against the Contractor’s claim for LDs) and prepare a loss and expense counterclaim for the designer.

Case study 2: Panel manufacturing plant
A contractor had ordered cladding panels for three rail stations. The dispute related to delay in the supply of panels by the manufacturer who commissioned the FDA to support a claim for an extension of time (EOT).

Case study 3: Bridge construction
The project was for the engineering, procurement and construction of a new cable-stay bridge of total length 525m and a central span of 290m. The FIDIC contract contained provision for a Dispute Adjudication Board (DAB) as an alternative dispute resolution device (see Bunni, 2005). The main contractor instructed the FDA consultant to help establish entitlement to EOT for unforeseeable ground conditions encountered during piling works.

Daily record-keeping is a fundamental requirement for the FD analyst, as it is for most consultant organisations. The records from the three case-study projects were reviewed to identify: (a) the type of task conducted by each consultant for each working day; (b) the reason for conducting the tasks; (c) the product that was produced as a consequence of each task; and (d) the time spent on a particular task. Initial analysis revealed that the FDA process can be divided into the following four broad categories of activities (or tasks):

Category 1: Preliminary tasks
These include a review of available records, meetings or correspondence with clients to establish the aims, objectives of the FDA and a basis for further records requests.

Category 2: As-planned v as-built analysis
These involves a review of available programmes to establish the accepted 'baseline' (as-planned) and as-built programmes, their validation, and the creation of tables, schematics and other charts to illustrate high level, mid-level and detailed comparisons, and drafting the methodology and findings. It is a process where the start and completion dates of the programme activities are compared to the available as-built records which could be in the form of daily, weekly or monthly reports.

Category 3: Causation analysis
This includes a review of contemporaneous records to identify relevant issues, create chronologies to describe identified issues, creation of tables, schematics and other charts to illustrate findings and draft and edit relevant sections of report.

Category 4: Undifferentiated activities
Where in a record it was difficult to allocate time to a single category, e.g., where records related to time spent overall on all of them, it was assumed that the relative proportion of time could be allocated to Categories 1-3 pro-rata to the predominant patterns from data that could be differentiated.

DATA ANALYSIS

Analysis of the records from each of the three case studies produced the following results.

Case study 1
The tasks executed by the Consultant to prepare a delay analysis were allocated to the four categories discussed above. Table 1 shows a summary of hours spent by the Consultant.

Table 1: Summary of production hours for Case 1

Categories	Preliminary Tasks	As-planned v As-built	Causation	Others	Total	Total less *Others*
Hours Spent	27	1518	823	1588	3956	2368

The major part of identifiable time (64%) was spent in the preparation of the As-planned vs. As-built analysis. Although this activity accounted for around 38% of the total, it was not possible to identify the 'other' activities, due to the level of accuracy in the description provided in the time sheets. It may be that a significant part of the 1588 'Others' hours was also spent on As-planned vs. As-built analysis. In contrast, the time spent on Causation Analysis, which is arguably the most contentious issue in FDA was 35% of identifiable time.

Case Study 2 (Panels manufacturing plant)
Table 2 shows a summary of hours spent by the Consultant on Case 2. Here, the records were more helpful (only 17 hours had to be classified as 'Others').

Table 2: Summary of production hours for Case 2

Categories	Preliminary Tasks	As-planned v As-built	Causation	Others	Total	Total less *Others*
Hours Spent	52	374	35	17	378	461

The 374 hrs spent on preparation of the As-planned vs. As-built analysis accounted for 81% of the classifiable hours (78% of the total). Again, a proportion of the 'Others' category may be similarly attributable. Less than 10% of time was spent on Causation Analysis.

Case Study 3 (Bridge construction)
Table 3 shows a summary of hours spent by the Consultant on Case 3

Table 3: Summary of production hours for Case 3

Categories	Preliminary Tasks	As-planned v As-built	Causation	Others	Total	Total Less *Others*
Hours Spent	58	374	175	381	988	607

As-planned vs. As-built analysis accounted for around 62% of the classifiable hours (38% of the total). As before, a proportion of the relatively large (381) 'Others' category may also be similarly attributable. The time spent on Causation Analysis (29%) was less than half that spent on establishing accepted as-planned and as-built programmes.

CONCLUSION

Following Haaskjold *et al.,* (2019), who found that "conflicts can lead to significant transaction costs", we conclude that TCE theory can be invoked to relate those costs to information deficiency or asymmetry. Based on three cases, we measured the resources required for managing contractual disputes over project delays. The findings indicate that up to 70% of FDA costs are expended in retrieving, validating and processing project records for analysis. Where these records are incomplete, inferences are needed that themselves require further efforts to justify. Not only does this support the estimates of Alkass *et al.* (1980) but indicates that little has changed in the intervening 40 years.

This is information that could theoretically exist in accurate and verifiable formats. For example, there is a range of available software products to support the management of time on projects and versions of these were available to all the key participants in the cases in question. All such products have a facility for the capture and archiving of evolving versions of the schedules they are used to produce. A more recent technological advance is that of Building Information Modelling (BIM). Authors from Gibbs, *et al.,* (2013) to Sanchez *et al.,* (2019) have explored how BIM and related digital technologies could assist with FDA. Advances in technology such as the introduction of 3D scanners (El-Omari and Moselhi, 2008), drones (Li and Liu, 2019), sensors (Akinci and Anumba, 2008) and other developments in information technology for the construction sector present an opportunity for accurate contemporaneous collection and processing of construction project. Furthermore, the automation of progress records in a construction project is likely to remove the human contribution and, as such, remove potential subjectivity. Hence, the exploitation of information technology is likely to improve the current efficiency of resolution (or avoidance) of contractual disputes by reducing (or even eliminating) the factual arguments, particularly arguments relating to the actual progress of the construction works.

Despite these opportunities, the proportion of time the FD analyst spends on As-planned vs. As-built analysis indicates serious current deficiencies in the capture, storage, retrieval, and processing of information by the representatives of the organisations in question. The findings indicate that this process is time-consuming and resource-intensive and, at nearly 70%, compares with less than 25% spent on the more contentious aspect, i.e., making an argument for causation. This lack of adequate and credible information is a clear example of the bounded rationality, which, as discussed earlier, is one of the main factors in the escalation of transaction costs. Bounded rationality provides scope for opportunistic behaviour and this is exploited by individual agents in their unwillingness to share such information that does exist. Together these factors contribute to the conflict and disputes in construction projects, and ultimately to their cost. Transaction efficiency could be improved by automating the capture and management of the required information by minimising arguments over the sufficiency or accuracy of the records and, as a consequence, potential disputes regarding the parties' liability for critical project delays. In the language of TCE, this amounts to relieving the impact of bounded rationality as well as well as that of information asymmetry, by making that information accessible and transparent: such a development could improve current issues of uncertainty and reduce opportunistic behaviour.

There are limitations to drawing conclusions from these findings. First, the sample is small and requires further cases. It should also be noted that although they are in themselves significant, FDA costs represent only a fraction of the avoidable transaction costs in the project delivery life-cycle. Here, they have been used as a lens through which to investigate how such costs can be measured and ultimately minimised. A more systematic, possibly automated or semi-automated, approach to the collection of project information that is both verifiable and accessible would go a long way to improving efficiency.

The automatic digital capture, storage and retrieval of project information is likely to increase efficiency and reduce transaction costs in terms of bounded rationality (through more accurate recording, collection and processing of information) and information asymmetry (by increasing its accessibility and transparency). The consequent reduction in uncertainty and prospects for opportunistic behaviour would lead to a reduction in disputes, the cost of managing them, and hence to construction costs in general.

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