Contractor Cash Flow and Profitability Analysis Between Best Value and Low Bid

Dr. Kenneth T. Sullivan and Yan Guo

ABSTRACT: In a best value environment, contractor selection considers two primary factors: price and performance. While the low-bid award system has been predominantly used by the industry, best value has met with some success and is commonly considered to have several advantages over the traditional low-bid. The majority of existing research, on the benefits of alternative bid and best value selection methodologies, has focused on the owner/client satisfaction or the performance of individual projects. This research explores the relative effects of a best value selection methodology on the contractor, specifically considering cash flow risks and project profitability. The cash flow risks explored in this article include: budgeting errors, change orders, retainage, labor/material cost fluctuations, owner initiated impacts, payment delays, safety, liquidated damages, and claims and litigation (among others). Moreover, the research explores contractor profitability differences and includes findings. These show an average contractor profit of approximately 2 percent for non-best value projects and an average contractor profit of approximately 8 percent for best value projects.

KEY WORDS: Bids, cash flow, management practices, profitability, risk and value

The construction industry has played a dominant role in maintaining economic growth and recovery. In 2004, construction contributed to nearly 9 percent of US GDP ($1.03 trillion) and more than $1.1 trillion in 2005. While it is a highly expanding industry, there are significant problems. The construction industry has the second highest bankruptcy rate of all businesses and suffers from low profit margins, with contractor profit margins at 1.7 percent and the average subcontractor profit margin at 2.3 percent (2005). Only 60 percent of contractors were profitable in 2005 [2, 6].

In the current construction industry, the most common procurement method is the traditional low bid price-based system. The awards system has often led to low owner satisfaction because of cost overruns, budget shortfalls, schedule delays and adversarial relationships between owners and contractors [1, 8, 15]. These problems decrease profit margins and increase cash flow risk, two primary threats to a construction company’s financial future.

HYPOTHESIS STATEMENT

It is proposed that the low bid, price-based system brings high risks, inefficiency, and low profit margins to its participants. It is also proposed that the best value award system creates a performance-based environment, thus increasing the efficiency, performance level, and profit margins of the participants.

The authors hypothesize that the best value procurement system (also called performance information procurement system (PIPS)) performs more efficiently than the low bid award system, reduces cash flow risks, and benefits the contractors’ cash flow management.

This hypothesis will be tested through the evaluation of construction contractors who have implemented projects in both the low bid process and the best value process. The contractors’ will compare the risks and cash flow for each type of project. Through the contractor’s responses, it can be determined whether there is a difference in cash flow risks and profits between the best value and low bid system.

OWNER RESULTS FOR THE BEST VALUE SYSTEM

The best value performance information procurement system (PIPS) was developed in order to minimize problems of non-performance in construction. Over the past 13 years, it has been tested 579 times, by 50 clients in both the public and private sector.

DIFFERENCE BETWEEN THE BEST VALUE SYSTEM AND THE LOW BID SYSTEM

The performance information procurement system uses performance information, as well as price, to evaluate participating contractors. The system minimizes project risk by identifying the highest performing contractor through past and current performance measurement information. The PIPS is based on the assumption that the problem in construction procurement rests with the procurement process and not with the construction project. Consider figure 1 [10].

In the performance-based environment, the owner uses an established system to select a performing contractor capable of minimizing project...
risk. The process involves steps that transfer responsibility to the contractor, minimizing the owner’s management role and creating a more efficient environment.

The owner does not control the vendor through direction, specification, and inspection. Instead, the performing contractor is asked to use their technical expertise and experience, in order to preplan, identify problems in budget or schedule at project initialization, and minimize the problems before they occur. They are then given the responsibility for project completion and performance. Through the best value system, the contractor is able to maximize their profit through their efficiency [17].

In the best value system, contractors have further incentive to perform throughout the project. At the completion of the project, the contractor is rated with a score that affects their ability to obtain work in the future. The system encourages contractors to produce quality work by placing the contractor at risk for their performance.

When a contractor is measured and is placed at risk by their performance, they are more likely to preplan, minimize risk, and complete the project on time and on budget. In addition, when the contractor is given control of the project, they are encouraged to complete the job in the most efficient manner in order to increase their profit.

This provides the owner with a successful project, as the contractor’s success depends on the delivery of a product completed on time, on budget, with minimal conflict.

In reality, many factors may have effects on cash flow during construction including time delays, change orders, and changes of cost pan elements [4]. While the best value PIPS does not eliminate change orders, it does allow the contractor to minimize the change orders and risks involved.

In this situation, contractors have a greater advantage in cash flow management and financial control. The contractor has incentive to increase productivity, and can be compensated for their expertise through a larger profit. Furthermore, the procurement system allows contractors to complete projects faster, and thus handle a larger pool of projects during a specific time.

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**Figure 1 — Construction Industry Structure [10]**

**SURVEY CREATION**

Thirteen cash flow risks were developed for the questionnaire survey based on contractor and owner feedback in over 500 construction procurement tests performed in the public and private industry [17]. These 13 cash flow risks are:

- budgeting error with client over/under budget;
- contractor’s estimating error;
- projects completed late;
- projects have claims and litigation;
- owner initiated impacts;
- change orders or requests for information;
- delays in payments from owner;
- delays in payment to subcontractors;
- delays in payment to suppliers;
- effect of front end loading;
- retention;
- labor/material fluctuation; and,
- safety/accident costs.

The contractors were asked to indicate the approximate probability and likelihood of the impact of each risk factor for both the best value and low bid system. The survey also asked contractors to compare the overall profit between the two procurement systems.

The questionnaire was distributed to 60 contractors with experience in both award systems over the past 8 years. The surveys were sent to the companies’ presidents, project managers, or pre-construction managers. The majority of respondents held senior management positions and were professionally qualified.

**Data Analysis**

A total of 26 contractors with average revenue of $44.5 million over the last fiscal year, including general, electrical, mechanical, flooring, and roofing contractors, returned their questionnaires (totaling $1.16 billion total construction/yr represented in the data).

This represents a 43 percent response rate, much higher than the norm of 20-30 percent response rate for the construction industry [3]. The 26 responses were located in Arizona, California, Colorado, Hawaii, Kentucky, Massachusetts, Minnesota and Texas.

The questionnaire elicited information regarding the contractors’ last fiscal year revenue. Figure 2 shows the distribution of the contractors’ revenue. From the 26 respondents, 31 percent received less than five million USD as revenue, 38 percent received between five to 25 million USD, 12 percent received a revenue of $25-50M USD, and 19 percent received over $50M USD of revenue.

The respondents’ project duration is shown in table 1. From the questionnaires, 62 percent of respondents identified their average project duration as six months, 15 percent as 7-12 months, and 23 percent identified their average project as 13 months.

The contractors were also asked to indicate their methods of project delivery (traditional design-bid-build (DBB), design-bid (DB), construction management at risk (CMAR), and other
While 63 percent of the contractors’ work was delivered by the traditional DBB system (See figure 3), 45 percent of these projects were procured through the low bid system, while only 11 percent were procured through the best value system (See figure 4).

**DATA ANALYSIS**

The two sample t-test was performed on the data set in order to determine whether the contractors’ responses for the low bid award and the best value award were statistically different. Table 2 displays the compiled data from the questionnaires, indicating the probability and impact of each of the 13 cash-flow risk factors occurring on a low bid and best value project. The t-test was used to assess whether the means of the two groups of data were statistically different from each other. In this case, the confidence interval (CI) = 95 percent was used, indicating that the risk of arriving at an invalid conclusion is less than 5 percent.

The hypothesis of the statistical analysis was that the best value PIPS process and the low bid process were significantly different in the probability of cash flow risk factors. The result of the t-test analysis performed on the data from table 2 produced an overall t-value of 12.67, much higher than the t-distribution value of 2.18. This indicated the dissimilarity between the contractor’s responses to low bid and best value PIPS. Also, the low P-value of 0.00 denoted the high significance level of the finding. Therefore, from the results analyzed, the data failed to reject the hypothesis that the best value PIPS system and the low bid system were significantly different in the probability of cash flow risk factors.

When the data set for the impact significance of the low bid and best value PIPS systems was analyzed, the results were similar. The confidence interval was set at 95 percent, and the t-value was found to be 14.93, much higher than the t-distribution value of 2.18. The p-value was 0.00. Again, the data indicated that the two procurement systems were significantly different in the impact significance of cash flow risk factors. Considering both risk analyses performed, there is a very high probability that the best value system is superior to the low bid system in minimizing the probability and impact of the cash flow risks. Also, based on the t-test analysis executed and the results obtained, it can be assumed that the variation of contractor firm size and project duration does not affect the ability of cash flow risk minimization in the low bid and best value PIPS system.

**Data Analysis on Each Cash Flow Risk Factor between Two Processes**

In order to understand the contribution of each risk factor to the overall analysis, the factors were individually tested. The t-test was performed in order to identify the significance of each factor. While the P-values varied slightly, all numbers were substantially lower than 5 percent. The six cash flow risk factors which can be most reduced by transferring from a low bid to a best value PIPS system are: change orders or requests for information, budget error with client over/under budget, labor/material fluctuation, contractor’s estimating error, delays in payment from owner and subcontractors. With best value PIPS, the probability of submitting a change orders is reduced 38.6 percent.

**Profit Difference between the Two Processes**

While all 26 contractors surveyed agreed that the best value PIPS system provided a greater benefit to cash flow management, the contractors’ profit margins in both systems varied. From all 26 contractors surveyed, the average profit received was 4.9 percent higher than the low bid system.

However, 46 percent of respondents indicated that they experienced the same profit from both the low bid and best value PIPS procurement systems and 54 percent indicated that they received higher profit than the low bid system. See table 3.
Possible Bias Analysis

The sample size used in the data analysis was 26 entities, which is relatively small. However, while numerous contractors had been involved in best value PIPS projects, many of the contractors did not fulfill the constraint of completing the best value project within the past eight years. Considering the completion time of the project, 60 contractors were identified as eligible to be sent the questionnaire survey. The 43 percent response rate was considerably higher than the norm of 20-30 percent response rate in most postal questionnaire surveys of the construction.

Validation of Profit Difference Analysis

Because of the small sample size, a secondary research effort was undertaken to validate the profit increase. The University of Minnesota Capital Projects and Project Management (CPPM) group has also implemented the PIPS process on 89 projects. The 89 projects include mechanical, electrical, general construction, roofing, and other maintenance work for a total value of $43M at awarded cost.

The projects have been completed by 18 different vendors. These vendors were surveyed to verify the average 4.9 percent profit difference (after tax) found in the initial analysis. The results of the survey yielded an average profit increase of 4.8 percent (after tax) across 13 vendors that returned the survey; nearly identical to the first survey. This secondary survey result helps validate the first finding.

Previous studies have suggested that best value PIPS is beneficial to owners who implement the system. However, a delivery system is unsustainable if it benefits only the client. The collected data indicates that the best value procurement system critically affects the cash flow risks and profit of the contractors involved.

Statistically significant differences existed between the best value PIPS and the low bid system regarding the probability and impact of cash flow risk factors. From the study and analysis performed, there is a high probability that the best value PIPS process may assist contractors in highly reducing the cash flow risks. Contractors have indicated that the best value PIPS provides equal or higher profits with minimized cash-flow risk impact than the traditional low bid system.

<table>
<thead>
<tr>
<th>Construction Duration (Month)</th>
<th>Number</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 6</td>
<td>16</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>7 – 12</td>
<td>4</td>
<td>15%</td>
<td>77%</td>
</tr>
<tr>
<td>13 – 24</td>
<td>6</td>
<td>23%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 — Average Probability of 13 Cash Flow Risks in Two Processes

<table>
<thead>
<tr>
<th>No</th>
<th>Risk Factors</th>
<th>Probability</th>
<th>Impact Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low Bid</td>
<td>PIPS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low Bid</td>
</tr>
<tr>
<td>1</td>
<td>Budgeting error w/ client over/ under</td>
<td>60.31%</td>
<td>26.00%</td>
</tr>
<tr>
<td>2</td>
<td>Contractor’s estimating error</td>
<td>40.05%</td>
<td>10.60%</td>
</tr>
<tr>
<td>3</td>
<td>Projects completed late</td>
<td>29.47%</td>
<td>14.74%</td>
</tr>
<tr>
<td>4</td>
<td>Projects have claims and litigation</td>
<td>26.16%</td>
<td>6.16%</td>
</tr>
<tr>
<td>5</td>
<td>Owner initiated impacts</td>
<td>42.67%</td>
<td>23.36%</td>
</tr>
<tr>
<td>6</td>
<td>Change orders or requests for information</td>
<td>64.21%</td>
<td>25.58%</td>
</tr>
<tr>
<td>7</td>
<td>Delays in payments from owner</td>
<td>45.28%</td>
<td>17.22%</td>
</tr>
<tr>
<td>8</td>
<td>Delays in payment to subcontractors</td>
<td>41.22%</td>
<td>14.56%</td>
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<tr>
<td>9</td>
<td>Delays in payment to suppliers</td>
<td>37.61%</td>
<td>11.22%</td>
</tr>
<tr>
<td>10</td>
<td>Effect of Front End Loading (Over billing)</td>
<td>34.87%</td>
<td>17.27%</td>
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<tr>
<td>11</td>
<td>Retainage (Retention)</td>
<td>62.20%</td>
<td>42.29%</td>
</tr>
<tr>
<td>12</td>
<td>Labor/material fluctuation</td>
<td>49.67%</td>
<td>19.56%</td>
</tr>
<tr>
<td>13</td>
<td>Safety/Accident Costs</td>
<td>31.22%</td>
<td>11.71%</td>
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</tbody>
</table>

Table 3 — Profit Difference Between Two Processes
REFERENCES

ABOUT THE AUTHORS
Dr. Kenneth T. Sullivan, is an assistant professor at the Arizona State University, Del E. Webb School of Construction, in Tempe, Arizona. He is a member of the Performance Based Studies Research Group and is highly involved in conducting process improvement research with the design and construction industries. He can be contacted by sending e-mail to: Kenneth.Sullivan@asu.edu

Yan Guo, is an estimator with Mortenson Construction of Chandler, Arizona. He is a graduate student of Dr. Sullivan at ASU. He can be contacted by sending e-mail to: Yan.Guo@mortenson.com.