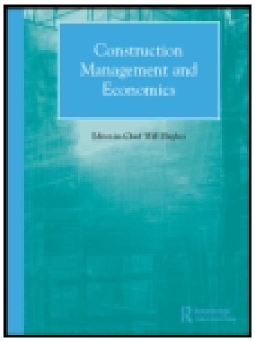

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Factors considered in tendering decisions by top UK contractors

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Decision-making involves a process by which a choice is selected from a number of options. Bid decisions by contractors are complex due to uncertainty about many factors affecting their outcomes. This study was able to identify, through a questionnaire survey, 55 factors characterizing the bid decision-making process. The questionnaire was mailed in August 1990, to 300 top contractors in the UK. The results indicate that several factors are considered equally important for bid/no bid and markup size decisions. Other factors are seen to have considerable importance for one decision but not for another. The need for work, the number of competitors tendering, and the amount of experience on such projects are identified as the top three factors that affect a contractor's decision to bid for a project. The degree of difficulty, the risk involving owing to the nature of the work, and the current work load are the highest ranked factors affecting markup size decisions.

Keywords: Construction tendering, tendering decisions, UK contractors.

Introduction

A construction firm may secure the right to provide services in a new job in one of two ways: by direct negotiation with an owner or his representative, or by competitive bidding. This paper is concerned with the competitive bidding situation in the construction industry of the UK.

In competitive bidding, an owner invites a selected number of contractors to compete for his/her project. Upon reception of the invitation, a selected contractor must decide on whether to accept or decline it. If the invitation is honoured, the contractor will prepare and submit a tender price. The submitted price is an offer which is binding upon the owner's acceptance.

Statement of the problem

The tendering process involves two crucial decisions. The first is the decision of whether or not to bid for a project decision. The importance of the tender decision emerges from its financial consequences. The decision implies the incurring of substantial costs which may not be recovered immediately. The value of the decision outcome is not defined. That is, if the contractor decides not to bid, an opportunity loss might be incurred. On the other hand, if the contractor decides to bid, the direct and indirect costs that the project will consume have to be estimated. Tendering a job involves the contractor in preparing an estimate which requires the commitment of resources (for example, financial deposits for bidding documents and estimator's hours).

The second decision is associated with the determination of the bid price. Under the traditional cost plus markup pricing model, the contractor calculates the cost of direct and indirect labour, equipment, and materials that will be consumed in the project. Then, the contractor marks up the estimated cost by a certain percentage to cover his/her office overhead, contingencies, and profit. The contractor wants to decide on a markup size that increases the chance of achieving a dominating criterion of the competition. For example, if price dominates the competition, each contractor will attempt to offer a price that maximizes the chance of winning the project and minimizes the differences between his/her bid and the bid price of a rival competitor. In the event of an unsuccessful bid, the contractor has to be prepared to write off the preparation costs involved. The importance of the markup size decision derives from its direct bearing on the contractor's business. A contractor must secure a designated business volume in a fiscal year to cover his/her operating costs and to realize a reasonable profit. Failure

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to do so will force the contractor into one of the following actions: to reduce his/her operating capacity, to liquidate the business, or to declare bankruptcy.

Both decision are very important to every contractor. The importance of such decisions stems from the fact that the success or failure of a contractor's business lies in the outcomes derived from those decisions. Both decisions are considered complex due to the two following elements:

1. The consequences of each alternative are uncertain (this uncertainty rules out any guarantee that the best outcome is obtained), and
2. The large number of factors having considerable effect on both decisions (Ahmad and Minkarah, 1988).

The complexity associated with these two decisions suggests the use of a modelling technique to develop representative models that will aid contractors in making a proper choice. The development of the model entails as a prerequisite the identification of the factors affecting such decisions. This study is an attempt to identify the factors affecting the bidding and markup size decisions.

Objectives of the study

The main objectives of this research are:

1. To identify the factors influencing a contractor's decision to bid for a project;
2. To identify the factors influencing a contractor's decision to set the markup size for pricing a job;
3. To evaluate the importance of the identified factors to the decision makers.

Previous studies

The contractor's decision to bid has received very little attention from researchers. Ahmad and Minkarah (1988) presented the factors affecting the bidding decision of top* US contractors. Their attempt resulted in the identification of 31 factors affecting the bid decision. Skitmore (1989) presented the application aspects of statistical models in tendering decisions. Akintoye and Skitmore (1990) analysed the UK tender prices for the purpose of finding an appropriate explanation for their movement. They indicated that market conditions (supply and demands) have a major effect on tender price movement.

In contrast, the markup size decision has been addressed by many researchers. As a result, many models have been developed and recommended for use in the construction industry to determine the proper markup size that will increase the chances of winning a bid. Among these are the models developed by Shaffer (1965), Casey and Shaffer (1964), Gates (1967), Broemser (1968), Morin and Clough (1969), Wade and Harris (1976), Carr (1982), Benjamin (1969), and Neufville *et al.* (1977). The current mathematical models were developed on the basis of the pioneering work of Friedman (1956). While the current models share a common objective (maximizing expected profit), they differ in their assessment of the winning density functions, the randomness of the cost estimate, the determination of the joint probability of beating more than one competitor, and the inference of the number of competitors that may enter the competitive bidding.

Recently, King and Mercer (1990) tested Friedman's model for finding the optimum markup in different situations such as different distributions of cost estimates. They found that the reliability of the model is sound in some instances and questionable in others.

Despite the availability of mathematical models, their utilization is not widely spread among construction contractors. Ahmad and Minkarah (1988) found that fewer than 11% of the top American contractors use some form of mathematical models for determining the proper markup size. Gates (1983) believed that these models were relevant for academia but not for the practitioners. Therefore, he has abandoned all current mathematical strategic models, including his own, and introduced a non-mathematical approach, based on the Delphi technique, designated as the Expert Subjective Pragmatic Estimate (ESPE).

Ahmad and Minkarah (1988) addressed the competitive system qualitatively. Their study attempted to determine the factors affecting a contractor's bidding strategy. They investigated the level of importance of each factor on the contractor's decision to bid and on the size of the markup.

The failure of the mathematical models is attributable to the following factors:

1. The assumptions that those models are based on oversimplify the situation (Benjamin and Meador, 1979) so that they yield outcomes that give no significant value to the practitioners. The followings are examples of factors underlie the existing models:
   (a) competitors will bid as they have done in the past;

*The majority of the participating contractors were taken from the 1986 list, top-400 general contractor firms of the USA, published in the Engineering News Record (ENR).

   (b) competitors bid to maximize total expected profit;
   (c) the ratio of actual cost to estimated cost is unity.
2. The models are incomplete and model only a tiny part of the situation (Bell, 1969).
3. The controversy between Friedman's model and Gates' model has directed the research effort into resolving this question.
4. The models fall short in representing reality in that they consider only the number of bidders as the prevailing factor.
5. They require excessive use of historical data. Skitmore (1989) indicated that the optimal solution to a model (designated 'Small World') is not necessarily the optimal solution to the real situation.

Research methodology

This section presents all the steps that were performed to achieve the objectives set for this study. The procedures include all information relevant to the required data, where and how the data was obtained and the method whereby a sample was selected.

Data required

The study objectives necessitated the identification of the various factors that influence the bid/no bid and the markup size decisions. A review of the American and British literature was conducted for the purpose of studying the available bidding models. The literature review resulted in the identification of 55 potential factors affecting a contractor's bidding and markup size decisions.

Data collection

The necessary data were collected primarily from the top management of the 300 top UK contractors. The method used for the collection of the information was a written questionnaire. A questionnaire that was originally prepared for a study carried out at the University of Cincinnati by Ahmad and Minkarah (1988) established the foundation for the development of this questionnaire. In the summer of 1990, the 1988 questionnaire was modified to suit the bidding environment in the UK. The writer discussed the revised questionnaire with several British experts* on the subject of competitive bidding to obtain an objective evaluation of the integrity, relevancy and practicality of its contents. As a result, the questionnaire was modified further and factors were added or removed depending on which were deemed appropriate and applicable for the British construction industry.

The questionnaire is divided into three parts. The first part contains questions about the firm – its type, its capacity, and other descriptive data. The second part of the questionnaire contains questions about the importance level of 55 potential factors affecting the decision on the size of the markup to be assigned. In this part, a scale from 1–7 is used to measure the level of effect of each factor on the decisions, where '1' means a low level of effect and '7' means a high effect. The respondents were asked to check a number on the scale which reflected their assessment regarding the effect each of these different factors. The last part of the questionnaire contains questions that reflect the firm's policy regarding bidding decisions.

In August 1990, the Department of Construction Management at the University of Reading mailed the questionnaire to 300 top contractors from all areas of the UK. The names and the addresses of the surveyed contractors were extracted randomly from the Independent Community Consultants (Hampton) ICC Publications Search Utility (Version 2.00, June 1990) database. The database lists the names of the 500 top UK construction contractors with their addresses, annual turnovers, and financial ratios.

The results

Eighty-five top contractors responded to the questionnaire. The response rate was 28.3% (85 out of 300). This section is devoted to the presentation of the description of the characteristics of the participating contractors and the findings relevant to the bid/no bid and markup size decisions.

Characteristics of UK top contractors

The collected data were obtained from experienced and successful construction contractors in the UK. The results indicate that the contractors who participated in the study have been in the construction business for an average period of 60.87 years (with a standard deviation (S.D.) of 54.76 years) and generating an annual average sales volume of £97.93 million (with a S.D. of £163.12 million). It is believed that obtaining the study required data from such contractors is one of the strengths of this study. The data obtained, especially those relevant to the evaluation of the importance of the 55 factors affecting the two decisions, are considered of

* (1) Dr P.R. Lansley, Department of Construction Management, University of Reading; (2) Professor R. Flanagan, Department of Construction Management, University of Reading; and (3) Mr Noel Unsworth, Chief Executive, The Builders' Conference.

high quality. This fact contributes positively to the reliability of the findings of the study.

The average job size that is constructed by a participating top contractor, expressed in millions of pounds sterling, is shown in Table 1. About 56% of the top contractors obtain work with an average size between £5.0 million and £15.0 million. The top contractors indicated that they obtain work through both competitive bidding and negotiation. Table 2 shows the percentage of work obtained through both methods.

Table 1 Average job size

Contract size	Number of contractors
Under £1 million	22
£1 million – under £5 million	48
£5 million – under £10 million	10
£10 million – under £15 million	3
£15 million – under £20 million	2
Over £20 million	—
Number	85

Table 2 Amount of work obtained through competitive bidding and negotiation

Work obtained (percentage of total work turnover)	Method of obtaining work	
	Competitive No. of contractors	Negotiation No. of contractors
Under 25%	42	12
25% – under 50%	8	16
50% – under 75%	17	34
75% – 100%	17	22

Half of the top contractors obtain less than 25% of their work through competitive bidding. On the other hand, about 40% of the top contractors obtain between 50–75% of their work through negotiation.

The top contractors indicated that they subcontract the majority of the work to domestic or nominated subcontractors. Table 3 shows the percentage of work subcontracted on an average project. Subcontracting the majority of the work to others may arise especially when a contractor tends to undertake a diverse range of projects. The contractor type profile is shown in Table 4. The results indicate that about 20% of the top contractors are involved in building type construction and about 7% in either housing or engineering type construction. No top contractor is involved in industrial type construction alone. The rest of the top contractors are combinations of these four types. It is evident that the majority of the top contractors do not specialize in a single type of construction such as building or industrial work.

The results reveal that a top contractor sometimes requests a performance bond from subcontractors. The relaxation of this bond requirement indicates that top contractors have great confidence in subcontractors. Table 5 shows the percentage of work for which top contractors require a performance bond.

Table 3 Size of work subcontracted on an average project

Percentage of work subcontracted	Number of respondents
None	1
Under 25%	12
25% – under 50%	20
50% – under 75%	32
75% – 100%	20

Table 4 Types of contractors

Type	Percentage of contractors
Housing	1.2
Building (non-housing: offices, educational, etc . . .)	18.8
Industrial (power plants, refineries, etc . . .)	—
Engineering (highways, harbours, airports, etc . . .)	5.9
Housing and buildings	28.8
Housing, building and industrial	9.4
Housing, building and engineering	3.5
Housing, building, engineering, and industrial	10.6
Building and industrial	4.7
Building and engineering	4.7
Building, industrial and engineering	9.4
Others	3.6

Table 5 Frequency of performance bond requirement

Frequency	Number of respondents
Always	1
Most times	3
Sometimes	56
Never	25

Factors affecting bid/no bid and markup size decisions

The participating top contractors have provided numerical scoring expressing their opinions on the level of effect of each factor on bidding decisions. For this type of data, the mean and standard deviation may not be suitable statistics for determining the overall ranking for the factors. Instead, the weighted average for each factor was calculated and then it was divided by the upper scale of the measurement resulting in what is referred to as an importance index. Therefore, the level of importance of the factors for both decisions were calculated using the following formula:

$$\text{Importance Index} = \Sigma(aX) * 100/7 \qquad (1)$$

where a = constant expressing the weighting given to each response. The weighting ranges from 1 to 7 where 1 is the least important and 7 is the most important; $X = n/N$; n = the frequency of the responses; N = total number of responses.

In addition, the percentage of respondents scoring 3 or less, 4 (the midpoint), and 5 or higher on the developed scale was calculated for each of the factors affecting both decisions. The interval scale was transferred into a nominal scale. A score of 3 or lower represents a weak effect on the decision, a score of 4 represents a moderate effect, and a score of 5 or more represents a strong effect on the decision. The calculated importance indexes and the percentage of respondents scoring weak, moderate or strong effects for all 55 factors affecting the bid/no bid and the markup size decisions are shown in Tables 6 and 7 respectively. The factors are ranked according to their importance indexes.

Examining the importance indexes for both decisions, we can see that some factors are considered heavily in both decisions, while other factors are considered heavily in one decision but not in another. For example, project size, owner/promoter/client identity, contract conditions, type of contract, project cash flow, current work load, past profit in similar projects and need for work are very important for bid/no bid and markup size decisions. Factors such as the tendering method, tendering duration, number of competitors tendering, experience in such projects and availability of qualified staff are considered more important for the bid/no bid decision than for the markup size decision. On the other hand, factors such as degree of hazard, completeness of the documents, anticipated value of liquidated damages and risk involved in the investment are considered more important for the markup size decision than the bid/no bid decision.

Despite the complexity of both decisions, the participating top contractors indicated that they rely on the mental model in making such decisions. Experience, judgement and perception are the gradients of the mental model. The results reveal that only 17.6% of the top contractors use some kind of mathematical/statistical model. The majority of the top contractors (96.5%) report that they are comfortable about the way they make tender decisions at present. Interestingly, two of the contractors who use mathematical/statistical models report dissatisfaction with the way they make tender decisions.

The top contractors were asked about the factors that make them feel that 'there is a good chance of winning this project'. The results are listed in Table 8. It is evident that it is not the overall economy that gives them the confidence in winning the project but their gained experience and strength in the industry. The contractors were also asked about the factors that make them think 'I must get this work'. Need for work and location of the project have the greatest influence on the perceived desirability of a project. Table 9 shows the factors that influence top contractors' perceived desirability of projects.

Conclusions

Most of the top contractors depend on subjective assessment in making bid/no bid and markup size decisions. They evaluate many influencing factors whenever they make either decision. Some factors are considered heavily in both decisions while some other factors are considered heavily in one decision but not the other.

Need for work, number of competitors tendering and experience in such projects are identified as the three major factors that affect a contractor's decision to bid a project. On the other hand, degree of difficulty, risk involved owing to the nature of the work, and current work load are the highest ranked factors that affect markup size decision. This finding supports the finding of Ahmad and Minkarah (1988) in negating the assumptions of competitiveness and profitability that are the basis of current bidding models. A contractor's confidence in winning a project is dependent on his experience and strength in the industry but not on the economy. Need for work and project location are the driving factors that increase a contractor's motivation to win a project.

It is hoped that the findings of this study will provide a foundation upon which researchers can develop a realistic bidding model.

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Table 6 Factors affecting bid/no bid decision

Factors	Percentage of respondents scoring			Number of respondents	Importance index	Rank
	⩾5	4	⩽3			
Need for work	91.70	7.10	1.20	84	86.39	1
Number of competitors tendering	82.10	11.90	6.00	84	83.50	2
Experience in such projects	85.70	10.70	3.60	84	83.16	3
Current work load	83.40	9.50	7.10	84	83.16	4*
Owner/promoter client identity	82.40	9.40	8.20	85	78.82	5
Contract conditions	75.00	17.90	7.10	84	78.57	6
Project type	77.40	11.90	10.70	84	78.57	7*
Past profit in similar projects	73.80	10.70	15.50	84	76.36	8
Project size	72.90	18.80	8.20	85	75.46	9
Tendering method (selective, open)	68.60	16.90	14.50	83	75.17	10
Risk involved owing to the nature of the work	69.10	13.10	17.90	84	74.83	11
Project location	71.80	18.80	9.40	85	74.12	12
Type of contract	64.70	20.70	14.60	82	71.60	13
Availability of qualified staff	60.80	20.20	19.00	84	71.60	14*
Rate of return	69.50	14.60	15.90	82	71.43	15
Project cash flow	60.20	16.90	22.90	83	69.19	16
Tendering duration	68.60	13.30	18.10	83	69.19	17*
Availability of other projects	57.20	21.40	21.40	84	68.88	18
Availability of labour	56.40	21.40	20.20	84	68.71	19
Completeness of the documents	61.40	19.30	19.30	83	68.67	20
Risk involved in the investment	54.20	21.70	24.10	83	68.33	21
Quality of available labour	56.00	23.80	20.20	84	68.20	22
Designer/architect/engineer	59.00	14.50	26.50	83	67.13	23
Anticipated value of liquidated damages	50.60	28.90	20.50	83	66.61	24
Type and number of supervisory persons available	52.90	22.40	24.70	85	65.21	25
Competitiveness of competitors	51.20	23.80	25.00	84	64.40	26
Contractor involvement in the design phase	47.10	20.00	32.90	85	63.53	27
Confidence in company work force	48.20	26.50	25.30	83	62.99	28
Degree of difficulty	45.20	25.00	29.80	84	61.73	29
Company strength in the industry	44.40	27.20	28.40	81	59.93	30
Reliability of company cost estimate	51.30	16.30	35.00	80	59.79	31
Design quality	45.70	20.50	33.70	83	59.04	32
Risk in fluctuation in labour prices	41.70	25.00	33.30	84	58.84	33
Degree of hazard (safety)	36.60	28.00	35.40	82	58.54	34
Availability of required cash	41.70	14.30	44.00	84	58.50	35
Risk in fluctuation in material prices	48.10	29.80	32.10	84	57.65	36
Labour environment (union/non-union)	39.50	25.00	34.50	84	57.65	37*
Identity of competitors	36.10	21.70	42.20	83	57.49	38
Owner's special requirements	36.10	25.30	38.60	83	56.63	39
General (office) overhead	29.90	28.80	41.30	80	54.01	40
Public exposure	29.30	28.00	42.70	82	54.01	41*
Project start time	28.20	24.70	47.10	85	52.77	42
Portion subcontracted to nominated subcontractors	29.70	27.40	42.90	84	51.81	43
Project duration	31.80	24.70	43.50	85	51.43	44
Availability of equipment	32.20	21.40	46.40	84	51.19	45
Type and number of supervisory persons required	28.90	24.70	49.40	85	50.92	46
Job related contingency	23.90	31.60	44.70	76	50.38	47
Portion subcontracted to domestic subcontractors	23.50	35.50	41.20	85	49.58	48
Qualification requirements	28.00	24.40	47.60	82	49.30	49
Policy in production cost savings	20.80	28.00	51.20	82	47.50	50
Policy in economic use of building resources	19.60	28.00	52.40	82	46.86	51
Bond requirements	20.20	22.60	57.10	84	43.88	52
Government regulations	8.40	44.00	47.60	84	43.71	53
Insurance premium	6.00	22.90	71.10	83	36.66	54
Tax liabilities	6.00	20.50	73.50	83	33.73	55

*Equal Importance indexes; ranked in accordance with the percentage of respondents scoring 5 or higher.

Table 7 Factors affecting the markup size decision

Factors	Percentage of respondents scoring ⩾5	4	⩽3	Number of respondents	Importance index	Rank
Degree of difficulty	83.10	13.30	3.60	83	81.76	1
Risk involved owing to the nature of the work	70.70	17.10	12.20	82	77.18	2
Current work load	70.40	16.00	13.60	81	76.37	3
Need for work	64.90	13.80	21.30	80	73.57	4
Contract conditions	68.70	17.50	13.80	80	73.37	5
Anticipated value of liquidated damages	62.50	25.00	12.50	80	71.07	6
Owner/promoter client identity	62.60	20.50	16.90	83	70.57	7
Past profit in similar projects	60.50	17.30	22.20	78	69.14	8
Completeness of the documents	55.00	25.00	20.00	80	68.75	9
Project size	55.40	26.50	18.10	83	68.33	10
Risk involved in the investment	55.60	22.20	22.20	81	68.07	11
Type of contract	55.60	24.10	20.30	79	67.81	12
Rate of return	52.50	22.50	25.00	81	76.37	13
Contractor involvement in the design phase	53.60	24.40	22.00	82	66.55	14
Project type	52.50	26.80	20.70	82	66.55	15*
Experience in such projects	53.10	24.70	22.20	81	66.49	16
Project cash flow	54.90	18.80	26.30	80	66.07	17
Risk in fluctuation in labour prices	52.40	22.00	25.60	82	65.16	18*
Quality of available labour	48.80	30.50	20.70	82	65.16	19
Availability of labour	47.90	29.60	23.50	82	64.55	20
Risk in fluctuation in material prices	47.60	28.00	24.40	82	64.11	21
Project location	42.70	37.80	19.50	82	63.41	22
Reliability of company cost estimate	46.20	26.90	26.90	80	63.37	23
Availability of other projects	45.20	26.80	28.00	82	63.07	24
Degree of hazard (safety)	47.40	21.80	30.80	78	61.90	25
Designer/architect/engineer	42.50	27.50	30.00	80	61.43	26
Design quality	46.20	23.80	30.00	80	60.89	27
Number of competitors tendering	42.00	28.40	29.60	81	60.32	28
Competitiveness of competitors	43.20	25.90	30.90	81	59.61	29
Owner's special requirements	37.40	28.80	33.80	80	59.46	30
Tendering method (selective, open)	36.70	34.20	29.10	79	59.31	31
Confidence in company work force	37.40	28.80	33.80	81	59.11	32
Availability of qualified staff	38.70	25.90	35.80	78	58.20	33
Project duration	33.80	30.10	36.10	83	56.45	34
Availability of required cash	32.40	31.30	36.30	78	55.71	35
Type and number of supervisory persons available	34.60	25.90	39.50	80	67.68	36
Labour environment (union/non-union)	35.90	25.60	38.50	78	54.76	37
Portion subcontracted to nominated subcontractor	35.50	17.70	46.80	78	54.64	38
Portion subcontracted to domestic subcontractors	34.60	22.20	43.20	79	53.79	39
Company strength in the industry	25.90	31.20	32.90	81	53.43	40
Identity of competitors	31.70	27.80	40.50	79	53.16	41
General (office) overhead	26.90	32.10	41.00	77	53.11	42
Project start time	42.70	37.80	19.50	83	52.50	43
Type and number of supervisory persons required	32.50	18.10	49.40	83	52.32	44
Job related contingency	23.70	31.90	44.40	72	51.39	45
Public exposure	20.50	33.30	46.20	80	50.73	46
Tendering duration	30.40	26.60	43.00	79	50.09	47
Qualification requirements	21.80	33.30	44.90	78	49.45	48
Availability of equipment	20.80	26.80	52.40	82	47.21	49
Policy in production cost savings	16.70	33.30	50.00	81	55.38	50
Policy in economic use of building resources	12.80	32.10	55.10	78	45.05	51
Government regulations	8.70	38.80	52.50	80	44.11	52
Insurance premium	10.10	21.50	68.40	79	37.61	53
Bond requirements	11.20	23.80	65.00	80	37.32	54
Tax liabilities	7.50	22.50	70.00	80	35.00	55

*Equal Importance indexes; ranked in accordance with the percentage of respondents scoring 5 or higher.

Table 8 Factors affecting the chance of winning a project

Factors	Percentage of respondents
Owner	54.20
Competitors	66.30
Type of job	91.60
Strength in the industry	48.20
Experience	83.10
Overall economy	16.90
Others	8.40

Table 9 Factors that make contractors feel desperate to obtain a job

Factors	Percentage of respondents
Need of work	90.20
Strength in the industry	18.30
Size of job	34.10
Location of the project	56.10
General office overhead requirement	42.70

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