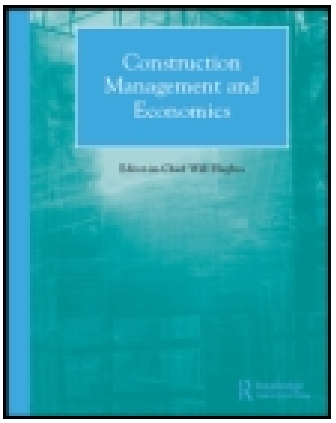

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Pricing strategy in the US construction industry

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This paper presents several issues related to pricing in construction. First, problems with current pricing strategy in construction are explored. Second, pricing strategies based on a market-based approach are proposed. Third, survey findings of the top 400 US contractors are presented regarding their current pricing practices and the applicability of the proposed pricing strategies. In conclusion, the belief that current pricing strategy in construction is predominantly cost-based is confirmed by the survey findings; indeed, in setting the markup, most contractors rely on their intuition after subjectively assessing the competition. The three internal pricing variables that have the largest statistically significant contingency coefficients with pricing strategy are 'marketing intelligence capabilities', 'annual contract value', and 'the type of client in most projects'. 'Owner's characteristics', 'competitors' characteristics', and 'market demand' are statistically significant external variables in making pricing strategy decisions. A change of bidding procedure is proposed so that all parties in construction can maximize the benefits of market-based pricing strategies.

Keywords: Cost-based pricing, market-based pricing, pricing variables, bidding procedure

Introduction

Price is the only element in the marketing mix that produces revenue; the other elements (product, place/distribution, and promotion) produce costs. Price is also one of the most flexible elements of the marketing mix, in that it can be changed quickly, unlike product features and subcontractor/supplier commitments. Price competition is the number one problem encountered by most marketing executives. Yet many construction companies do not handle pricing well. If one transposes the most common mistakes made by marketing executives (Kotler, 1997) to the construction industry, one observes the following. First, pricing is too cost oriented. Second, once an offer is made, the price is not revised to capitalize on market conditions or to fend off competitive pressures. Third, the price is not set as an intrinsic element of a market-positioning strategy. Fourth and finally, the price is not adjusted enough for different clients, project types, amount of work at hand, equipment ownership, etc.

Best (1997) claims that there are basically two extreme pricing strategies: cost-based pricing and market-based pricing. Any other pricing strategy is always in between these two extremes. Cost-based pricing starts by establishing the total cost of making a product. The product is then sold with additional cost-based markups, commonly a desired profit. There are two problems with this pricing logic. First, it is possible to grossly underprice a product using cost-based pricing and forgo even greater levels of profitability. The second possible consequence of cost-based pricing is overpricing. Since the price is set based on internal cost and margin requirements, the price that results could be too high or too low relative to competing products of comparable quality and reputation. Had the pricing started with the market (customer, competitors, and product position), a business would know what cost reductions would be needed to achieve a desired level of profit. Then, if

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those cost targets could not be met at the market-based price, perhaps an alternative positioning strategy would have to be developed. Or perhaps the project should not be pursued, since the profit potential is not likely to be achieved. However, there are conditions under which cost-based pricing does make sense and needs to be used: in commodity markets where competitors face the same cost of supply; and in competitive bidding markets, where pre-qualified bidders are selected on the basis of low price (Best, 1997). A review of pricing strategies both in general and in construction can be found in Mochtar and Arditi (2000).

This paper presents several issues related to pricing in construction. First, problems with current pricing strategies in construction are explored. Second, a pricing strategy based on a market-based approach is proposed. Third, survey findings of current pricing practices and findings related to the applicability of the proposed strategy are presented. Finally, conclusions are drawn and recommendations are made regarding pricing strategy in construction.

Pricing in construction

The construction industry in most countries in the world is one of extreme competitiveness, with high risks and low margins of profit when compared with other areas of the economy. Consequently, pricing is one of the most important aspects of marketing in construction. However, in contrast to other industries, transactions and contracting in construction are conducted through the competitive bidding process, so that pricing mostly takes place in the bidding process. Currently, the pricing approach used in construction is cost-based. The typical procedure in cost-based pricing involves estimating the project cost, then applying a markup for profit. This approach is presented in Figure 1. Many researchers propose bidding strategies based on this approach (de Neufville *et al.*, 1977; Paek *et al.*, 1977; Carr and Sandahl, 1978; Ahmad and Minkarah, 1988; de Neufville and King, 1991; Ioannou and Leu, 1993; Moselhi *et al.*, 1993; Fayek, 1998). However, there are problems with this pricing logic (Best, 1997).

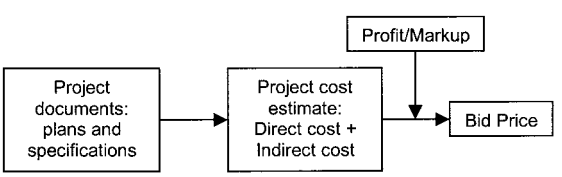

Figure 1 Cost-based pricing (model 1)

Market-based pricing, developed mostly in the context of manufacturing industries, is an alternative strategy. There are models published by researchers concerning bidding strategies in the construction industry (Fuerst, 1976; Wade and Harris, 1976; Benjamin and Meador, 1979; Carr, 1982, 1987; Ioannu, 1988; Griffis, 1992) that, to a certain extent, include market information. However, the use of these models in the industry is very limited because most of these bidding strategy models require sensitive information about competitors, such as their minimum and maximum markup, and some of them require sensitive information about customers/owners; most of the time this information is not readily available.

Proposed pricing strategies in construction

Considering the problems with a cost-based strategy and the benefits of more market oriented concepts, a series of 'market-based pricing' models has been developed for use in the construction industry and these are presented in Figures 2, 3, and 4. Figure 2 depicts a hybrid-pricing model, from now on called model 2. It is a variation of the purely cost-based pricing approach, from now on called model 1 (Figure 1); model 2 includes additional market information. The cost optimization process in model 2 involves adjusting the estimated costs to fit the price range allowed by the market. In this model, detailed project cost estimating tasks are performed independently of market data collection. A decision is then made whether to bid or not, based on whether the company can achieve cost levels that are within the market price range. Once a decision to bid is made, the risk policy of the company is decided. The company could skim or penetrate the market. Skimming involves pricing the bid offer relatively higher than the figure the market would allow, based on the belief that the company enjoys competitive advantage over the other bidders in terms of delivering the owner's most important requirements and providing the owner with best value. Skimming aims to maximize a company's profit. On the other hand, penetration is the opposite of skimming. Penetration involves keeping the profit margin deliberately and consistently lower than the market standard in order to outbid competitors already entrenched in a particular sector of the industry. This policy aims at penetrating a sector for the sake of securing a foothold in that sector, even though it is known that the project will generate minimal profit or maybe a small loss.

Figure 3 depicts model 3, another version of a hybrid pricing model. The main information for this model is market data collected through marketing intelligence,

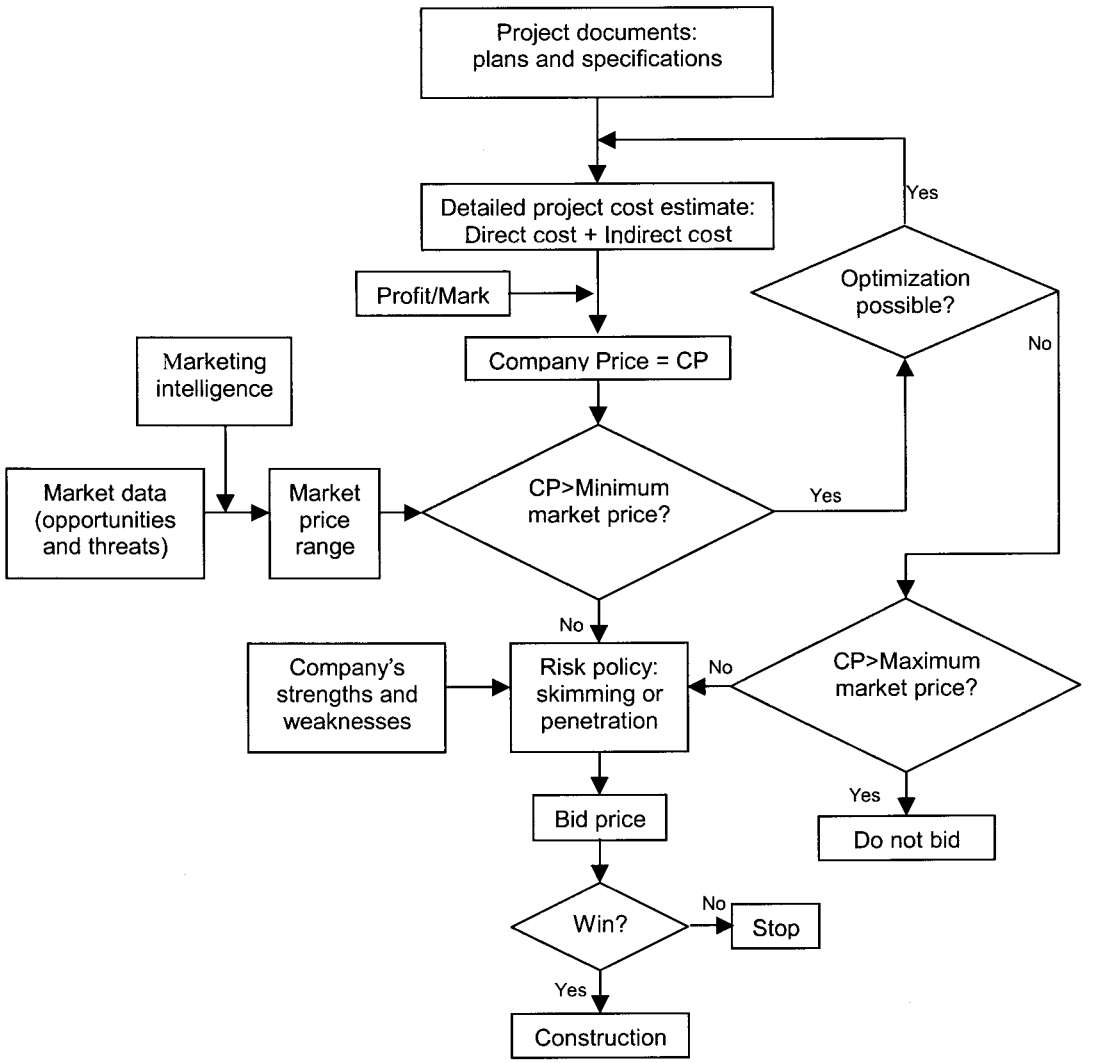

Figure 2 Hybrid pricing (model 2)

so that a cost target can be set based on the market price range. Approximate cost estimates are calculated based on historical data and bidding documents. Cost analysis and adjustments are performed to optimize the cost and see if it fits within the market price range. Finally a decision is made to bid or not to bid.

Figure 4 depicts model 4, a purely market-based pricing model. The main information used in this model is market data collected through marketing intelligence. This model suggests that the cost estimating function is not necessary at all. The decision is always to bid the project, fully based on collected market information through marketing intelligence. Cost analysis and adjustment are performed only after winning the project, before the construction phase begins. The big assumption of model 4 is the belief that the company is always able to find ways and methods to construct the project below the market price with a reasonable profit.

Pricing models 1, 2, 3, and 4 constitute a pricing strategy spectrum, from a purely cost-based strategy in model 1 to a purely market-based strategy in model 4. The market-based components of models 2, 3, and 4 are largely dependent upon marketing intelligence functions in place in a company. A company with extensive marketing intelligence capability is expected to implement a more market-based pricing strategy in order to ensure a more competitive bid offer. A review of marketing intelligence in general and a discussion of the findings of a related survey conducted in the construction industry can be found in Mochtar (1999). The findings of a survey conducted to explore the applicability of market-based pricing strategies in the construction industry are discussed in the following sections.

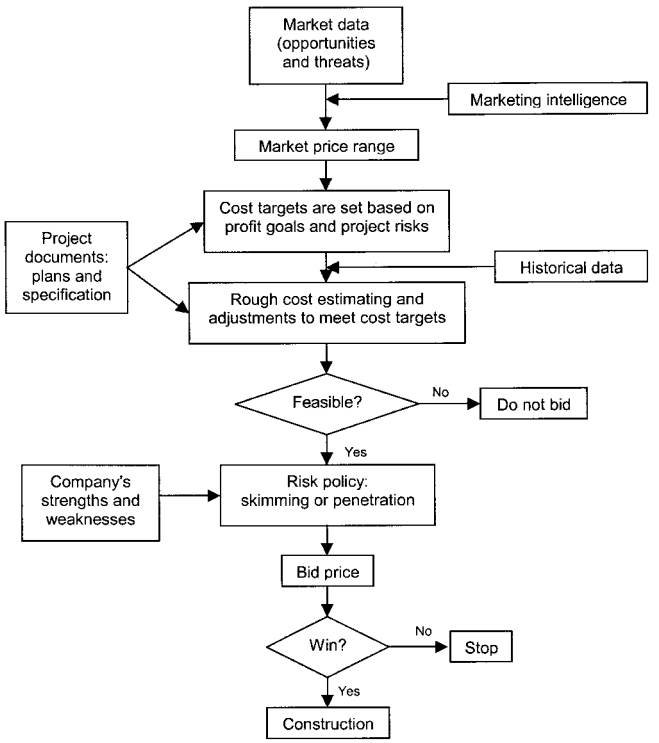

Figure 3 Hybrid pricing (model 3)

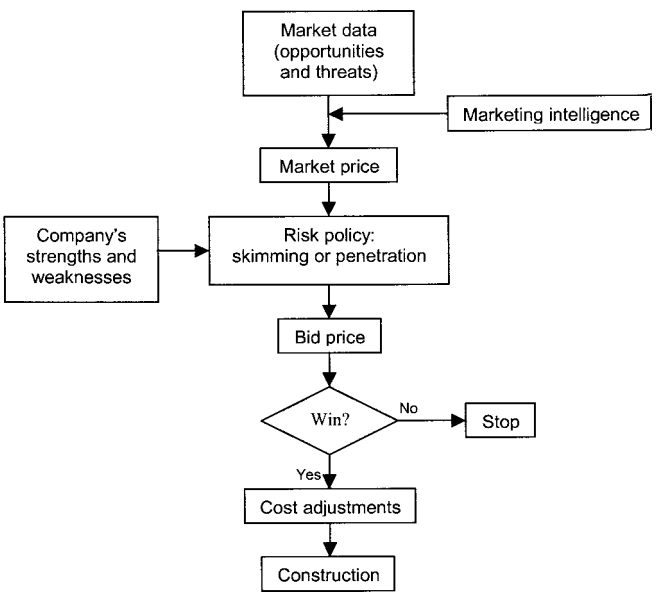

Figure 4 Market-based pricing (model 4)

The survey

A simulation model and a survey instrument were developed. The questionnaire was sent to the presidents/CEOs of the *Engineering News Record* (*ENR*) top 400 construction companies in the USA (*ENR*, 1998). It is believed that the nature of bidding (external variables) combined with the characteristics of a company (internal variables) lead to a specific pricing strategy. In this study, pricing strategy is represented by either the purely cost-based pricing model (model 1), one of the hybrid models (models 2 and 3) or the purely market-based pricing model (model 4) presented in the previous section.

The eleven internal variables include: type of most projects performed (building or heavy), geographic location of projects (within or outside the USA), work subcontracted (below or above 50% of contract value), marketing expenditure (below or above 2% of annual contract volume), annual contract volume, marketing orientation (competitive or negotiated contracts), type of client in most projects (public or private), equipment policy (owned or leased/rented), technological sophistication (high or low), level of experience (extensive or limited), and marketing intelligence capabilities (extensive or limited). These company characteristics are assessed in the first section of the survey.

A simulation model that is composed of eight hypothetical bidding scenarios (HBSs) was used to represent the use of different pricing strategies under different conditions (external variables) and how these relate to company characteristics (internal variables). Descriptions of the eight bidding scenarios are presented in Table 1. These eight scenarios consist of combinations of three external variables that have a significant impact on the pricing approach adopted by a firm. The three external variables include the owner's characteristics (whether they are known or unknown), competitors' characteristics (whether they are known or unknown), and market demand (whether it is low or high). An owner's characteristics may include information about the owner's financial stability, reputation, history of litigation, potential for commissioning projects in the future, etc; the same type of information about the owner's consultants such as architects/engineers or construction management firms, is considered to be part of the owner's characteristics. Competitors' characteristics may include information about the names and number of bidders, their bidding history, financial situation, current workload, expansion plans, etc. Market demand includes not only current market conditions but also past trends and future projections in the company's sphere of activity and in related fields. A company has little or no control over external variables.

In the second section, respondents were asked to indicate the most probable pricing approach they would use, in terms of the four models 1, 2, 3, and 4, in each hypothetical bidding scenario. In the third section, the contractors were asked questions related to their current pricing strategy. This section includes the pricing strategy used, the assessment of markup,

Table 1 Hypothetical bidding scenarios (HBSs)

External variables	HBS 1	HBS 2	HBS 3	HBS 4	HBS 5	HBS 6	HBS 7	HBS 8
Owner's characteristics	Unknown	Unknown	Unknown	Unknown	Known	Known	Known	Known
Competitors' characteristics	Unknown	Unknown	Known	Known	Unknown	Unknown	Known	Known
Market demand	Low	High	Low	High	Low	High	Low	High

the decision-making concerning markup, and the importance of factors in their pricing strategy.

Out of 400 questionnaires mailed, 4 or 1% were returned because the addressee was unknown, and 91 or 22.75% were returned duly completed. This rate of return was obtained after two consecutive mailings to the same list of contractors.

Survey findings

The findings related to current pricing strategy practices are presented in Tables 2, 3, and 4. Table 2 presents data regarding pricing strategies currently used by respondents. There were six choices of pricing strategy given to the respondents. These choices range from a purely cost-based pricing strategy that basically reflects model 1 (rating: 1.0) to a purely market-based pricing strategy that basically reflects model 4 (rating: 4.0). The four strategies in between these two extremes include a strategy between models 1 and 2 (rating: 1.5), a strategy that corresponds to model 2 (rating: 2.0), a strategy between models 2 and 3 (rating 2.5), and a strategy that corresponds to model 3 (rating: 3.0). The range between models 1 and 4 was split into six variables rather than four (one for each model) in order to define the alternatives in more precise terms and thus allow respondents to refine their choices. Table 2 indicates that 14.3% of respondents are using pure cost-based pricing (model 1) and that 86.9% are using model 2 or more cost-based approaches. The remaining three choices that are more market-based than model 2 are being used by a total of only 7.7%. The weighted average strategy is found to be 1.62 on a scale 1 to 4 where 1 = purely cost-based and 4 = purely market-based pricing. It appears that, on average, a construction company performs a detailed cost estimate, exactly the same procedure used in cost-based pricing, then applies a markup based on the company's preferences and general market conditions. No cost adjustments are made later. This is very close to the cost-based approach in model 1 except that in setting the markup some market conditions such as competitors' past bids are taken into consideration. Most bidding models discussed by Mochtar and Arditi (2000) are in line with this strategy.

Table 2 Current pricing strategy

Pricing strategy (1)	Rating system (2)	Per cent of respondents (3)	Rating (2) × (3) (4)
1. Detailed cost estimate is performed, then markup is set based on company's preferences (model 1).	1.0	14.3	14.3
2. Detailed cost estimate is performed, then markup is set based on company's preferences and market conditions; no cost adjustments (model 1–model 2).	1.5	40.7	61.1
3. As above, but with cost adjustments/optimization (model 2).	2.0	31.9	63.8
4. Cost/markup is set based on market conditions; then detailed cost estimate is made and then adjusted to fit cost targets (model 2–model 3).	2.5	4.4	11.0
5. Cost/markup is set based on market conditions; then rough cost estimate is made and then adjusted to fit cost targets (model 3).	3.0	1.1	3.3
6. Cost/markup is set fully based on market conditions; costs are adjusted to fit targets only after the award of contracts (model 4).	4.0	2.2	8.8
Total		100.0	162.3
Weighted rating			1.62

A question in the survey explored pricing and markup assessment practices currently in place in responding companies. Besides the regular spreadsheets, there exists on the market software specially developed for pricing activities, such as CLAAS and Pricedex. CLAAS integrates price analysis, risk and trade analysis, and estimating. Pricedex manages and produces historical data on competitors' prices and information databases for products/services. In some other software, the user inputs information such as the number of competitors and competitors' minimum and maximum markups, then the software will generate a number of best price alternatives by using mathematical and statistical methods or fuzzy logic. Using special pricing software appears not to be popular in construction bid pricing; the responses indicate that 55.6% of respondents use spreadsheets, while only 33.3% use special pricing software.

The markup estimation problem is a decision problem that is so highly unstructured that it is very difficult to analyse and formulate an adequate solution mechanism (Moselhi *et al.*, 1993). Table 3 presents data concerning types of markup decision assessment. It indicates that in deciding their markup 60.4% of contractors assess the competition. This assessment may include learning about who the competitors are and how many of them there are. This way a bidder can determine the severity of the competition and, based on that assessment, decide the most competitive markup for a particular bid. This finding agrees with Ahmad's (1990) findings that competition is a significant factor in markup decisions. Next to competition assessment, 50.5% of respondents stated that they use intuition in deciding the magnitude of their markup. This finding agrees with Ahmad and Minkarah (1988), whose study attempted to uncover the underlying factors that characterize the bidding decision-making process, and who found that bidding decisions are greatly influenced by subjectively evaluated criteria. The usual practice is to make bid decisions on the basis of intuition, derived from a mixture of gut feeling, experience, and guesses (Ahmad, 1990). Even though the strategy consisting of 'a constant percentage that does not change from project to project' is used by only 9.9% of respondents, this strategy seems to have worked in those cases. One respondent commented that they have been using such a strategy for almost 40 years, and that they survived in *ENR*'s top 400 US contractors. Among 'other' types of assessment mentioned by respondents, considering the company's current workload (13.2%) and the risk involved in the project (12.1%) are the two most frequently cited methods. This finding is in agreement with the finding of de Neufville and King (1991) that both need for work and risk affect contractor bid markups.

Table 3 Markup decision assessment

Types of assessment	Per cent of respondents
Intuition	50.5
Probability/mathematical models	14.3
Empirical models	24.2
A constant percentage that does not change	9.9
An assessment of the competition	60.4
Others:	
Project location and owner's characteristics	7.7
Risk/ value of project	12.1
Subcontractors' edges	2.2
Current workload	13.2
Time of year	1.1
Experience in similar project	1.1
Market demand	5.5

Table 4 Importance of factors in current pricing strategy

	Average importance	
Factors	Rating[a]	Rank
Project size/complexity	4.13	1
Financial goals of company	4.13	1
Company's strengths and weaknesses	4.12	3
Expected future project from the owner	3.97	4
Need for work	3.97	4
Owner's characteristics	3.83	6
Project location	3.76	7
Demand/economic conditions	3.67	8
Competition	3.40	9
Owner's consultant characteristics	3.24	10
Subcontractors' characteristics	3.19	11

[a]1 = least important; 5 = most important.

As seen in Table 4, the five most important factors that affect respondents' current pricing strategies are project size/complexity, financial goals of company, company's strengths and weaknesses, expected future projects from the owner, and need for work, with average importance scores of 4.13, 4.13, 4.12, 3.97, and 3.97, respectively, on a scale of 1 to 5 where 1 = least important and 5 = most important.

The fact that 'project size/complexity' and 'the financial/monetary goals of companies' are tied for first place is supported by de Neufville *et al.* (1977). The well known SWOT (strength, weakness, opportunity, and threat) analysis in business management theory seems to be highly applicable in the construction business since the internal characteristics of a company, i.e. its strengths and weaknesses, is the third ranking factor in the order of importance. The implication of the two factors tied for fourth place, i.e. 'expected future projects from the owner' and 'need for work',

is that bidders may price their bid substantially lower than normal, with the hope of having the opportunity to show the quality of their work to the owner and to maintain a good relationship with the owner; in return, the contractors hope the owner will award them other projects in the future or at least recommend them to other clients. Another implication may be that companies with a desperate need for work may price their bids way lower than normal.

Findings related to simulated bidding situations are presented in Tables 5, 6, and 7. Contingency analysis was conducted to explore the strength of the relationship between internal variables and pricing strategy in different bidding scenarios. Table 5 indicates that only 10 out of 88 coefficients in 6 out of 8 HBSs of 4 out of 11 internal variables are statistically significant at 95%. It should be noted that 'marketing intelligence capabilities' does not have a predetermined cutoff point that differentiates between its two categories (limited or extensive). A trial and error process was performed to find the most appropriate cutoff point. It was found that a score of 2.3 gives the strongest contingency coefficients and a significant difference between companies having limited (score < 2.3) and extensive (score > 2.3) marketing intelligence capabilities.

Table 5 indicates that the contingency coefficients between pricing strategy and four of the internal variables are statistically significant at 95% in certain HBSs. First, the contingency coefficient associated with 'annual contract volume' is significant in HBS 1, where both the owner's and competitors' characteristics are unknown and market demand is low. This finding is not surprising, because in that situation contractors need to dig for both the owner's and competitors' information to win the bid while at the same time they might want the job very badly as market demand is low. Annual contract volume may be highly related to how deep a contractor's pocket is to support digging for owners' and competitors' information in such hard times. As a consequence, it is hypothesized that the larger the annual contract volume the more market-based the pricing strategy. The test of the hypothesis is conducted by comparing the average pricing strategies of companies with less than and more than \$250 million annual contract turnover. The result, presented in Table 6, indicates that the hypothesis is supported at 95%.

Second, the contingency coefficients associated with 'type of client in most projects' are not significant except in HBSs 7 and 8 (owner's and competitors'

Table 6 Pricing strategy of significant internal variables[a]

Internal variables	Average pricing strategy
Annual contract volume	
Under \$250 million	**m_1= 1.7843**
Over \$250 million	**m_2= 2.1440**
Hypothesis: $m_1 < m_2$	**Yes**
Type of client in most projects	
Public	**m_1= 1.7483**
Private	**m_2= 2.1427**
Hypothesis: $m_1 < m_2$	**Yes**
Equipment policy	
Owned	m_1= 1.8872
Leased/rented	m_2= 2.0822
Hypothesis: $m_1 < m_2$	No
Marketing intelligence capabilities	
Limited (below score of 2.3)	**m_1= 1.5957**
Extensive (over score of 2.3)	**m_2= 2.0974**
Hypothesis: $m_1 < m_2$	**Yes**

[a]Note: bold denotes significance at 95%.

Table 5 Contingency coefficients between internal variables and pricing strategy in hypothetical bidding scenarios (HBSs)[a]

Internal variables	Pricing strategy in								
	HBS 1	HBS 2	HBS 3	HBS 4	HBS 5	HBS 6	HBS 7	HBS 8	Average
Type of project performed	0.1170	0.1175	0.1814	0.2325	0.2780	0.1479	0.2316	0.3035	0.2012
Geographic location of most projects	0.1388	0.2209	0.0937	0.0916	0.0960	0.1073	0.1891	0.1708	0.1385
Work subcontracted on average job	0.1412	0.1306	0.2166	0.2110	0.1961	0.0755	0.1995	0.2641	0.1793
Marketing expenditure	0.2496	0.2525	0.1633	0.1299	0.1162	0.1439	0.1609	0.1636	0.1725
Annual contract volume	**0.3477**	0.2815	0.2953	0.2466	0.2220	0.2448	0.1641	0.1826	0.2481
Marketing orientation	0.1654	0.2499	0.2111	0.1112	0.1969	0.1963	0.1607	0.2139	0.1882
Type of client in most projects	0.1365	0.1677	0.2057	0.1434	0.2999	0.2662	**0.3219**	**0.3243**	0.2332
Equipment policy	0.2142	0.2401	0.1484	0.0835	**0.3359**	0.2994	0.1201	**0.3294**	0.2214
Technological sophistication	0.1778	0.2255	0.1951	0.1991	0.2617	0.2964	0.1990	0.2035	0.2198
Level of experience	0.1367	0.1194	0.1207	0.0575	0.1566	0.1936	0.1602	0.1040	0.1311
Marketing intelligence capabilities	0.1637	**0.3294**	**0.4083**	**0.3891**	0.3026	0.2629	**0.3804**	**0.4255**	0.3327
Average pricing strategy	1.5874	1.8289	1.8731	1.8983	1.9745	2.0543	2.1567	2.2953	1.9586

[a]Note: HBS refers to Table 1; bold denotes significant association at 95%.

Table 7 Pricing strategy in conditions characterized by external sub-variables[a]

External variables	Average pricing strategy
Owner's characteristics	
Unknown	m_1= **1.7891**
Known	m_2= **2.1214**
Hypothesis: $m_1 < m_2$	**Yes**
Competitors' characteristics	
Unknown	m_1= **1.8653**
Known	m_2= **2.0785**
Hypothesis: $m_1 < m_2$	**Yes**
Market demand	
Low	m_1= **1.9061**
High	m_2= **2.0330**
Hypothesis: $m_1 < m_2$	**Yes**

[a]Note: Bold denotes significance at 95%.

characteristics are known). Public clients are strictly bound by public laws and regulations that govern the bid evaluation process; these are well known to all contractors. On the other hand, each private owner's characteristics are unique; each would use a different method to evaluate a contractor's proposal. More mysteries are involved in the case of private owners than public owners. It is hypothesized that if the client were a private organization, a contractor would use a more market-based pricing strategy. The test of the hypothesis is conducted by comparing the average pricing strategies of companies that undertake projects mostly for private clients and those working mostly for public clients. The result presented in Table 6 indicates that the data support the hypothesis at 95%.

Third, the contingency coefficient between 'equipment policy' and pricing strategy are significant in HBSs 5 (known owners, unknown competitors, and low demand) and 8 (known owners and competitors, and high demand). The data in Table 6 seem to indicate that if a company owns equipment then it is likely to use a less market-based strategy in its pricing (m_1= 1.8872) as opposed to a company that leases/rents most of its equipment (m_2= 2.0822). If this hypothesis is tested, it is found that it is not supported at 95%. It appears that there is no link between equipment ownership and the pricing strategy used by a contractor, except in very special cases such as HBSs 5 and 8.

Finally, it seems that the contingency coefficients associated with 'marketing intelligence capabilities' are the most consistently significant; most (five out of eight) coefficients for that variable are significant at 95%. Marketing intelligence capabilities describe a company's ability in discovering market information. Respondents characterized their companies' marketing intelligence capabilities as either limited or extensive. This finding indicates that marketing intelligence capability is the most closely associated variable with a contractor's pricing strategy in most bidding situations. The hypothesis associated with this factor is that the more extensive a company's marketing capability, the more market-based its pricing strategy. The test of the hypothesis is conducted by comparing the average pricing strategies of companies with limited and extensive marketing intelligence capabilities. The result presented in Table 6 indicates that the hypothesis is supported at 95%. The implication of this finding is that a company should develop its marketing intelligence capabilities if market-based pricing is adopted as its pricing strategy. For example, forming a marketing intelligence department or assigning some staff to be responsible for marketing intelligence activities in such a construction company is highly desirable. The important jobs of this department would be conducting planned and organized marketing research, maintaining management information systems and related decision support systems, organizing intelligence actions, and finally distributing all important marketing/pricing information to the relevant parties involved in pricing decisions.

Interestingly, the bottom row in Table 5 also indicates that the average pricing strategy preferred by respondents is consistently changing from less market-based to more market-based as one goes from HBS 1 to HBS 8 (from model 1.5874 to model 2.2953). It can be seen in Table 1 that HBSs 1 to 8 constitute a spectrum from unknown to known owners' and competitors' characteristics. The better known are the owner's and competitors' characteristics, the more market-based is the pricing strategy used. This finding contradicts the traditional belief in construction that pricing is a one-strategy phenomenon, i.e. that all contractors use the same cost-based strategy with minor variations. The fact that respondents prefer using a different pricing strategy in each of the bidding scenarios is proof that the contractors tend to be more market-based in their pricing strategies if they know more about their clients and competitors.

Three internal variables have the largest average contingency coefficients across HBSs (last column in Table 5): marketing intelligence capabilities (0.3327), annual contract volume (0.2481), and type of client (0.2332). As discussed earlier, when these variables' respective hypotheses were tested, it was found that all of them are supported at 95%. Furthermore, when the average of the average pricing strategies is calculated across HBSs, it can be seen that contractors would use a pricing strategy that corresponds to model 1.9586 (Table 5, rightmost cell in bottom row). It appears that if one averages the effects of HBSs, contractors

use a pricing strategy that is very close to model 2, which is basically a cost-based approach that includes additional market information and cost optimization process. In this kind of strategy, traditional detailed project cost-estimating tasks are still performed. However, the tasks are performed independently of market data collected through the company's marketing intelligence activities. Moreover, according to this strategy, a cost optimization process takes place followed by a decision to bid or not based on the risk policy of the company (either skimming or penetration).

Table 7 presents data regarding the pricing strategy used under conditions characterized by external subvariables. The hypotheses for the three external variables are as follows.

- Owner's characteristics: an environment where contractors have access to owners' characteristics favours more market-based strategies than an environment where owners' characteristics are not available.
- Competitors' characteristics: an environment where contractors have access to competitors' characteristics favours more market-based strategies than an environment where competitors' characteristics are not available.
- Market demand: an environment characterized by high construction demand favours more market-based strategies than an environment characterized by low construction demand.

t-Tests have been conducted to test the hypotheses of average differences. The results presented in Table 7 indicate that all hypotheses are supported at 95%. As expected, when information about the owner's and competitors' characteristics is not available, contractors tend to use a less market-based pricing approach than when information about the owner and competitors is readily available. Also as expected, in an environment characterized by low market demand (high competition, more secretive practices and less access to market information), contractors tend to use a less market-based pricing approach than in an environment characterized by high market demand (less competition, more open practices and more access to market information).

In the light of the hypotheses associated with 'owner's characteristics' and 'type of client', variables that are found to hold true at 95%, it can be stated that the way construction clients organize their project letting procedures (bidding) is very important for a contractor's pricing strategy decisions. To allow for a more market based approach to pricing, a drastic departure is highly recommended from the current bidding process presented in Figure 5 to the proposed bidding process as presented in Figure 6. The proposed bidding process is a modification of the bidding process used by NASA and discussed by Flett (1999). It can be seen that in the current bidding process presented in Figure 5, final proposals are submitted right after bidding invitation, project explanation, and field visits. Evaluation and contract award constitute the next events. Most clients

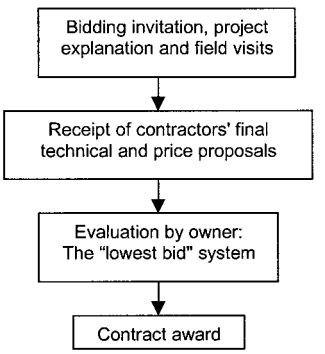

Figure 5 Current bidding events

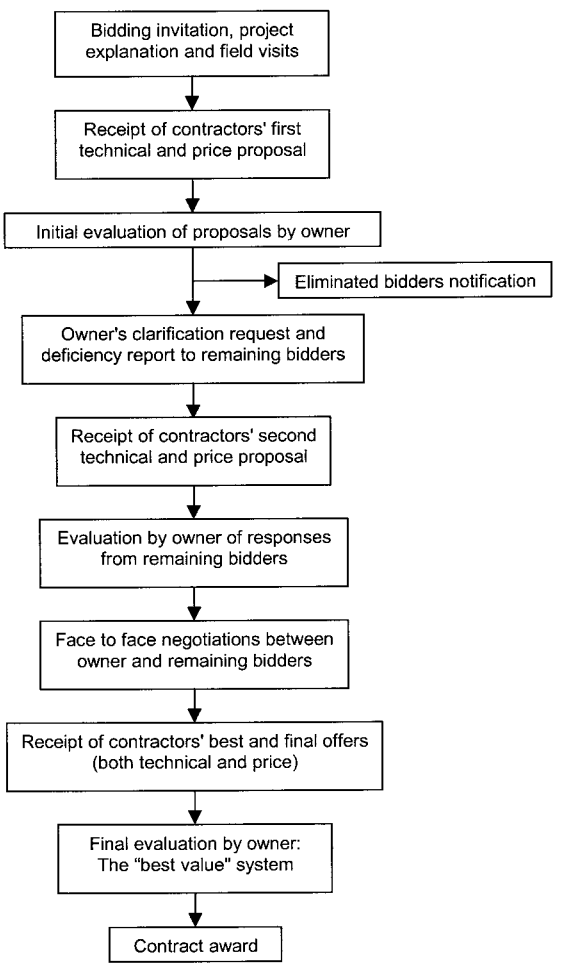

Figure 6 Proposed bidding events

use the 'lowest bid' evaluation system. No clarification, correction, or negotiation of the bid offer takes place. In contrast, in the proposed bidding process presented in Figure 6, the best and final offer is submitted only after clarification, correction, and negotiation; marketing intelligence actions can be conducted by the bidders until the 'best and final offer' event. Final evaluation using the 'best value' system is the next event. The best value for each client may be different depending on the client's 'most important requirements'. The most important requirements can be identified and assessed by contractors through their intelligence activities. Even though the proposed alternative may involve a longer and more complex process, by applying the proposed bidding process, clients allow contractors an opportunity to use a more market-based pricing strategy; in turn, clients get the best price and the best contractors for their projects.

Conclusion

One way of looking at pricing strategy is to consider it to be part of a continuum. According to Best (1997), cost-based strategy is at one extreme of this continuum, and market-based strategy is at the other. Any other pricing strategy is always in between these two extremes. There are problems in cost-based pricing, such as overpricing or underpricing. A market-based strategy is a comprehensive approach that may minimize such problems, but has problems of its own, including considerable effort on the part of the company to collect all relevant information through its marketing intelligence activities. Because of the bidding system in place in construction transactions, pricing strategy in construction is predominantly based on cost-based approaches as depicted in Figures 1 and 2. But as mentioned above, the cost-based approach is only one of many pricing approaches available.

The rate of return (22.75%) of a survey administered to the largest 400 contractors in the USA was considered not to be low, considering that pricing-related information is of somewhat sensitive nature. The conclusions and major findings of this research and the associated recommendations are presented in the following paragraphs:

- *Current pricing strategy.* The general belief that pricing strategy in construction makes use of predominantly cost-based approaches is confirmed by the survey findings. The current average strategy used by respondents (1.62 in a continuum where 1 = purely cost-based and 4 = purely market-based strategy) first requires a detailed cost estimate and then a markup is set based on the company's preferences and market conditions, with no cost adjustments. It is very close to the purely cost-based approach except that in setting the markup some market conditions such as competitors' past bids are taken into consideration. Most bidding models developed by researchers in construction are in line with this strategy as they attempt to optimize cost-based markup in terms of either expected monetary values or expected utility to the bidder. In setting their bid offer, most contractors rely on their intuition after subjectively assessing the competition; most contractors do not use special pricing software. The pricing decisions would be much improved if they were not based only on intuition and a cursory assessment of the competition, but they also considered up-to-date information about all relevant market characteristics (owner and competitor characteristics, and demand level). Special pricing software such as those that organize market price databases and perform price analysis could improve pricing decisions.
- *Association between internal variables and pricing strategy.* No general trends were found in contingency table analysis, except that the average pricing strategy consistently changes from less market-based to more market-based as one goes from HBS 1 (unknown owner and competitor characteristics and low demand) to HBS 8 (known owner and competitor characteristics and high demand). It can be concluded that contractors practice more market-based pricing when owner and competitor characteristics are available even though they rely extensively on their intuition. Statistical analyses (contingency table analysis and hypothesis testing) indicate that three internal variables have a major influence on pricing strategy. The internal variable that has the largest influence on pricing strategy is 'marketing intelligence capabilities'. This finding stresses the importance of developing a company's marketing intelligence capabilities for implementing market-based pricing strategies. The second most influential internal variable is 'annual contract volume' that underlines the importance of a company's resources such as staff, expertise, and money to implement market-based pricing strategy. Indeed, such resources are justified only in companies with larger annual contract volume. The third most influential internal variable is the 'type of client in most projects'. When considered alongside the external variable 'owner's characteristics' that was also found to be significantly related to pricing strategy, it can be stated that a change

in bidding procedures towards a system presented in Figure 6 could allow for the implementation of more market-based strategies. If clients' handling of the bidding process is changed in the direction of the proposed bidding system, it is not impossible for contractors to use a strategy that is close to model 4 (a purely market-based strategy). The proposed bidding practice has actually been used successfully in electronic and computer procurement by NASA (Flett, 1999) where, as a result, most contractors are using pricing strategies that fall between models 3 and 4.

A shift from the traditional cost-based pricing strategy to a more market-based pricing strategy is to be anticipated in the new millennium, where markets are expected to be more globalized, competition to grow fiercer, and breakthrough developments in information technologies to emerge rapidly. This shift is likely to be dependent on changes in the bidding environment in the direction of the system presented in Figure 6. Market-based pricing is a promising solution that can overcome the challenges in marketing construction services in the future and that can maximize the benefits derived by all the parties involved in construction projects.

It is recommended that new surveys be conducted every 4 to 5 years to observe and identify new trends in pricing practices in the industry and to steer research in the appropriate direction.

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