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A survey of indirect cost estimating in practice

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This paper presents the findings of an investigation into the current practices of estimating the indirect costs involved in tendering for construction work. It shows the results of a survey of current practices and attitudes in seven firms towards the quantification and allocation of general overheads, risk contingencies and profit in a tender. The survey indicates that the methods used are highly subjective and are based on past experience. Quantitative methods involving statistics and probability, even though advocated, are rarely used. This suggests that future methods adopted in a computerized estimating environment should reflect the subjective nature of the process and should be simple enough to be applied.

Keywords: Indirect cost estimating, general overheads, risk contingencies, profits, subjective decision making.

Introduction

The primary objectives of contracting organizations include survival, growth, and profitability within an increasing competitive industrial environment. These objectives can only be achieved by ensuring that an adequate workload is obtained. The approach generally adopted by contractors in obtaining construction work is to prepare and submit a bid or tender in accordance with the Code of Estimating Practice (1979). The tender price consists of both direct and indirect cost elements and making a distinction between the two is difficult and subjective. However simply put, direct costs are those that are traceable to a specific work item and indirect costs are those which are not traceable to a specific work item and cannot be allocated to a cost centre. The direct costs consist of labour, plant, materials and sub-contractors' costs and the indirect costs consist of site overheads, general overheads, profits and allowances for risks. When indirect costs exclude site overheads, they are often termed the 'mark-up'. Despite the difficulties generally associated with cost estimating and the time constraints on bid preparation, direct cost estimating methods are becoming similar between firms. There are a number of reasons for this: they all have access to the same labour supply; they use the same type of equipment; they obtain supplies and materials from the same sources; they have somewhat comparable supervisory capabilities and there is mobility of labour between firms. Thus, the variations in competitors' bids are mainly due to their selected mark-ups which reflect the bidding policies chosen to achieve their own objectives. Therefore, it is perceived that efforts in improving tender prices should be directed towards improving the methods of determining indirect costs. Furthermore, the competitive tendering process results in high tendering costs (Cook, 1990), and hence high general overhead costs. Thus, any tool that increases the efficiency of the tendering process will be of benefit to individual firms within the construction industry.

This paper presents a survey of the current practices of estimating the indirect costs involved in tendering for construction work. Key questionnaire and interview responses are analysed highlighting the characteristics of the contractors involved, the composition of indirect costs, and the qualification of indirect costs. The paper concludes that indirect cost estimating involves management decisions that are highly subjective, involving qualitative information that is often vague, and difficult to structure and quantify.

Objectives of the survey

The main objective of this survey is to investigate the current practices of estimating the indirect costs

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involved in tendering for construction work. It should enable us to gain some insight into the methods currently being used for indirect cost estimating and should also provide an indication of the extent and nature of subjectivity on indirect cost estimating.

Methodology

The estimating of indirect costs is considered a sensitive and confidential issue by companies within the construction industry. Informal discussions with potential participants in the survey indicated that not many companies were willing to participate. Those that were willing to participate indicated that they would only speak in general terms and would not be too specific in their responses. The semi-structured interview technique was used, asking open-ended questions to ensure detailed discussions with the few companies that were willing to participate. In addition to the interview responses, examples of the company procedures and data were collected for further examination.

A questionnaire was designed based on a combination of preliminary informal discussions with senior estimators, own work experience, and the Cost of Estimating Practice. The questions were designed to elicit information on the characteristics of the firms, the project management procedures, composition of indirect costs and the methods of quantifying and distributing indirect costs. The details of the questionnaire can be found in Assegide (1991).

Sample size, response rates, representativeness

As indicated earlier in the paper, informal discussions with potential participants in the survey indicated that not many companies were willing to participate due to the sensitive nature of the information required. A letter of invitation to participate in this survey was sent to the senior managers of 22 contracting organizations, 12 building and 10 civil engineering. Seven contractors responded. Six contractors agreed to be interviewed and one declined the interview but agreed to complete the questionnaire, giving a response rate of only 29%. The low response rate was a limiting factor in this research. Therefore, the results should be seen only as an indication of current practice. Key responses to each of the four parts of the questionnaire are reported and discussed in the following sections.

Analysis of questionnaire responses

Characteristics of contractors

The general characteristics of the contractors involved are shown in Table 1 in terms of the type of work undertaken, and the size of the firm in terms of its annual turnover. The seven contractors are designated C1 to C7 for reasons of confidentiality. Table 1 indicates that about 43% of the respondents were engaged in exclusively building works, 28.5% in exclusively civil engineering, and 28.5% in both civil enginering and building. The invitation of contractors to participate in this work was intended to provide an equal proportion of both civil and building contractors of small, medium, and large sizes. Although Table 1 indicates a balance between civil engineering and building respondents in number, only medium sized contractors (C1 and C2) and large sized contractors were represented.

Composition of indirect costs

Contractors were asked to indicate what they considered to constitute indirect costs. The responses to this question are presented in Table 2. The top five items were presented as choices and the respondents were asked to include any other items. Items included are indicated by a '√' in the table. All the respondents considered general overheads, risk margins, and profits as indirect costs. Whereas contractors C1, C2, and C3 did not consider preliminaries and site overheads as indirect costs contractors C4 to C7 did. The former consider these costs as part of the direct cost and every cost that is related to a project is considered as direct cost. Several extra items were included by some contractors as part of indirect costs as indicated in Table 2. The responses indicated that contractors had different perceptions as to what were indirect costs, although it was generally agreed that general overheads, risk margins, and profits did constitute indirect costs.

Site expenses

The contractors were presented with the list of items shown in Table 3 and asked to indicate where the costs would be charged. The table shows that items may be charged as preliminaries (p), site overheads (s), head

Table 1 Characteristics of contractors

Contractor	Type of work	Annual turnover (£ × 10^6)
C1	Building	60
C2	Foundations, piling . . .	60
C3	Building	200
C4	Civil and mining	250
C5	Civil and building	1970
C6	Civil and building	–
C7	Building	–

Table 2 Constituents of indirect costs

Item	Contractor						
	C1	C2	C3	C4	C5	C6	C7
Prelims/general items	–	–	–	√	√	√	√
Site overheads	–	–	–	√	√	√	√
General overheads	√	√	√	√	√	√	√
Profit	√	√	√	√	√	√	√
Risk margin	√	√	√	√	√	√	√
Escalation	√	–	–	√	√	–	–
Insurance	–	√	–	–	–	–	–
Fees	–	–	√	–	–	√	–
Finance	–	–	–	–	–	√	–
Bond	–	–	–	–	–	√	–

Table 3 Distribution of site expenses

Item	C1	C2	C3	C4	C5	C6	C7
Site cleaning	p	p	p	s	p	p	s
Clearing rubbish	p	p	p	s	p	p	s
Site accommodation	p	d	p	p/s	p	p	p/s
Site transport	p	d	p	p/s	p	p	p/s
Mechanical plant	p	d	p	d/s	p	d	s
Scaffolding and gantries	p	p	p	s	p	p	s
Temporary services	p	p	p	s	p	p	s
Service charges	p	p	p	s	p	p	s
Small plant	p	d	p	d/s	p	p	s
Defects and liabilities	p	d	p	–	p	p	s
Final clearance and handover	p	h	p	s	p	p	d/s
Abnormal overtime	p	d	p	d	d	d	s
Insurance	p	h	p	s	d/p	p	s
Bonds	p	d	p	p	p	p	s
Payroll and taxes	p	d	p	s	p	d	s
Wages and taxes	p	d	p	d	d	d	s
CITB contribution	p	d	p	s	d	d	s

p: preliminaries, s; site overheads, h; head office overheads, d; direct costs.

office overheads (h), direct costs (d), and p/s or d/s if expenses are shared.

It can be seen from Table 3 that Contractor 1 includes all site expenses in the preliminary bill. Contactor 2 considers the majority of site costs as direct costs. Site cleaning, clearing of rubbish, and service charges such as bills for water, power and gas are included in the preliminary bill. Commissioning and handover of works are considered to be the responsibility of the head office. Contractor 3 includes all but the CITB contribution in the preliminary bill, as this is included in the 'all-in' labour rate. Contractor 4 considers costs of mechanical plants and small plants as a percentage of direct costs and site overheads. 80% to 90% is included in site overheads and 10 to 20% in direct costs. The company's 'all-in' labour rate includes abnormal overtime and taxes for wages. Charges for bonds are included in the preliminary bill as a lump sum. Contractor 5 includes all costs with the exception of insurances, wage taxes, and CITB contribution in the preliminaries bill. Insurances for employer and professional liability is included in the direct cost. Contractors 'all risk' insurance is considered in the preliminary bill. Taxes for wages and CITB contribution are considered in the direct cost in the 'all-in' labour rate. Contractor 6 includes the cost for mechanical plant and small plant costing more than £1,000 in the direct cost. Its 'all-in' labour rate includes abnormal overtime, taxes for salaries and wages, and CITB contribution. Scaffolding and gantries required for work are partly considered as direct costs; those sections of scaffolding with general access nature are included in the preliminaries. All other items are included in the preliminary bill. Contractor 7 considers final clearance and handover, and site transport partly as direct costs and partly as site overheads. All other items are included in the site overheads.

The distribution of costs largely depends on each contractor's assessment of the contract documents and their judgement of how best to recover the costs. Two of the contractors do not have a specific rule about where to include the site overheads. Each project's measured work and payment clauses are studied properly before a decision is made on how to include them. Inclusion is made using one of three methods:

1. as a percentage on measured works;
2. as a lump sum in the preliminary bill; and
3. as a combination of both.

The four others include their site overheads in the preliminary bill with the exception of a few items related to labour which are incuded in the 'all-in' labour rate.

Quantification of indirect costs

Site overheads

The contractors were asked if they had a standard method of their own for estimating site overheads or if they depended on information given in the bill of quantities. All contractors indicated that they had their own check list to assist the estimator in calculating site overheads. The check list acts as a guide to the estimator or as a reminder not to leave out any item that has to be included. Prior to calculating the site overheads, the total direct cost estimate has to be determined. This should indicate the level of overhead support required and the timing and duration of overhead requirements. Dependence on the bill of quantities is for the client contractual and specified requirements.

General overheads

The contractors were asked to explain how they determined the general overheads amount and how it was distributed among projects. The general overheads amount is generally determined by expressing the budgeted annual overheads as a percentage of budgeted turnover and applied as a proportion of the cost of individual contracts. In all cases this percentage is determined by senior management. Two respondents indicated that their companies had a policy that the general overhead amount is a fixed percentage of the tender sum, as they had a good reputation for achieving their turnover target. The fixed percentage is determined by senior management and is applied irrespective of each project.

Five contractors indicated that adjustments may be made to the calculated percentage based on observations made as to the sales achieved per year. They indicated that: if the company succeeds in achieving the anticipated turnover target then overheads are recovered; if it succeeds in increasing the turnover target then overheads are over recovered; if it does not succeed in achieving the anticipated turnover target then overheads are under recovered. The value of the percentage may be adjusted up or down or left unchanged, depending on other factors including the anticipated sales volume, head office contribution, strength of the company, and market conditions. The contractors were also asked if they could give guidance as to the size of the percentage adjustment to reflect the effects of these factors. All declined from giving details of the percentages but gave verbal general indications such as the following:

> 'If the company is competing satisfactorily then the overheads percentage may be left unchanged, or it may be reduced to win the contract, or it may be increased if failure to win the contract will not affect the company;
>
> If the head office contribution to a given project is significantly more or less than average then the overheads percentage charged to the project may be more or less than the average percentage;
>
> If as the year progresses and there is evidence that turnover target will be increased, then the overheads percentage may be reduced;
>
> If as the year progresses and there is evidence that the turnover target will not be met then the overheads percentage may be increased;
>
> If as the year progresses and no tenders are being won (i.e. the firm is non-competitive) then it may be better not to adjust the overheads but accept a reduction in profit and then carry out a management appraisal of overheads.'

Responses to the method of allocation or spread of the general overhead amount within the bill of quantities were varied, although some respondents declined to answer for reasons of confidentiality. Two contractors indicated that it is spread over all the bill items including the preliminary bill except provisional sums and prime cost items. One contractor includes the general overheads partly as a lump sum in the preliminary bill and the remaining is spread over the measured work. Another distributes it as a percentage of the contract's direct cost excluding prime cost.

The contractors indicated that the major factors that influenced the value of the general overheads amount included the anticipated and actual sales volume, the head office contribution, and the amount of work bid for. Other factors included the strength of the company, market conditions, competition, type of work, size of

contract, resource content, duration and the location of the contract.

Profits

Contractors were asked how they determine and distribute profits. All the contractors have a budgeted turnover target to achieve. This includes work in hand, future work, and anticipated tenders to be won. Based on this and other factors senior management decides on the amount of money or a percentage of the contract cost to be added as profit. In addition to the percentage method, one contractor also used the number of machine hours on the job for profit allocation. The argument is that the number of machine hours on the job is related to the volume of work. Each machine is expected to earn a fixed amount of money annually as a profit, decided by senior management. This amount is divided into the expected working hours per year. The profit for a project is, therefore, the sum of the rate of profit for each machine multiplied by the respective durations to execute the work. The contractors indicated that the major factors that affected profit included type of work, complexity of work, experience, market conditions, contract duration and competition.

Risk

Contractors were asked how they determine and distribute risk margins for projects. All contractors classified risks into two categories: quantifiable and unquantifiable risks. When the risks are quantifiable the estimator includes the appropriate costings for the risks in the cost estimate. The cost depends on what is exposed to risk. It is calculated as the product of the cost of the element exposed to risk and an assessed probability of the risk occurring. Where the risk in unquantifiable the amount added is based on management's perception of the situation. The addition for risk is made in one or more of the following ways:

1. a percentage in the profit margin;
2. a separate percentage on all the costs;
3. a lump sum in the preliminary bill; and
4. a percentage in one bill if the risk is in that bill alone.

Contractors were also asked if they used any statistical analysis to determine risks. All seven contractors indicated that they do not perform any form of statistical analysis to determine risk. They indicated that each risk was unique and should be evaluated on its own based on different methods of construction and the financial damage it will incur in the event of its occurrence. The major risk factors that affected contractors included the type of contract, location, conditions of contract, funding, cash flow, experience, resources and the client.

Discussion of questionnaire responses

The interviews confirmed that most contractors make a distinction between site overheads and general overheads. However, one contractor considers only general overheads and all other costs incurred at site level are considered to be direct costs. The specialized nature of this company in foundations and piling work probably explains this disparity. The method used to determine the site overheads is similar in all firms as all contractors have a check list for the estimators to work from. However, their differences lie in establishing, analysing, and costing the individual facets of site expenses due to such factors as construction methods, efficiency of the workforce including the sub-contractor, proper evaluation of attendances, supply terms and conditions, and level of site management.

All contractors agreed on the method of estimating the general overheads amount. It is estimated as an annual budget for the company based on the previous year's expense, adjusted for inflation. Whereas some contractors adjusted the budgeted overheads amount to take account of such factors as the anticipated sales volume, contract duration, head office contribution, strength of the company and market conditions, others used the original budgeted amount on all projects. The determination of the general overheads amount is simple but its allocation to individual projects is a complex and perplexing problem.

The percentage method is based on the assumption that a company will be able to obtain the anticipated workload for the year. This presupposition poses a problem if half way into the year a company has obtained all or none of its anticipated workload. The problem that arises is, what amount should be added to further contracts? The logical solution will be for the company to reduce the percentage of all work that is being obtained and to increase the percentage if adequate work is not being obtained. These both have negative consequences. In the former case there might be no need to reduce overheads as any excess earnings are added rewards to a company's competitiveness. In the latter case the increase will result in high tender prices which will not help the company win contracts to remedy its already non-competitive situation. We support Harrison's (1981) view that there is a necessity to allocate overheads in a manner which takes account of the differing uses of 'overhead' resources by individual contracts and work types. He advocates the use of a percentage which varies according to the contract's

characteristics (i.e. type of contract, size of contract, labour, materials and plant content, etc).

Regardless of the method used to allocate general overheads, the main objective of a contractor is to recover a specific amount of money within a specific period. To accomplish this, the company must attain its anticipated workload for the year so as to achieve the sales volume required to pay for overheads. The apparent problem lies in the uncertainty in the volume of work that the company can successfully bid for at the time of allocating general overheads to a contract.

All seven contractors indicated that no rigorous quantitative methods were used to perform risk analysis. Available statistical and probabilistic methods were considered too difficult, too time consuming, and expensive to implement. Risk margins are therefore set on adjudication as a contingency profit. The percentage that is added is based on the subjective judgement, often described as the 'hunch' of senior management.

All companies indicated that the percentage addition for profit was determined by senior management. The industry is increasing its use of investors' money. An understanding of the cost of capital to the company and the rate of return on the capital employed is paramount in the determination of profit. Companies have broken from the old thinking of determining profit as a percentage of turnover, and are now fixing it as a percentage of capital employed. More thought is not directed towards profitability rather than profit as a figure.

Conclusions

This paper presents the findings of a survey conducted among seven UK contractors. The purpose of the survey was to investigate the current practices of estimating the indirect costs involved in tendering for construction work. There was a low rate of response in this survey, due to the sensitive and confidential nature of the subject. This has been a limiting factor and the results should be seen as an indication of current practice. However, the investigation has provided some insight into the methods currently being used for indirect cost estimating, indicating a high degree of subjectivity on indirect cost estimation.

The survey indicated that no rigorous quantitative methods were used to perform risk analysis. Available statistical and probabilistic methods were considered too difficult, too time consuming, and expensive to implement. Risk margins were set on adjudication as a contingency profit. The percentage that is added is based on the subjective judgement, often described as the 'hunch' of senior management. The subjective decision making processes involved in these tasks are characterized by qualitative data and knowledge that is often vague, and difficult to structure and quantify. Models are currently being developed by the authors (Tah *et al.*, 1993) that attempt to provide decision support for these tasks by the use of both knowledge-based systems techniques and approximate reasoning methodologies based on fuzzy set theory.

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