



Transaction costs incurred by construction owners

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Abstract

Purpose – Transaction costs arise from economic exchange rather than production activities. However, the term “transaction cost” is not consistently defined in the construction industry because the concept of transaction cost is not universally accepted by all stakeholders in construction projects. As a result, empirical studies are few and conflicting because accessing data on transaction costs is problematic, and the interpretation of the data is difficult. The purpose of this paper is to analyze the transaction costs borne by the owner in a construction project from the perspective of transaction cost economics and construction project characteristics.

Design/methodology/approach – A questionnaire survey was administered to construction owners. The factors that impact transaction costs were analyzed in the context of human-related issues (the owner’s and the contractor’s positions in the transaction), and environment-related issues (the transaction environment, and project management efficiency). Statistical analyses were conducted to compare the transaction costs incurred in the pre- vs post-contract phases of a project relative to the private vs public sector, different project delivery systems, different procurement methods, and different types of contracts.

Findings – The owners surveyed believe that transaction costs may be reduced if the owner and the contractor follow some basic guidelines (e.g. experience in similar projects, prompt payment, good relationship with project participants, no irregularities in bidding, and only few material substitutions and claims), if the project is well-run (e.g. technical competency, strong leadership, prompt decision-making, effective communication, and fair/speedy conflict management), and if the transaction environment is favorable (e.g. fair risk allocation, early contractor involvement, and complete design documents). The findings of the survey also indicate that post-contract transaction costs are much higher than pre-contract transaction costs expressed as percent of project value and that transaction costs are affected by the owner (public vs private), the procurement method, the project delivery system, and the type of contract.

Originality/value – The primary contribution that this research makes to the body of knowledge is a better understanding of transaction costs incurred by construction owners in the USA. The highest transaction costs are to be expected in the post-contract phase of public projects awarded on a unit price basis, but can be reduced, hence reducing overall project cost.

Keywords Transaction costs, Contracts, Project delivery systems, Procurement methods, Construction owners

Paper type Research paper

Introduction

A transaction occurs when a good or service is transferred across a technologically separable interface (Williamson, 1985). In addition to the cost of production, there are



also transaction costs to be considered (Winch, 1989). While production costs are the costs of transforming inputs into outputs, transaction costs arise from economic exchange. The costs incurred by activities such as preparing a bid document, estimating, drawing up a contract, administering the contract, and dealing with any deviations from contract conditions are also important. These costs are known as transaction costs in the study of economic organizations (Coase, 1937). However, it is not clear whether transaction costs can be reduced, mainly because they are not defined systematically (Li *et al.*, 2013). Also, it is not clear whether transaction costs are higher at the pre- or post-contract phases of a construction project, in private or public projects, in different project delivery systems, and different types of contracts. Clarity has to be brought to these issues.

The transaction paradigm has received considerable attention by academics and has been applied to a variety of construction-related topics including project organization and governance (Pietroforte, 1997; Turner and Keegan, 2001; Winch, 2001; Müller and Turner, 2005; Jobin, 2008); construction market and subcontracting (Winch, 1989; Eccles, 1981; Gunnarson and Levitt, 1982; Reve and Levitt, 1984; Constantino *et al.*, 2001; Bremer and Kok, 2000; Miller *et al.*, 2002; Lai, 2000); project delivery systems (Lynch, 1996; Whittington, 2008); construction contracts (Brokmann, 2001; Turner and Simister, 2001; Bajari and Tadelis, 2001); and the measurement of transaction costs (Antinori and Sathaye, 2007; Dudkin and Väililä, 2005; Ho and Tsui, 2009; Soliño and Gago de Santos, 2009; Farajian, 2010). The majority of these studies on transaction costs in construction projects have focussed on the theoretical and qualitative aspects of this issue, probably because it is difficult to measure transaction costs using the accounting systems currently in use in the construction industry.

The objective of the study is to analyze the transaction costs borne by the owner in a construction project. The factors that impact transaction costs are imported from previous research (Li *et al.*, 2013) and are systematically scrutinized in this paper. Information about these factors was collected by means of a questionnaire survey administered to construction owners. Comparisons are made between the transaction costs in the pre- vs post-contract phase of a project, the private vs public sector, different project delivery systems, different procurement methods, and different types of contracts.

Transaction costs in construction projects

The transaction costs in the construction phase of a project may be much higher than the transaction costs in the procurement phase (Turner and Simister, 2001; Hughes *et al.*, 2006; Whittington, 2008; Lingard *et al.*, 1998). So there appears to be a need in the construction industry to define transaction costs in a way that covers not only the pre-contract phase but also the post-contract phase of a project.

Pre-contract transaction costs are incurred before a transaction takes place. They include the costs incurred in drafting and negotiating agreements and vary with the design of the good or service to be provided. In this study, the pre-contract transaction costs are defined as the transaction costs borne by the owner before the construction contract is signed. At the pre-contract stage, Soliño and Gago de Santos (2009) try to distinguish between external costs (such as technical, legal, and financial advice) and in-house costs such as project preparation costs. Soliño and Gago de Santos's (2009) pre-contract transaction costs include the costs of environmental impact assessment, economic feasibility study, preliminary design, and bidding including tender documentation preparation and negotiation. Soliño and Gago de Santos (2009)

basically agree with Whittington's (2008) characterization. Whittington (2008) finds in six case studies that pre-contract transaction costs in the design-bid-build project delivery system are on average 2.6 percent of the value of the contract, but less in the design/build project delivery system (2.2 percent). Based on data collected from PPP projects financed by the European Investment Bank, Dudkin and Vålilä (2005) conclude that transaction costs in the pre-contract phase of infrastructure projects, is about 2-3 percent of the contract value on average. Dudkin and Vålilä's (2005) findings tend to agree with the average findings of Whittington (2008), probably because they have used the same measures mentioned by Soliño and Gago de Santos (2009). In this study, pre-contract transaction costs are defined in a broader way and include the cost of market research, the cost of exploring financing opportunities, the cost of conducting an economic feasibility study, the cost of bidding/negotiation, and the cost of day-to-day pre-contract project management. The respondents who participated in the survey were presented with this definition, and were then asked to estimate the approximate cost of pre-contract transaction costs with respect to contract value in the last project they completed for their company/agency.

Post-contract transaction costs include the costs incurred after the contract has been signed up until the constructed facility is handed over to the owner. According to Williamson (1985), post-contract transaction costs include the "setup and running costs of the governance structure to which monitoring is assigned and to which disputes are referred and settled: the maladaptation costs that are incurred; the haggling costs that attend adjustments (or the lack thereof); and the bonding costs of effecting secure (credible) commitments." This characterization points out that post-contract transaction costs arising from disputes and litigation could be high. Indeed, conflicts and disputes inflict a high cost to the construction industry in many countries including Australia, the USA, the UK, and Hong Kong both in terms of direct costs (lawyers, claims consultants, management time, delays to project completion) and indirect costs (degeneration of working relationships, consequences of mistrust between participants and dysfunctional teamwork) (Yates, 1999). Whittington (2008) finds in six case studies that the post-contract transaction costs for the design-bid-build project delivery system is on average 12.6 percent of the contract value, but less in the design/build project delivery system (9.5 percent). On the average, post-contract transaction costs appear to be much higher than pre-contract transaction costs possibly because post-contract transaction costs include a wide range of costs. In this study, post-contract transaction costs include the cost of day-to-day contract administration, the cost of administering claims and change orders, the cost of dispute resolution, and incentive payments. The respondents who participated in the survey were presented with this definition, and were then asked to estimate the approximate cost of post-contract transaction costs with respect to contract value in the last project they completed for their company/agency.

Research methodology

According to transaction cost economics, it is the inter-relationship between human and environmental factors that should ideally determine the eventual nature and governance structure of the transaction (Greenwood and Yates, 2007). Human factors involve organizations, relationships, roles, responsibilities, and the expectations of the owner and contractor. Environmental factors involve the manner in which the contract and construction are carried out. In other words, the characteristics of the transaction environment and of the efficiency of project management have significant impact on transaction costs (Li *et al.*, 2013).

In this study, the factors that impact transaction costs are considered under two human-related categories: the owner's and the contractor's positions in the transaction; and two environment-related categories: the transaction environment, and project management efficiency. The factors that define these four categories are presented in the following section. They cover the core antecedent variables of the transaction cost economics framework defined by Williamson (1979), namely frequency, uncertainty, and asset specificity.

This research employed a questionnaire survey conducted by email to collect the required data on the variables about transaction costs incurred by owners in construction projects. The questionnaire was designed for response over a web link and was administered to higher executives with direct experience in construction project management in construction owner organizations. The potential respondents were selected from the list of the Construction Owners Association of America (COAA) 2011 Membership Directory, the Federal Highway Administration (FHWA), the 2010 members of the American Association of State Highway and Transportation Officials (AASHTO), and the largest owners listed by *Engineering News-Record* (Top Owners List, 2010). Respondents were required to rate (using a one to five-point Likert scale) the level of each variable in the questionnaire by taking into account the characteristics of their organization's last construction project in which they were involved. From March 2011 to April 2011, 2,628 e-mails were sent out. 129 potential respondents were out of office, and 195 e-mails were not delivered. Finally, a total of 239 completed responses were returned for data analysis. The rate of response is 10 percent.

An analysis of variance (ANOVA) was used to test the effect of the different project characteristics on transaction costs, including different project owner organizations, different project delivery systems, different procurement methods, and different types of contract. This analysis assumes that the observations in the samples are independent from each other and follow a normal distribution. It is safe to assume that the 239 observations in this study are normally distributed. However, when the sample is split into groups (e.g. pre- vs post-contract phases) and subgroups (e.g. private companies vs public agencies in the pre-contract phase) for comparison purposes, sample sizes go down. Just in case the normality assumption does not hold for any of these distributions, the Wilcoxon-Mann-Whitney test was also performed. This is a non-parametric test that also assumes that the observations in the samples are independent but that the normality assumption does not hold.

The reliability of the constructs used in the survey was established by Li *et al.* (2013) by calculating the Cronbach's α coefficients of the constructs, all of which were found to be above 0.70, the threshold recommended by Nunnally (1978).

Analysis of the survey data

Characteristics of the respondents and projects

In all, 82 percent of the respondents were from the public sector, and the remaining 18 percent from the private sector. This distribution is not surprising because most of the membership of COAA, AASHTO, and FHWA are public organizations. All respondents were top and middle management level (26 percent executives, 51 percent project manager, and 24 percent supervisory staff). On the average, respondents had 18 years of experience with 67 percent having more than 20 years in the industry. Given the respondents' top and middle managerial level and their extensive professional experience, they are expected to have adequate knowledge about projects. Their answers can be considered to be reliable.

According to Figure 1, all project delivery systems including design-bid-build, design-build, and construction management are well represented in the survey sample. As to the procurement method illustrated in Figure 1, competitive bidding appears to be quite dominant, because 82 percent of the respondents were from the public sector; competitive bidding is required by law in public construction projects. Figure 1 also indicates that all types of contracts including lump sum, unit price, and cost-plus-fee contracts were used in the projects covered in the survey. The delivery systems, procurement methods, and contact types used in the reported projects appear to represent well the operations of public agencies that constitute the large majority of the owners in the survey sample.

The factors that affect transaction costs

The findings related to the owner’s position in the transaction, the contractor’s position in the transaction, project management efficiency, and the transaction environment are described in the following paragraphs.

The owner’s position. Figure 2 shows that most owners had experience in similar type projects, were in the habit of paying their contractors and suppliers on time, had a good relationship with the contractor, designer, suppliers and government agencies, and enjoyed high efficiency in their organization. All these observations are likely to reduce conflict between owner and contractor. More respondents denied that owners issue frequent change orders. It would have been interesting to see how contractors would have answered the same question.

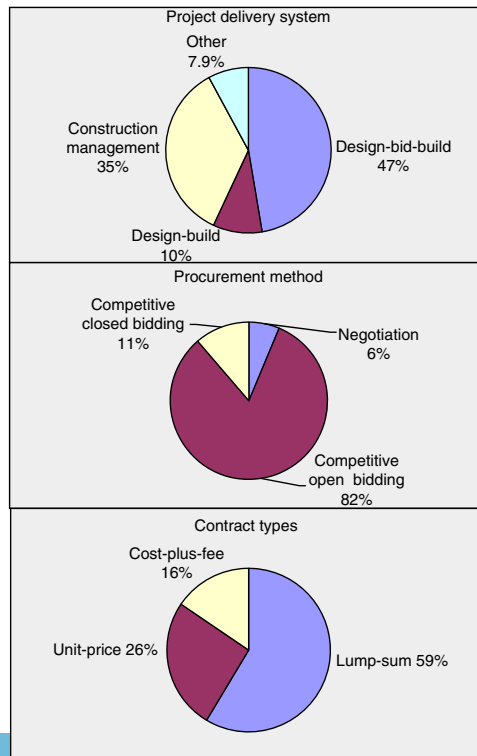


Figure 1.
Characteristics of the projects surveyed

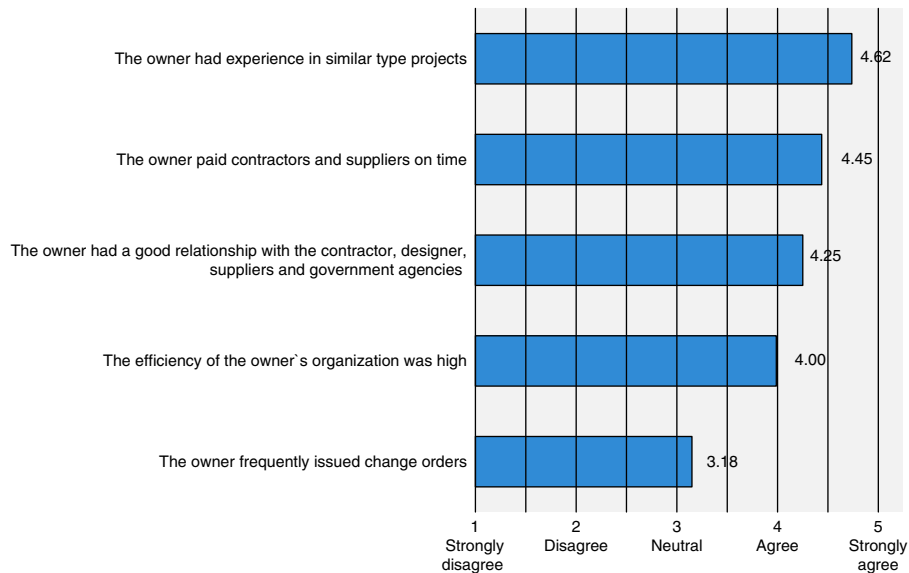


Figure 2.
The owner's position

The contractor's position. According to Figure 3, owners thought that it was relatively easy to judge if a contractor was qualified to do the proposed job and to detect irregularities in the contractor's bidding behavior such as unbalanced pricing, cheating, or collusion. Also, they were mostly confident that the contractors they choose are experienced and competent. Contractors' relationships with subcontractors and previous owners were also perceived by owners to be good on average. As to contractors' practices relative to material substitutions and claims, owners reported that they seldom occurred. So the bidding mechanism in the USA is perceived to be good enough to help owners find the right contractor. This should be a positive signal indicating less transaction costs.

Project management efficiency. Project management efficiency is important for delivering a project and solving a problem if and when problems occur. As Figure 4 shows, technical competency, leadership, decision-making, communication, and conflict management were rated by owners as relatively high. Despite the fact that the participants of a project including owner, designer, contractor, subcontractors, and suppliers have different objectives, owners seem to be reasonably satisfied with the efficiency in project management. This finding is conducive to lower transaction costs.

The transaction environment. The transaction environment is assessed by means of nine factors presented in Figure 5. On the average these factors are rated as "neutral." Higher ratings in some factors would be conducive to lower transaction costs. For example, fairer risk allocation, early contractor involvement, more completed design documents would lower transaction costs. On the other hand, it would be possible to achieve lower transaction costs with lower ratings in some of the factors, such as lower uncertainty in weather and site conditions, less fluctuation in material prices and wages, lower project complexity, and less demanding bonding requirements. Fragmented design and construction is common in the design-bid-build delivery system and contributes to the uncertainty in the transaction environment, hence increasing transaction costs.

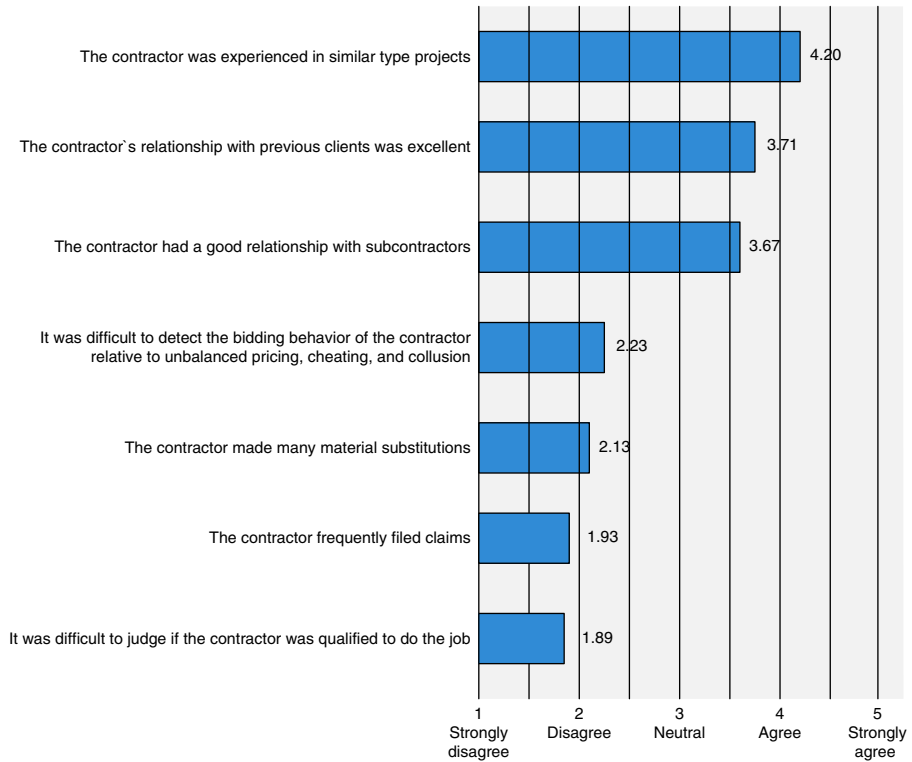


Figure 3.
The contractor's position

Comparative analysis of transaction costs

The average pre-contract transaction cost was 3.6 percent of the contract value, while the average post-contract transaction cost was 6.4 percent. The difference between the pre- and post-contract transaction costs is found to be statistically significant at $\alpha = 0.05$ when tested by one-way ANOVA ($p = 0.03$), and by the Wilcoxon-Man-Whitney test. These findings confirm the assertions of Turner and Simister (2001), Hughes *et al.* (2006), Whittington (2008), and Lingard *et al.* (1998) that transaction costs in the post-contract phase of construction projects would be higher than the transaction costs in the pre-contract phase. However, these findings are well beyond the range of 2-3 percent determined by Dudkin and Vålilä (2005), because the definition of transaction cost in Dudkin and Vålilä's (2005) study is narrower than the definition used in our study. The reason why transaction costs are much higher in the post-contract phase may be because the construction phase is longer in duration, requires coordinating a larger number of stakeholders, and necessitates a more complex project setup (Figure 6).

The factors that affect transaction costs at pre- and post-contract phases are examined in the following sections with respect to four project characteristics, namely the type of owner organization, project delivery system, procurement method, and type of contract.

Type of owner organization. Figure 6, transaction costs in public projects were larger than transaction costs in private projects, both in pre- and post-contract phases. As seen in Table I, the difference between the pre-contract transaction costs incurred by public vs private owners is significant at $\alpha = 0.05$ when tested by ANOVA and by

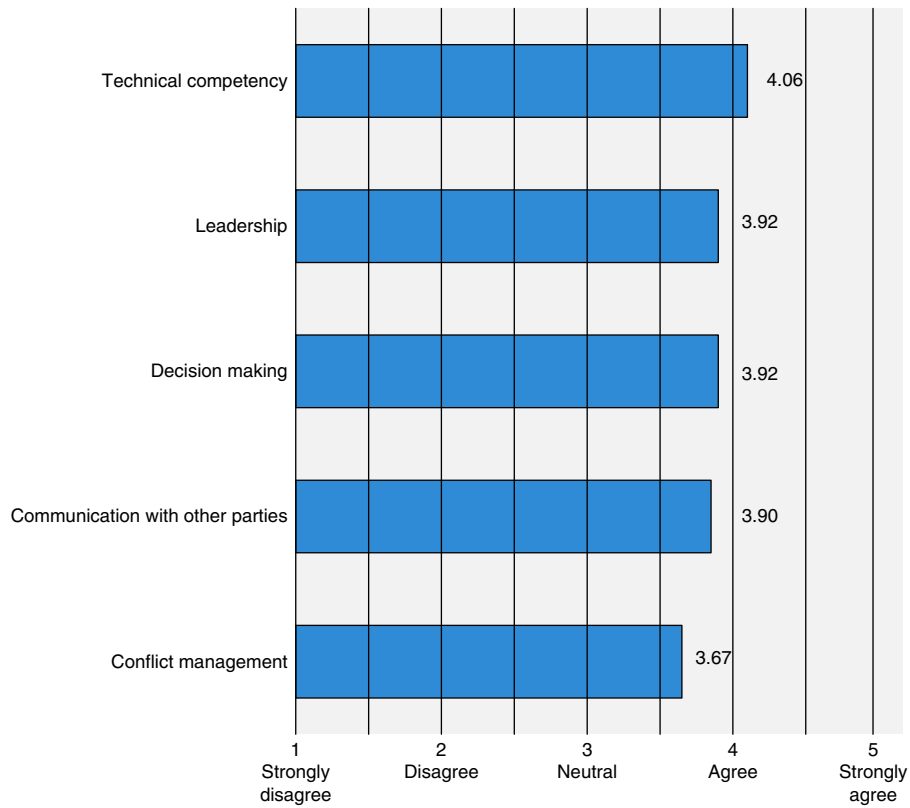


Figure 4.
Project management efficiency

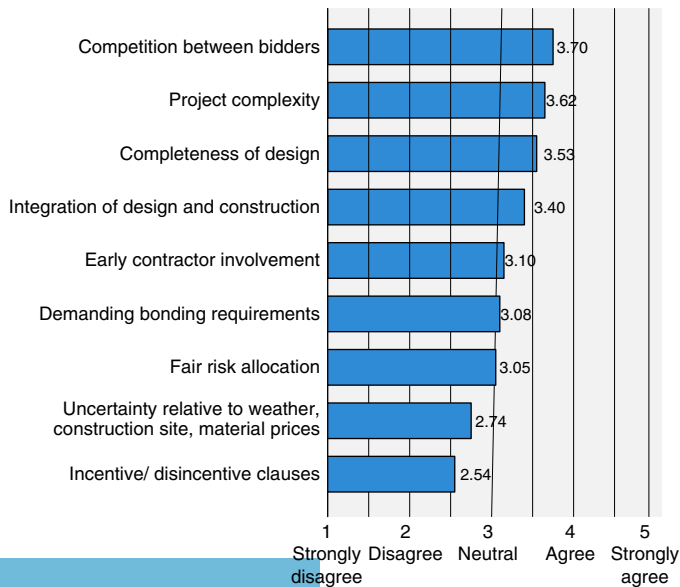
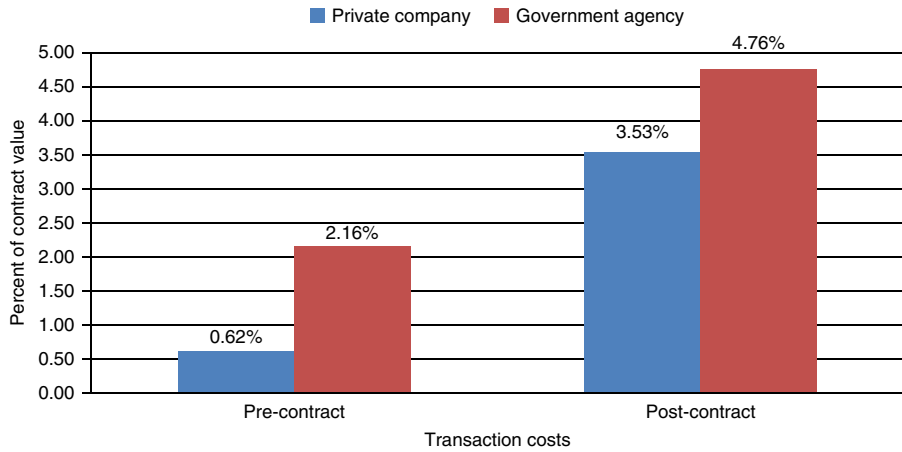


Figure 5.
The transaction environment

Figure 6.
Transaction costs incurred
by different organizations
(in percent of contract
value)



Project characteristics	Classification	Pre-contract transaction costs (<i>p</i> -value)		Post-contract transaction costs (<i>p</i> -value)	
		ANOVA	Wilcoxon-Mann-Whitney	ANOVA	Wilcoxon-Mann-Whitney
Type of owner organization	Private Public	0.002*	0.013	0.091	0.072
Project delivery system	Design-bid-build Design-build	0.881	0.342	0.369	0.109
	Construction management				
Procurement method	Negotiation	0.037*	0.021*	0.195	0.113
	Competitive open bidding				
	Competitive closed bidding				
Type of contract	Lump sum contract Unit price contract	0.004*	0.002*	0.000*	0.003*
	Cost plus fee contract				

Note: *Statistically significant difference at $\alpha = 0.05$

the Wilcoxon-Mann-Whitney test, because private owners may enjoy more flexibility in decision-making and may therefore be more efficient in performing pre-contract project management. The post-contract transaction costs incurred by private owners is also less than the transaction costs incurred by public owners, presumably because private owners have access to alternative dispute resolution methods that are less time consuming and less costly than formal legislation. However the difference between them is not significant at $\alpha = 0.05$.

Project delivery system. As seen in Figure 7, transaction costs incurred in design-bid-build, design-build, and agency construction management project delivery systems are quite close to each other both at the pre- and post-contract phases. As seen in Table I, tested by ANOVA, the difference between the transaction costs incurred in the different project delivery systems are not significant at $\alpha = 0.05$ ($p = 0.881$ for the pre-contract phase, and $p = 0.369$ for the post-contract phase).

No statistically significant difference is found when the samples are tested using the Wilcoxon-Mann-Whitney test either. Even though Abdel-Meguid and Davidson's (1996) work indicates that there is a positive correlation between project cost/time overrun and frequency of claims and disputes on the one hand, and the project delivery strategy chosen, on the other, transaction costs appear to be quite uniform across all project delivery systems in our study. This finding can be explained by two conflicting arguments. One point of view is that public construction owners are quite familiar with design-bid-build because this is the most commonly used project delivery system, and therefore transaction costs in design-bid-build should be lower than in other systems. Another point of view is that improved integration, collaboration and communication in the design-build and agency construction management systems should reduce transaction costs (Vrijhoef and Ridder, 2007). The findings in this study seem to indicate that these two arguments neutralize each other.

Procurement method. As seen in Figure 8, awarding a contract by negotiation generates the lowest pre-contract transaction costs when compared to competitive bidding. According to the statistical analysis presented in Table I, the pre-contract transaction costs incurred in awarding a contract by negotiation are significantly lower than in competitive bidding when tested by ANOVA ($p = 0.037$) and by the Wilcoxon-Mann-Whitney test at $\alpha = 0.05$. Negotiation is a common practice for private owners that involves hand-picking a contractor on the basis of previous cooperation, reputation, and overall qualification to do the job. Since negotiation is a pre-contract activity, the transaction costs incurred in the post-contract phase are not expected to be affected by the procurement method selected; indeed, in the post-contract phase, the differences between transaction costs are not significant at $\alpha = 0.05$ for different procurement methods.

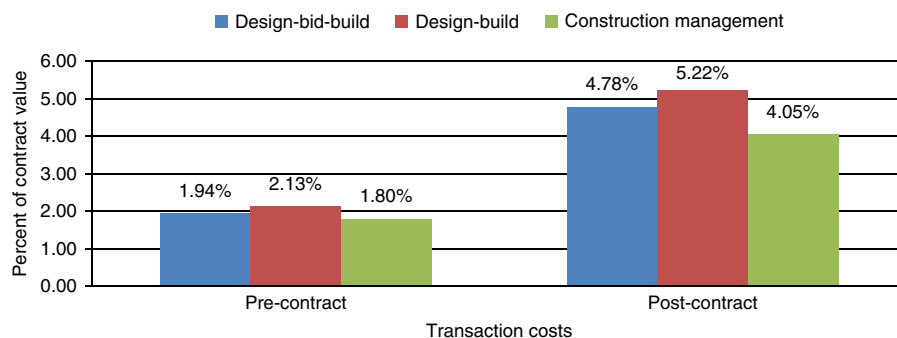


Figure 7. Transaction costs incurred in different project delivery systems (in percent of contract value)

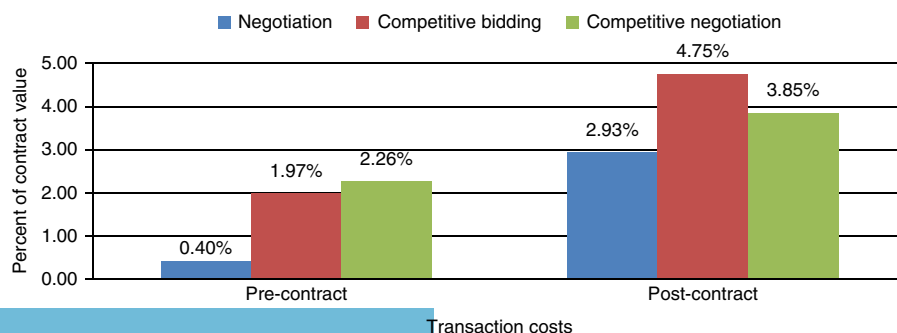


Figure 8. Transaction costs incurred in different procurement methods (in percent of contract value)

Type of contract. As seen in Figure 9, transaction costs are higher in unit price contracts than in lump sum and cost-plus-fee contracts, regardless of whether they are incurred in pre- or post-contract phases. According to the information presented in Table I, the differences are statistically significant at $\alpha = 0.05$ when tested by the Wilcoxon-Mann-Whitney test and by ANOVA at both pre- ($p = 0.004$) and post- ($p = 0.000$) contract phases.

Unit price contracts are often used in projects where drawings and specifications are not complete. The money paid to the contractor for each work item remains unknown until completion of the line item. Given this uncertainty, it is likely that many change orders will be filed. Also, because the contractor is paid on the basis of the quantities produced, the owner must support, either directly or through the architect-engineer, a strong field force for the measurement and determination of the true quantities of work accomplished. It is therefore not surprising that pre- and post-contract transaction costs are high in unit price contracts.

Conclusion

The construction project is performed in a complex and high risk environment. In such an environment, questionable decisions can be made in the planning and design phase, and disagreements, conflicts, disputes, change orders, and claims can occur in the construction phase. These problems contribute to an increase in transaction costs. But the inconsistency in defining “transaction costs” results in inconsistency in the collection of data, and makes the analysis and interpretation of the data difficult (Farajian, 2010). In addition, there are many problems in terms of accessing data on transaction costs due to the limitations of the current accounting systems used in the construction industry. Furthermore the concept of transaction cost is not universally accepted by all participants in the construction industry. There have been only a few studies attempting to quantify transaction costs in online buying behavior (Teo and Yu, 2005), and supply chain management (Grover and Malhotra, 2003). As to empirical research related to construction project transaction costs, only a few studies can be referenced such as the ones by Dudkin and Vålilä (2005), Soliño and Gago de Santos (2009), Farajian (2010), and Li *et al.* (2013). In this study, a questionnaire survey was administered to construction owners to seek their opinions about transaction costs and factors that affect transaction costs. Transaction costs were classified into pre-contract

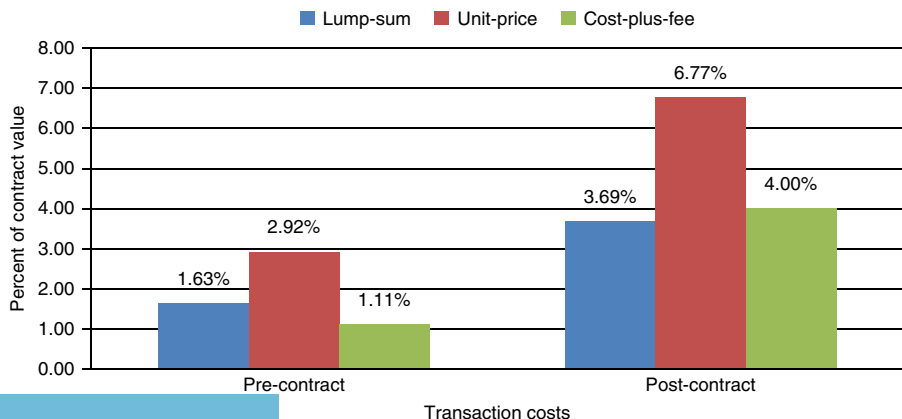


Figure 9. Transaction costs incurred in different types of contract (in percent of contract value)

and post-contract transaction costs and the findings were discussed relative to the owner's and contractor's positions relative to transaction costs, project management efficiency, and the transaction environment.

The owners surveyed believe that transaction costs may be reduced if the owner and the contractor have experience with similar type projects, and enjoy good relationships with the other project stakeholders. It also helps if the contractor does not cheat when bidding, keeps material substitutions and claims to a minimum, while the owner in return pays the contractor on time. As far as project management efficiency and the transaction environment are concerned, owners are of the opinion that a well-run project (competent parties, good leadership, efficient decision making, effective communication, and speedy conflict management) and a smooth transaction environment (healthy competition between bidders, complete design, and early contractor involvement) are prerequisites for lower transaction costs.

The analysis of the transaction costs reported by the owners who were surveyed showed that post-contract transaction costs are much higher than pre-contract transaction costs expressed as percent of project value. It also shows that public projects' transaction costs are higher than private projects' transaction costs at the pre-contract phase, indicating some degree of inefficiency on the part of public owners. This is reinforced by the fact that awarding a contract by negotiation (done mostly by private owners) generated less transaction costs compared to competitive bidding (generally practiced by public owners). While the project delivery system appears to have no impact on transaction costs, the type of contract appears to be of importance, indicating that unit price contracts generate higher transaction costs than lump sum or cost-plus contracts.

It should be pointed out that many transaction costs cannot be eliminated; it may also be quite difficult and/or impractical to reduce some transaction costs. Most transaction costs are incurred to receive benefits such as achieving transparency in contract award (e.g. bidding, negotiation, etc.), mitigating risk of contractor default (e.g. performance and payment bonds), mitigating risk of accidents or unexpected events (e.g. insurance). On the other hand, we may at times overdo risk mitigation or efforts to reflect transparency. For example, according to the Miller Act of 1935, a performance bond that covers 100 percent of the contract value is required in federally funded projects, meaning that the owner is covered by the surety company in case the contractor defaults a minute after the contract is signed (Clough *et al.*, 2005). A more intelligent approach that allows the owner to retain certain risks rather than transferring them to a surety or insurance company for a hefty fee could be considered and maybe adopted (Al-Sobie *et al.*, 2005). Such a rational change could reduce transaction costs to a certain extent.

This study sensitizes the parties involved in a construction project to the existence and importance of a set of costs that are classified as transaction costs. The main contribution of the study is that project participants now know that the highest transaction costs are to be expected in the post-contract phase of public projects awarded on a unit price basis. Most of all, project participants now know that some transaction costs can be reduced, hence reducing overall project cost. Future research could strive for a higher rate of response from a pool of respondents that have closer to equal representation in the public/private sectors. In future research, it would be desirable to quantify the contribution of the different transaction costs to the overall cost of a project by collecting hard cost information from a larger number of representative projects. An analysis could then be conducted to identify those transaction costs that can be controlled easily by project participants and that have the greatest impact on overall project cost.

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