

# PREVENTING UNETHICAL AND ILLEGAL PRACTICES IN CONSTRUCTION

DAVID ARDITI

*Dept of Civil, Architectural, and Environmental Engineering, Construction Engineering and Management Program, Illinois Institute of Technology, Chicago, IL, USA*

Despite the fact that all professional associations, including ASCE, CMAA, PMI, AACE, and NSPE have codes of ethical conduct, the majority of the stakeholders in the construction process have encountered unethical behavior at one time or another. This is a contentious issue because there is always disagreement about what is and is not ethical. This paper looks into two practices that are most common in construction contracting, namely unbalanced bidding, and pre-award bid shopping. Both practices are considered to be totally acceptable by some, and totally unethical by others. Both practices can be stopped if preventive measures are put in place. The nature of these behaviors is examined, their impact is assessed, and preventive measures are formulated. In addition, in rare instances, illegal practices come to light. Collusive behavior is one such practice that is difficult but not impossible to detect. The nature of bid rigging is examined, its impact is assessed, and recommendations are made to detect parties that are involved in collusive practices. In addition to professional associations' efforts to publish standards for ethical conduct, the construction industry needs to be proactive in creating awareness about ethics issues, clear the confusion about what is ethical and what is not, and in promote ethical values throughout the entire spectrum of professions involved in construction.

*Keywords:* Ethics, Pre-award bid shopping, Unbalanced bidding, Bid rigging.

## 1 INTRODUCTION

Ethics is a set of accepted moral principles and values governing the appropriate conduct of an individual or group. Moral principles and values involve standards of what is right or wrong conduct. The importance of ethical conduct is recognized by all organizations. Administrators believe that good ethics is good business. Professional ethics, be it in science, medicine, law, or construction, is considered essential to the functioning of the profession (Loo 2002).

In the construction industry, the National Society of Professional Engineers (NSPE), the American Society of Civil Engineers (ASCE), the Construction Management Association of America (CMAA), the Project Management Institute (PMI), the Association for the Advancement of Cost Engineering (AACE), and many other associations have issued their respective standards of ethical conduct and consistently promote these principles to their members. The Accreditation Board for Engineering and Technology (ABET) has consistently expected an ethics dimension across the civil engineering curriculum in all accredited programs in the nation.

Despite these efforts to promote ethical conduct in the professions involved in the construction activity, there is a widespread perception of unethical conduct in the construction industry. A survey of owners, contractors, subcontractors, designers, and construction managers found that (1) nearly two thirds of the respondents believed that the industry is tainted by unethical actions; (2) more than 80% had personally encountered within the previous year acts or transactions they considered unethical; (3) fewer than one third of respondents' firms had an ethics policy that was formal, well understood by everyone in the firm, and enforced by top management; and (4) more than one third believed that unethical and illegal activities generate additional costs that amount to 2% or more of the total job budget (Doran 2004).

It has to be noted that even though most ethical decisions are rational, some are more emotional than rational. The trolley problem is a case in point that is cited by psychologists. Suppose a trolley is rolling down the track toward five people who will die unless you pull a lever that diverts it into another track where unfortunately lies one person who will die instead. Most people find this to be an easy call as it minimizes the loss of life. Now suppose the only way to save the five people is to push a bystander whose body will bring the trolley to a halt before it hits the others. It is still a one-for-five swap, but most people think that this is wrong. Similarly, in construction, one person's "unethical" may be another person's "tough competition". This paper takes up two controversial practices in construction, namely unbalanced bidding, and post-award bid shopping, practices that are justified as legitimate business practices by some and unethical behaviors that need to be stopped by others.

One should not confuse "unethical" with "unlawful". Ethics are governed by societal norms, whereas laws and regulations spell out what is legal or illegal. There are statutes in every country that spells out what constitutes a crime. Bribery and fraud are examples of unlawful action. After reviewing the evidence and hearing witnesses, a court of law decides whether the action is illegal or not. A conviction will result in sentencing that can include fines and/or incarceration. It is difficult to detect and prosecute unlawful conduct. This paper discusses one such practice, namely bid rigging, and proves that it is possible to detect and prevent collusive behavior.

## **2 UNBALANCED BIDDING**

Unbalanced bidding is a serious problem in the construction industry. The owner may end up paying more money if the bid is unbalanced by the contractor. The owner has the right to reject an unbalanced bid. A bidder unbalances a bid by inflating the unit price of some line items and reducing the unit price of other line items. Frontloading is the most common practice where a bidder can mathematically unbalance a bid by overstating the unit price of line items scheduled to be performed early in the project and understating the unit price of line items performed later. A bidder can also overstate the unit price of a line item whose quantity was somehow underrated by the engineer. If the owner proves that a mathematically unbalanced bid costs more to perform, the bid is said to be materially unbalanced, in which case the owner can reject the bid.

While early linear programming models of unbalancing bids is relatively easy to detect by the owner, Nassar's (2004) research aims to unbalancing a bid and not be caught in the process. Cattell *et al.* (2007) summarize methods of unbalancing bids and

argue that a client is given full information of a contractor's item pricing and that the client is given the choice to select among the contractor's competitors, implying that there are no ethical implications of unbalancing a bid. In other words, if an owner suffers the high cost of an unbalanced bid, it is rather the owner's fault to have selected the contractor who unbalanced the bid and not the contractor's fault who unbalanced the bid. However, according to a survey of 270 owners, architects, engineers, construction managers, general contractors, and subcontractors about ethical practices in the construction industry, unbalancing a bid was considered unethical by 84% of the respondents (Doran 2004). Also, New York City's Procurement Ethics Guide specifically asks contractors not to engage in unbalanced bidding.

A model was developed by Arditi and Chotibhongs (2009) that formalizes and automates the process of detecting mathematically and materially unbalanced bids by comparing line item prices with the engineer's estimates or the average prices offered by the bidders. This model allows owners to detect and reject unbalanced bids, and deters bidders from unbalancing their bid.

Because the extra cost of an unbalanced bid cannot be justified by the owner, and because owners have the right to legally reject unbalanced bids, owners should be able to stop and prevent unbalanced bids. A bidder's line item prices can be compared to the engineer's estimates to see if there are significant differences, an indication that the bid is potentially unbalanced. One can also compare a bidder's line item prices to the average line item prices of all bidders. Two separate models are therefore proposed but only one is described below. Since unbalancing can take the form of frontloading or adjusting the unit price of a line item whose quantity was understated by the engineer, both models are designed to deal with these situations. Both models are completely automated using MS Excel.

The proposed methodology is presented in Figure 1. Once all the bids are received from the bidders, the bottom line offers are compared with each other. Assuming that the bidders are qualified, the lowest offer is a candidate for contract award.

Starting from the first line item, the prices of each line item in the lowest offer are compared with the engineer's estimates (Figure 1) or the average prices of the respective items in all bids. If the differences are within acceptable limits, this bid is not unbalanced. The limits can be set by the owner depending on the type of project and the historical precedents. For example, Texas DOT has defined different limits for major and minor line items, while Wisconsin DOT's limits are based on project size. If the price difference for an item is beyond the acceptable limit, the analyst needs to check whether the quantity of the item was understated by the engineer.

- If the price of a line item is inflated by the bidder compared to the engineer's estimate (or the average prices of all bids) and the quantity involved in the line item was somehow understated by the engineer, this bid is mathematically unbalanced. In such cases, it is justified for the owner to recalculate the bids using the new (bigger) quantities but the same unit prices originally proposed by the bidders in order to establish if the lowest bid is materially unbalanced. If after recalculating the bids using the new quantities but the original unit prices proposed by the bidders, the original lowest bidder remains the lowest bidder, the contract is awarded to this bidder. But if the original lowest bidder is not the lowest bidder any more, then the original lowest bid is rejected on

the basis that it was mathematically and materially unbalanced. The next lowest bidder becomes the new candidate for award of contract. The process described in this bullet point is repeated until an award is made or all bidders are exhausted, in which case the bid is re-advertised.

- If the price of a line item is inflated by the bidder compared to the engineer's estimate (or the average prices of all bids) and there are no doubts about the quantity involved in the line item, then the analyst needs to check if this bid was frontloaded. If the line item is scheduled early in the project, then the bid is frontloaded, i.e., it is mathematically unbalanced. The analyst then needs to check if this frontloading affects the present worth of the payments to the contractor by using an appropriate work schedule, discount rate, and economic analysis principles. If after calculating the present worth of the payments, the original lowest bidder remains the lowest bidder, the contract is awarded to this bidder. But if the original lowest bidder is no longer the lowest bidder, then the original lowest bid is rejected on the basis that it was mathematically and materially unbalanced. The next lowest bidder becomes the new candidate for award of contract. The process described in this bullet point is repeated until an award is made or all bidders are exhausted, in which case the bid is re-advertised. Back-end loading is not considered in this study because it is not likely to take place in the current low inflation environment in the U.S.

Unbalanced bidding is a serious problem for the construction owner. Unbalancing a bid is considered by many as unethical. Unbalanced bids can be rejected if caught by the owner. If awarded, the cost of these contracts to the owner is unjustifiably increased. Despite these facts, most researchers appear to be interested in the optimization of a contractor's cash flow by unbalancing a bid and not be caught in the process (e.g., Nassar 2004, Cattell *et al.* 2007). Detecting an unbalanced bid is normally difficult and has become even more difficult thanks to the efforts of these researchers. Given the current literature that aggressively tries to teach contractors the various methods of unbalancing a bid without getting caught, it is time to provide a sensible tool that allows owners to detect and reject unbalanced bids.

FHWA and a number of state DOTs in the U.S. have spelled out general principles to protect their interests with respect to unbalanced bids. Many DOTs routinely but informally check bids for unbalancing using different processes. Some DOTs have a formal process in place but each use different approaches and different assumptions. The proposed model represents a marked improvement on existing practice because it is an attempt to develop a thorough methodology that systematically covers all aspects of unbalancing a bid. The proposed model is fully automated. It institutionalizes the process of detecting unbalanced bids and is expected to deter bidders from unbalancing their bids.

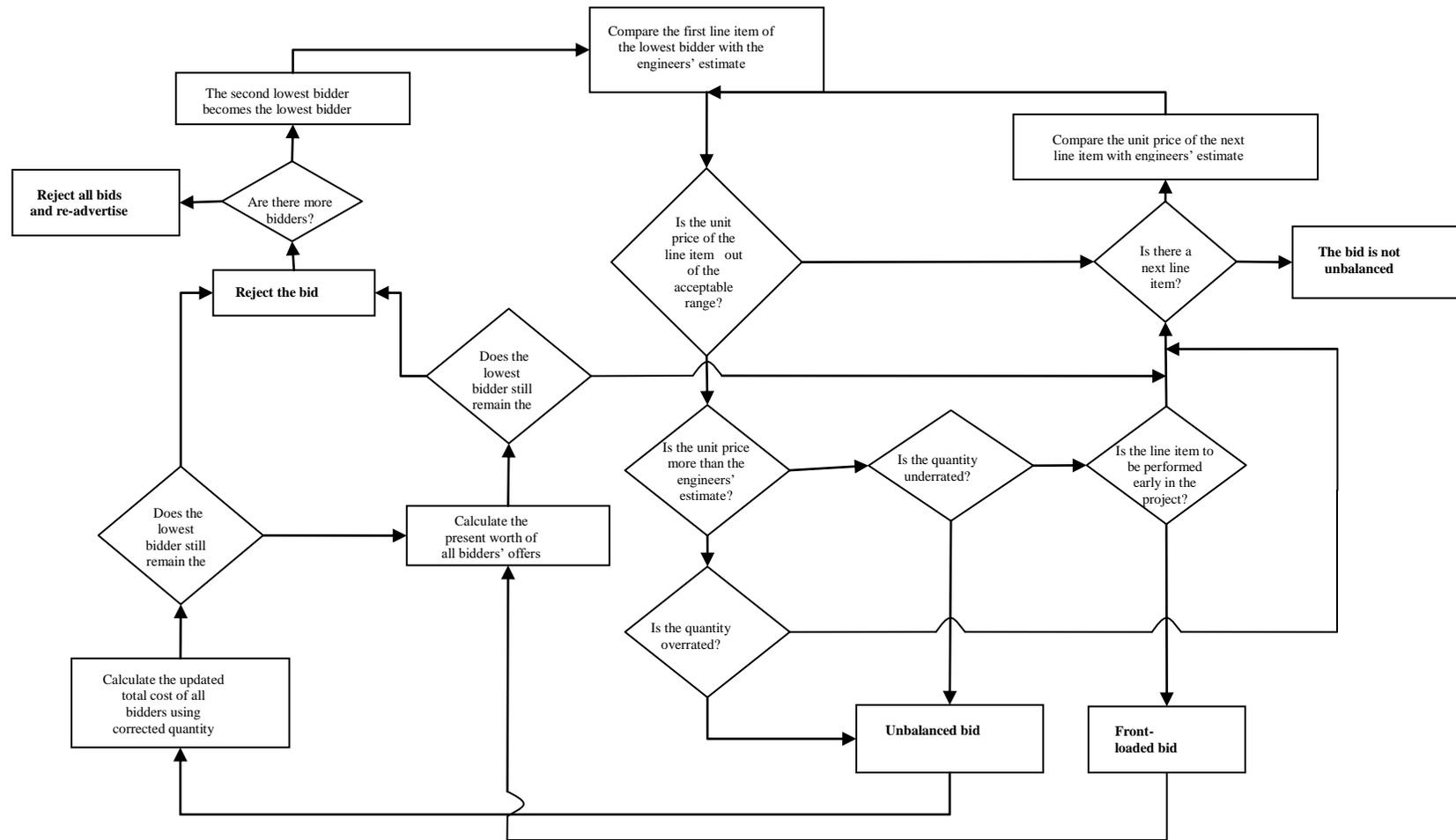


Figure 1. Detection and analysis of unbalanced bids using the engineer's estimates.

### 3 POST-AWARD BID SHOPPING

Pre-bid bid shopping is a way of life in the construction industry. General contractors typically shop bids before submitting a bid to the owner. If bid shopping occurs before a contract is awarded, the general contractor may or may not benefit of the practice, depending on the number of the other competing bidders who receive the same reduced quotations. The owner receives the benefit of the practice unless quality standards are reduced to accommodate the lower subcontractor quotations. The subcontractor who is selected for the project as a result of submitting the lowest price is the apparent beneficiary of bid shopping.

Post-award bid shopping is initiated by a general contractor who is awarded a contract. A general contractor who indulges in this practice will try to get the subcontractor to decrease the submitted bidding price or will engage another subcontractor who is willing to perform the specified job at a reduced price. The doctrine of promissory estoppel binds a subcontractor to perform in accordance with its bid if accepted by the general contractor. Conversely however, the contractor is not bound to use the subcontractor to perform the work, but is free to shop for a lower bid in an attempt to get a better price.

Any reduction in the subcontractor's price made after the contract is awarded, directly increases the general contractor's profit but may harm owners as well as subcontractors. It is likely that a bid that has been shopped is often awarded to an unqualified subcontractor who entered into the process late in the bid phase and has not adequately planned for the job. Consequently, post-award bid shopping may promote lower standards of work performance, reduce overall project quality, create an adversarial relationship between the parties, provoke legal disputes, foster unfair competition, be conducive to subcontractor insolvencies, and reduce overall jobsite safety (Clough *et al.* 2005). Post-award bid shopping and is considered unethical by most parties (Doran 2004, Arditi and Chotibhongs 2005).

How often do general contractors shop bids to select their subcontractors after the contract is awarded? On a 0-3 scoring system, the average frequency is 1.42 for subcontractors, 0.18 for general contractors and 1.36 for owners. The difference between the frequencies reported by subcontractors and owners is not statistically significant but the differences between the frequencies reported by general contractors and the other two groups are statistically significant at  $\alpha = 0.05$ . It is not surprising that the average frequencies of the responses from subcontractors and owners are high because post-award bid shopping is a major problem for them. On the other hand, general contractors appear to deny that post-award bid shopping is at all happening possibly because this practice is considered to be a legal but unethical practice in the industry.

What can be done to improve general contractors' selection practice of subcontractors? The distribution of the responses in Figure 2 shows that according to the large majority of owners (91%) and subcontractors (78%), a bid listing required by owners appears to be the best way to eliminate post-award bid shopping (Arditi and Chotibhongs 2005). Some states have enacted statutes that require general contractors to list their subcontractors in their bid to owners. In these states, the general contractor cannot change subcontractors if its bid is accepted. On the other hand, it is not surprising that only 14% of general contractors agree with this recommendation.

Indeed post-award bid shopping is clearly in the interest of general contractors since it helps them achieve their primary objective of profit maximization, albeit by means that are considered by most parties involved in the construction activity to be unethical.

About half of the general contractors (58%) and owners (49%) believe that subcontractors should submit fair quotations to stop bid shopping whereas only 17% of subcontractors agree with this assessment. It appears that some general contractors and owners attribute the necessity for post-award bid shopping to higher-than-expected quotations on the part of subcontractors, whereas subcontractors justify higher-than-expected quotations in order to better position themselves in the inevitable bid shopping that will occur after the award.

Some respondents (52% of subcontractors, 24% of general contractors, and 33% of owners) suggested that trade associations (e.g., AGC, ABC, ASA, etc.) should seriously discourage bid shopping in order to prevent adversarial relationships between subcontractors and general contractors. Post-award bid shopping is clearly disturbing to all subcontractors whenever general contractors shop bids for any reason other than scope changes in the subcontracted work. The fact that owners do not see the benefit of post-award bid shopping while only general contractors benefit from it makes it unacceptable for both subcontractors and owners.

Many subcontractors (66%) and general contractors (55%) indicate that subcontractors should consider the history of bid shopping of the general contractor before sending in a quotation.

#### **4 COLLUSIVE PRACTICES**

Collusion is a serious unethical and illegal practice in competitive bidding. In this scheme, a cartel bidder is allowed by other cartel bidders to win a particular bid and obtain the greatest possible benefit from it. Collusion among cartel bidders creates a non-competitive bidding environment (Zarkada-Fraser and Skitmore 1998). Collusive bidding behavior also increases standard market costs and causes economic damage to non-cartel bidders because of unfair competition (Zarkada-Fraser and Skitmore 1998). According to the U.S. Department of Justice, some potential signals of collusion include the same bidder winning many bids, the same group of bidders submitting bids, the bidders in the group taking turns being the lowest bidder, bids being much higher than the engineer's estimate, fewer bidders bidding compared to normal bidding instances, bidder bidding significantly higher on some bids, and bid prices drop whenever a new or infrequent bidder submits a bid.

The factors that affect collusion, the reasons why contractors are tempted to enter into collusive agreements with other contractors, the legal implications of collusion for contractors and construction owners have long been investigated by a small number of researchers. Zarkada-Fraser and Skitmore (1998) conducted a survey of 72 Australian estimators to explore the factors that affect collusive intent and found that the welfare of a respondent's company overrides abstract philosophical principles, and that the law, industry norms and direct orders rank higher than moral concerns, or personal values. Porter (2005) discusses the factors that facilitate or inhibit collusive schemes. According to Porter and Zona (2008), cartel members may bid high or refrain from bidding in anticipation of the opportunity to obtain higher profits, contemporaneously or in the future. Doree (2004) asserts that a tougher public sector procurement policy

and continued reliance on lowest bid prices may not contribute to a collusion-free environment. According to Doree (2004), an alternative approach allowing for a balance of competition and collaboration with a wider number of selection criteria would create a more dynamic and iterative competitive process.

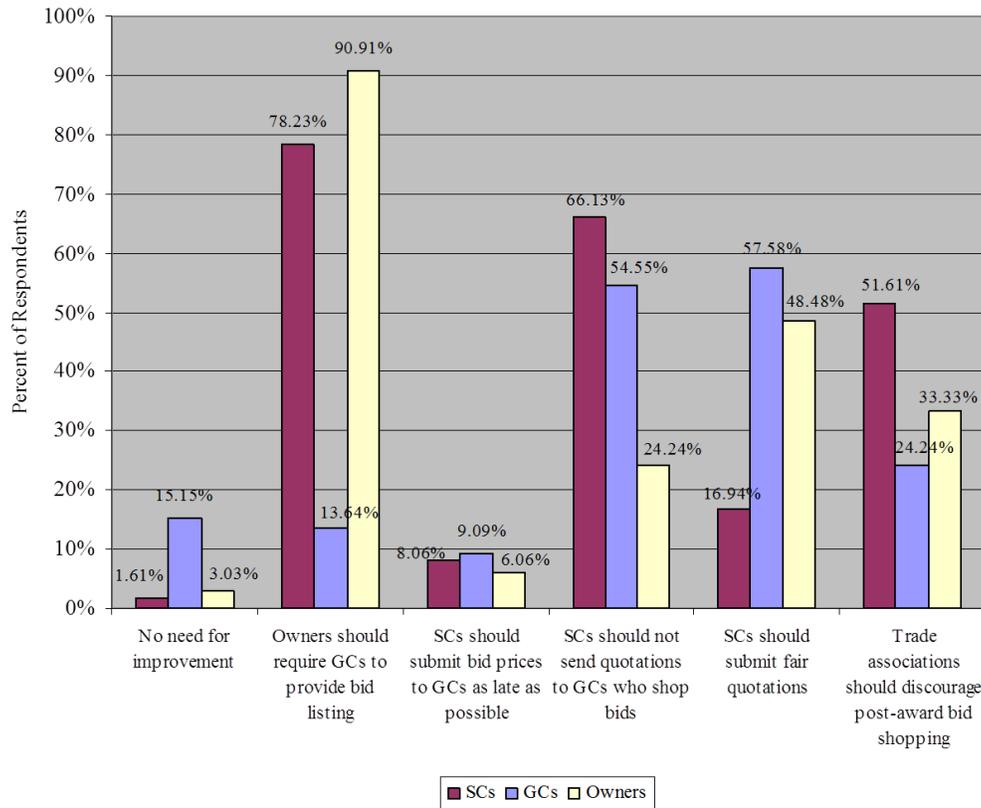


Figure 2. Ways to improve subcontractor selection practice.

It is difficult to tell how common collusion is in construction contracting even though Zarkada-Fraser and Skitmore (1998) believe that collusion is an “endemic malaise” in construction bidding. Because the marketing function of construction companies revolves around competitive bidding in public contracts, it is likely that there will be occasional cases of collusion even though it is considered illegal in most countries. For example, many writers exposed collusive practices in Japan, the U.S., the Netherlands, South Africa, and Australia.

Because collusion is a secret conspiracy between cartel bidders, its detection requires extensive police investigation in the form of collection of legal evidence such as recordings of meetings between cartel bidders and witness testimonies. Often collusion is detected by means of cooperation agreements with colluders in exchange for leniency. Another way to detect collusion is to analyze the abnormalities in the bids. For example, Porter and Zona (1993) investigated the differences in the cost structures between known cartel bidder and non-cartel bidder groups in federal highway

construction projects. Pesendorfer (2000) investigated the differences in cost structures in sealed bid first-price auctions. Bajari and Ye (2003) proposed statistical methods to detect collusion in highway contracts. Despite these efforts to detect collusion, using these methods, it is difficult to detect cartel bidders with certainty, and the applicability of these methods is limited.

The differences in the bidding behavior of potential cartel bidders and non-cartel bidders were analyzed by Chotibhongs and Arditi (2012a, 2012b). In this study, the collusive behavior of construction companies bidding in response to the solicitations of a public agency during a 10-year study period 2001-2010 was investigated. After a list of potential cartel bidders was determined, three additional analyses were performed to confirm/refute the suspicion by adding a measure of certainty to the decision.

By using the residual and the cost structure stability tests in the first step (Figure 3), six bidders were categorized as potential cartel bidders since they failed both tests. The residual test assesses the correlations between the residuals of the regression equations. The cost structure stability test investigates whether bidders behave the same way when they are confronted with the same cost structure. These six bidders possess almost 50% (47.75%) of the public agency's market during the study period 2001 to 2010. They bid against each other 12 times on average during this time.

The first analysis in the second step (Figure 3) involved the analysis of bid distributions. This analysis provided an important outcome that the bids predicted by the potential cartel bidder model are higher than the bids predicted by the non-cartel bidder model. This result agrees with the assumption that cartel bidders increase their bids over the normal competitive level. The second analysis in the second step (Figure 3) involved the analysis of model dispersion. This analysis showed that the bid clustering of potential cartel bidders is denser than non-cartel bidders' because cartel bidders try to regulate and control the competitive bidding environment by forcing other bidders to bid higher but not much higher than their offers. The third analysis in the second step (Figure 3) involved the comparison of the cost structures. It showed that the independent variables impacted the bid prices of the potential cartel and non-cartel bidders differently. All these analyses, individually and jointly, reinforce the suspicion that the six potential cartel bidders identified in Step 1 have indeed been involved in potentially collusive activities.

Of the six potential cartel bidders who failed both the residual and the cost structure stability tests, two were audited by the public agency relative to bid fraud, while another was found guilty by a court of law for bid-rigging and banned from doing business with the public agency. None of the remaining bidders' names were mentioned in the news as having been involved in bidding irregularities. This information was found after the model was set up and run, quite independently of the study reported in this paper. It was welcome news as it partially supported the findings of the study.

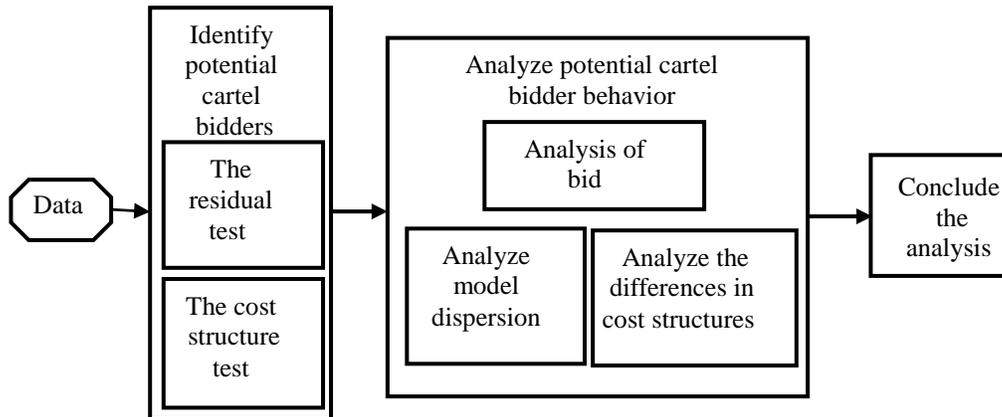


Figure 3. Collusion analysis model.

## References

- Arditi, D. and Chotibhongs, R. (2009). Detection and Prevention of Unbalanced Bids, *Construction Management and Economics*, Vol. 27(8), 721-732.
- Arditi, D. and Chotibhongs, R. (2005). Issues in Subcontracting Practice, *Journal of Construction Engineering and Management*, ASCE, Vol. 131(8), 866-876.
- Bajari, P. and Ye, L. (2003). Deciding Between Competition and Collusion. *Review of Economics and Statistics*, 85(4), 971-989.
- Cattell, D.W., Bowen, P.A., and Kaka, A.P. (2007). Review of Unbalanced Bidding Models in Construction. *Journal of Construction Engineering and Management*, ASCE, 133(8), 562-573.
- Chotibhongs, R. and Arditi, D. (2012a). Detection of Collusive Behavior, *Journal of Construction Engineering and Management*, ASCE, Vol. 138( 11), 866-876.
- Chotibhongs, R and Arditi, D. (2012b). Analysis of Collusive Bidding Behavior, *Construction Management and Economics*, Vol. 30(3), 221-231.
- Clough, R.H., Sears, G.A. and Sears, S.K. (2005). *Construction Contracting*. Wiley.
- Dorée, A. G. (2004). Collusion in the Dutch construction industry: An industrial organization perspective. *Building Research and Information*, 32 (2), 146-156.
- Doran, D. (2004). *FMI/CMAA Survey of Construction Industry Ethical Practices*. FMI Corporation, Raleigh, NC.
- Nassar, K. (2004). "Using Spreadsheets to Optimally Unbalance a Construction Bid." *Cost Engineering*, AACEI, 46(12), 28-32.
- Pesendorfer, M. (2000). A Study of Collusion in First Price Auctions. *Review of Economic Studies*, 2000(67), 381-411.
- Porter, R. H. (2005). Detecting collusion. *Review of Industrial Organization*, 26(2), 147-167.
- Porter, R.H. and Zona, J.D. (1993). Detecting Bid Rigging in Procurement Auctions, *Journal of Political Economy*, 101(3), 518-538.
- Zarkada-Fraser, A.Z. and Skitmore, M. (2000). Decisions with Moral Content: Collusion. *Construction Management and Economics*, 2000(18), 101-111.