ENGINEERING CONTRACTING ADDED VALUE ANALYSIS AS AN AID TO DISPUTE RESOLUTION

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Introduction

As technology has evolved over time, capital plant has become progressively more complex entailing, potentially, increased risks and uncertainties associated with engineering, manufacture and installation. Offsetting this trend, however, techniques to highlight problems, facilitate project control and reduce the potential for risk and uncertainty have also become more sophisticated, including PERT/CPA, financial analysis and, more recently, Project Risk Management. While the application of such techniques has been commonplace in large projects such as power, defence, aerospace, industrial and civil infrastructure investment, the advent of the personal computer allied with today's user-friendly software, has also enabled these techniques to percolate downwards to smaller construction projects.

Where liability to recovery of contributions to overhead costs and profit has been agreed, and where records exist demonstrating with a reasonable degree of certainty the impact of disruption on a contract arising from owner-caused delays to the critical path, a recurring financial problem concerns the measurement of the opportunity cost arising — the lost contribution to overheads and profit, at whatever level in the business.

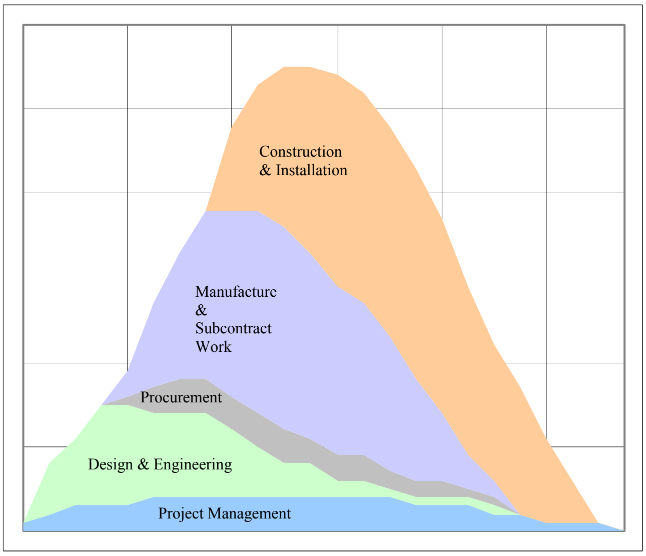
A key element concerns the analysis and division of costs into those which are fixed or variable, or which are shorter or longer term in nature, the time over which they should be considered and the relevance or not of them to the contract dispute. While the technique of Marginal Cost Analysis clearly separates out these costs, agreement between owner and contractor is still required as to which categories the costs actually fit into with regard to a specific project or contract. In the very long term, all costs can be considered as variable, and overheads can vary in some proportion to general business levels, while in the very short term many costs are effectively fixed. In the middle ground there is a grey area where disputes can be more difficult to resolve. To complicate matters, the cost structures of the key players — engineers, contractors, manufacturers and constructors — are often quite different in nature from each other, and the size of players varies, from the one-man architect up to the large-scale providers such as Siemens or Alsthom.

A number of financial formulae[1] have been developed to attempt to simplify the estimation of quantum. They rest on particular hypotheses concerning the relationship of overheads (i.e. supposedly fixed) to turnover or costs (i.e. supposedly variable), whether planned or actual, or to the delay period. It is not surprising that using different formulae can produce quite different results. This is not to say, however, that the Court should simply ignore such efforts to elucidate the costs of delay, but rather to seek the best-fit representation of the facts as presented to it, on which to make a judgement.

Project / Contract Cost Structure

The format of a project is generally a combination of processes; initial design and engineering, followed by manufacture & procurement, and then construction & installation. The exact combination of these depends upon the market being served and the way individual corporations have adapted their expertise to meet the market.

Figure 1. Project Costs/Resource over Time



While the primary expertise of a firm of engineering consultants or architects is that of design, moving down the chain, a process plant contractor may be more orientated towards expertise in contract management and procurement allied to licensed technology know-how, with supply and manufacturing risk passed to third-party suppliers and subcontractors.

For major technology components such as heat exchangers and steam and gas turbines (often associated with significant research and development costs) the emphasis switches to a manufacturing based contractor, with in-house engineering and construction teams to design and install manufactured parts.

At the other end of the process, the expertise of a construction team, such as a group of tunnel miners, may be centred around the provision and management of skilled and unskilled site labour, allied to technology equipment from cranes to tunnel boring machines.

1. Hudson, Eichleay, Emden, Ernstrom, Carteret, Allegheny

Added Value

A possible means of highlighting the key differences between the main players, and of throwing some light on the question of overheads is by reference to added value analysis. Figure 2 summarises the generally accepted structure of added value:

Figure 2. Structure of Added Value

	SALES TURNOVER (TO)	*Net VAT, Excise duties*
+	Other Income	*Share of profits of associated companies, interest received*
=	GROSS INCOME	
-	Bought out costs	*Materials, components, services, utility costs, interest paid*
=	ADDED VALUE (AV)	
-	Wage costs (WC)	*Wages, social security, pensions, profit sharing*
=	PROFIT before Depreciation	*Profit before tax + depreciation & amortisation*

A provider of a product or service buys in outside products/ services and adds value to them, with which to recompense employees and providers of capital, and reinvest in the business.

The table at figure 3 below summarises raw data for one year of a range of different sized companies, chosen to illustrate some of the dynamics of this process. The list is not an exhaustive one. The sources of the data obtained were Perfect Analysis, FAME and company accounts. Companies chosen included UK registered companies/subsidiaries, or European companies. US and Japanese companies were not selected because their accounts generally do not publish details of employee wage costs. The list below is placed in Added Value order. Figures for ABB group relate to 1998, prior to merger of interests with Alstom

In most of the large groups, only parts are engaged in engineering contracting activities. While about half of Alstom is concerned with power engineering, in the case of Rolls Royce, only about 10% of activity is directed to energy work, similar to Siemens. Where possible, subsidiaries of the larger groups have been researched, and further analyses in this report concentrates on those rather than their parent companies.

Figure 3. Some Companies with Project Activities

Company	Year End	Currency	Turnover M £ $ €	Added Value M £ $ €	Employees
Siemens	9.03	€	74233	32458	419300
ABB	12.98	$	30872	19037	199232
Alstom	3.03	€	21351	4397	109671
BAE Systems	12.02	£	8076	2794	69400
Rolls-Royce	12.02	£	5788	1897	39200
AMEC	12.02	£	3213	899	22964
Kellogg Brown & Root Holdings (UK)	12.01	£	2154	693	14988
Carillion	12.02	£	1847	490	16959
W S Atkins	3.03	£	935	448	15450
Taylor Woodrow	12.02	£	2209	436	6030
Alstom Power UK Holdings	3.02	£	1027	319	4613
AMEC Capital Projects	12.02	£	987	238	6608
Alfred McAlpine	12.02	£	768	213	6476
Carillion Construction	12.02	£	856	147	4125
Mitsui Babcock Energy	3.03	£	260	136	3772
Foster Wheeler Europe (13m)	12.01	£	597	120	4478
Taylor Woodrow Construction	12.02	£	445	91	3291
Rolls-Royce Power Engineering	12.02	£	642	80	3474
McAlpine Capital Projects	12.02	£	361	52	1149
Fluor Ltd	12.02	£	223	42	625
Bechtel Holdings Ltd (UK)	12.01	£	256	35	1279
Aker Kvaerner Projects Ltd (UK)	12.02	£	59	22	633
Merz & McClellan Parsons Brinckerhoff	10.02	£	40	16	485
Davy Process Technology Ltd	12.02	£	30	16	170
AMEC International Construction	12.02	£	59	15	342
Stone & Webster	8.02	£	23	14	243
Snamprogetti	12.02	£	29	9	267

Make or Buy, Provide Service/Subcontract Out

A key ratio for the market is the extent to which firms subcontract value production (and associated risk and control over costs) to other suppliers. This is normally measured by the ratio of added value/gross income, but for purposes of contract analysis, other income such as interest received and share of profits of associated companies is ignored, and the ratio reduces to that of added value/turnover. The higher the ratio, the less value that is sourced to outside suppliers and subcontractors.

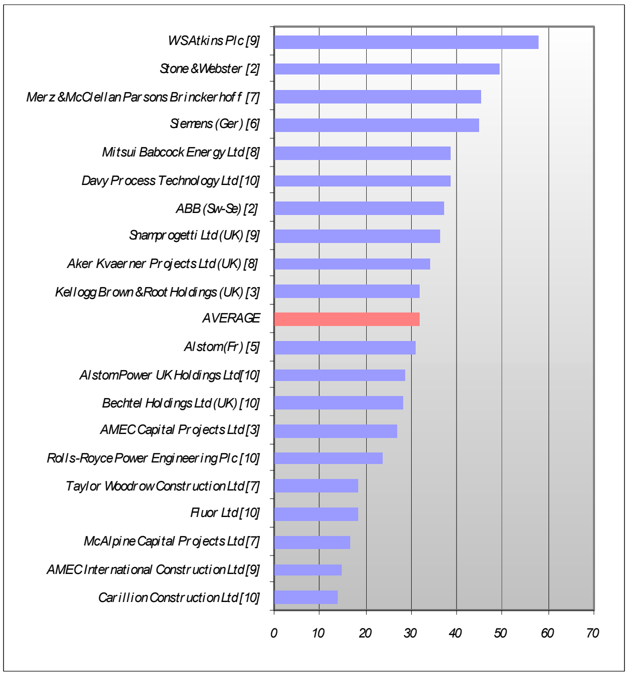
A pure contractor is likely to subcontract most of the value production to others, retaining a margin for contract management costs and profit. A manufacturer, on the other hand, may buy in raw materials and components, to do substantial work on and to fit to complex plant, before installing in the factory or on site. It may also have to invest in substantial capital plant and research & development in furtherance of its business.

It might be expected that a firm of engineering consultants would have a very high ratio, but even here items such as rent, insurance, stationery, computers and software, interest paid, utilities, advertising and subcontract staffing subtract from turnover. The level of the ratio for a pure constructor will depend upon the amount of labour that is subcontracted to smaller construction teams and self-employed labourers.

The chart at figure 4 below shows the extent to which some companies add value. Averages have been computed over periods of up to 10 years' history for each company up to 2003. For some companies the period of history was shorter than this, owing partly to ease of availability of data, but also to be consistent in comparing ratios. There have been some significant changes in the market over the years, in particular the switches of ownership of turbine production among GEC, ABB, Alstom, Westinghouse and Siemens, complicated by significant losses for some groups, and the introduction of the Euro.

Figure 4. Average Percent Ratio Added Value / Turnover

(Number of years, over which average calculated, in brackets)



At the top of the scale are the engineering consultants and professionals, where added value constitutes 40-60% of turnover (and therefore outsourced costs 60-40%). At the other end of the scale contractors and constructors add only about 20% of value to output, with 80% being outsourced. In between are the manufacturers adding 30-50%.

Some scatter in the ratio is to be expected for given specialities, the relative make or buy situation, and relative profitability in any one year. Some companies such as Alstom and Rolls Royce Power Engineering have had particularly turbulent recent profit histories and their ratio is lower than might otherwise have been expected.

A simple statistical measure of scatter over the years considered can be obtained by dividing the standard deviation of a ratio for a company over a period by the mean of the ratio calculated over the same time period. Among all the companies over the periods examined, on average about 2/3rds of data scatter occurs within a range of ± 25% either side of the mean level. Thus for an expected added value/turnover ratio of 32%, a range of about 24—40% might cover 2/3rd of the data variations. Clearly, however, some companies have higher or lower scatter of the ratio than this over the periods of years examined. *It should be pointed out that care should be exercised in the interpretation of standard deviations and means calculated from small samples.*

Overheads

Overheads, defined as costs not allocable directly to contracts, can occur at all levels of a business, and not just at the head/home office. In a factory or on a construction site it may not be possible always to charge all of the cost of shop-floor management to a contract. If a foreman is underemployed or his/her time is spent on non-contract activities, then the cost of underutilisation has an effect on recoverable costs and a reduction in profit level occurs. This might reasonably be regarded just as part of the relative efficiency of the firm. In a competitive situation, firms have to judge whether they can charge more for particular underutilised resources, or take a reduction in profit. At the home office level, typical costs include:

- Executive wage costs and expenses of senior management & staff in accounts, human resources, marketing & selling, legal services
- Head office utility and IT costs
- Advertising, rent of premises & machines, professional services
- Depreciation & amortisation (D&A)
- Interest on borrowings (Int)
- Research & development not allocable to a contract (R&D)

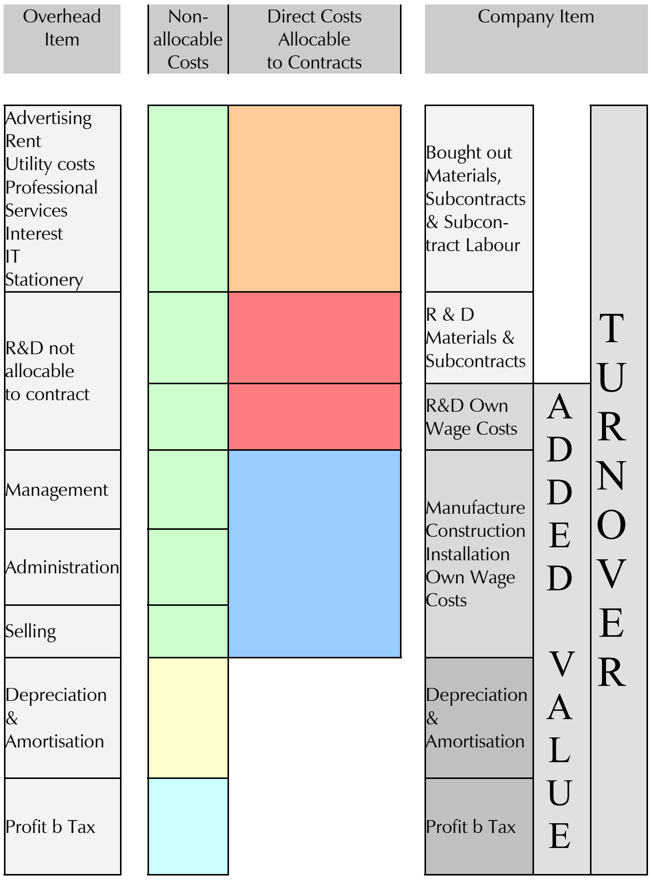
Among these are a number that are not a part of the added value of the firm, such as interest paid, utility costs, and sub-contract services. They form part of the bought-out costs. Depreciation and amortisation (D&A), ordinarily regarded as parts of overheads and deductions against tax, effectively have similar properties to profit, in that they are potential sources of cash flow to fund capital expenditure to invest in the future. The diagram at figure 5 illustrates how overheads fit into the scheme of added value.

Overhead costs vary in a number of ways, but in general are affected by:

- Overall level of output of the business
- Relative resources required to manage added value
- Business cycle, often lagging changes in profitability
- Investment and R&D requirements
- Relative ease or not of being able to book costs to projects
- Costs of financing the business and contract cash flow

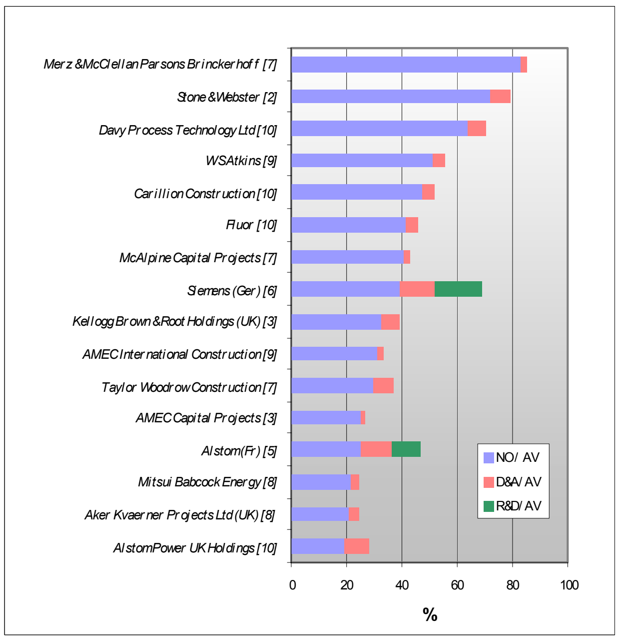
Accounts for most public companies include a breakdown of overheads into marketing & selling, administration and R & D. Figures for D&A, while included in administration, are separately stated elsewhere. Thus it is possible to split up overheads into separate items, for the purposes of analysis to assist in dispute resolution. In figure 6, a Net Overhead (NO) item has been derived over the specified time history for some of the companies referred to earlier, to exclude R&D expenditure (where known), interest, depreciation & amortisation.

Figure 5. Schematic Representation of Added Value and Overheads



Accounts of BAE Systems and some other companies do not include an item for selling and administration. For the smaller companies, information of FAME 'other expenses' was used as a basis to estimate Net Overheads, but it is not possible to be certain of the result without extensive investigation of individual accounts, which was precluded from this research. The figure likely includes R&D, and some significant non-wage items, some non-recurring, which increases the potential for data scatter.

Figure 6. Percent Ratios to Added Value
(Number of years, over which average calculated, in brackets)

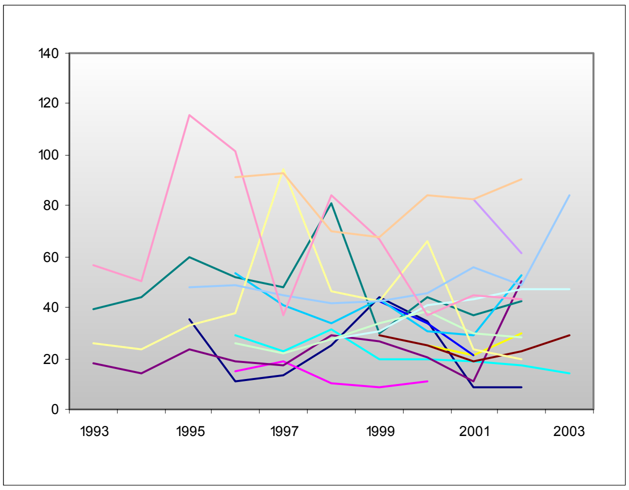


Across the sample of years for each company, D&A as a percent of added value varied significantly about a mean of 4.4%. Firms with D&A/AV percent ratios in excess of this are those with manufacturing bases. They also may have significant R&D expenditures.

In engineering consultancies, overheads are high as a proportion of added value, compared to contracting orientated companies, and overhead recovery rates on project work are therefore also quite high.

Figure 7 illustrates how the net overheads (NO) for selling & administration (not including D&A, R&D and interest) have varied with added value over the years for fifteen companies (not annotated). As stated earlier, net overhead include some charges not part of added value.

Figure 7. Net Overhead / Added Value Ratio %
Annual data 15 companies



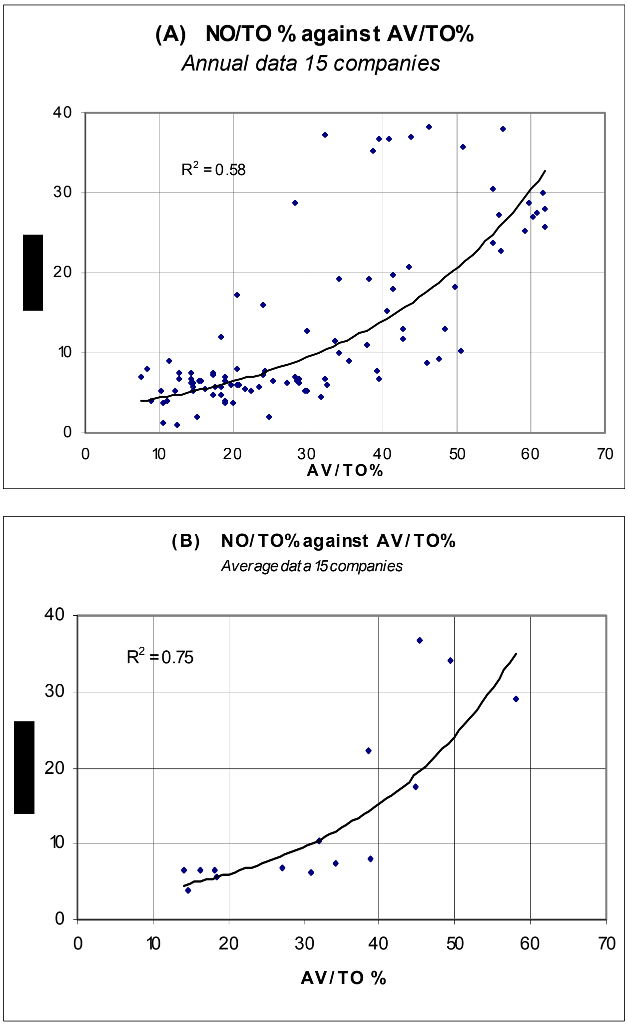
It is apparent that for some companies, the ratio has varied significantly compared to some others. As with the data on the AV/T/O ratio, a measure of scatter for the NO/AV ratio can be calculated for each company's historical record, by dividing the standard deviation by the mean value of the data years, with the proviso of the limitation placed by small samples. An average of all the company scatter figures is in the region of ±37%, accounting for 2/3rd of the results. Likewise for the net overhead/turnover ratio and the net overhead/wage cost ratio, the comparable figures are ±30% and ±26% respectively. However, if one company's results are excluded, because of possible unreliable/skewed data, leaving 15 in the sample, the scatter results reduce to ±31% NO/AV, ±29% NO/T/O and ±25% NO/WC. About this band there are some companies with higher or lower scatter.

Some reservation is held by the writer concerning what items are included in the FAME overhead data for some smaller companies. Very large profits or losses in one year can also skew added value figures, and potential errors can also arise from using small samples to calculate averages. An analyst, using company data to calculate supposed relationships of overheads to turnover, added value and wage costs, with which to compute potential overhead recovery from a claim, will need to tread with care.

The two charts at figure 8 have been constructed to try to show the relationships between net overheads, added value and turnover for some companies. The points on chart A represent all the data in the sample years for each company.

'Best-fit' relationships between net overhead/turnover and added value/turnover ratios have been added to the charts of the form:

Figure 8. Relationships of Net Overhead
(Ex D&A Interest and R&D)
to Turnover and Added Value



$$\frac{NO}{TO} = f\left(\frac{AV}{TO}\right)$$

The slope of the line is likely to be a function of the NO/AV ratio, which rises as the added value/turnover ratio rises. The correlation coefficient is not very high, but is improved if the averages for each company are plotted instead individual annual data, as per chart B.

Proceeding further, recognising that net overheads are more likely to be related to added value than to turnover, charts can be drawn to link net overheads with wage costs and added value, and these are shown at figure 9.

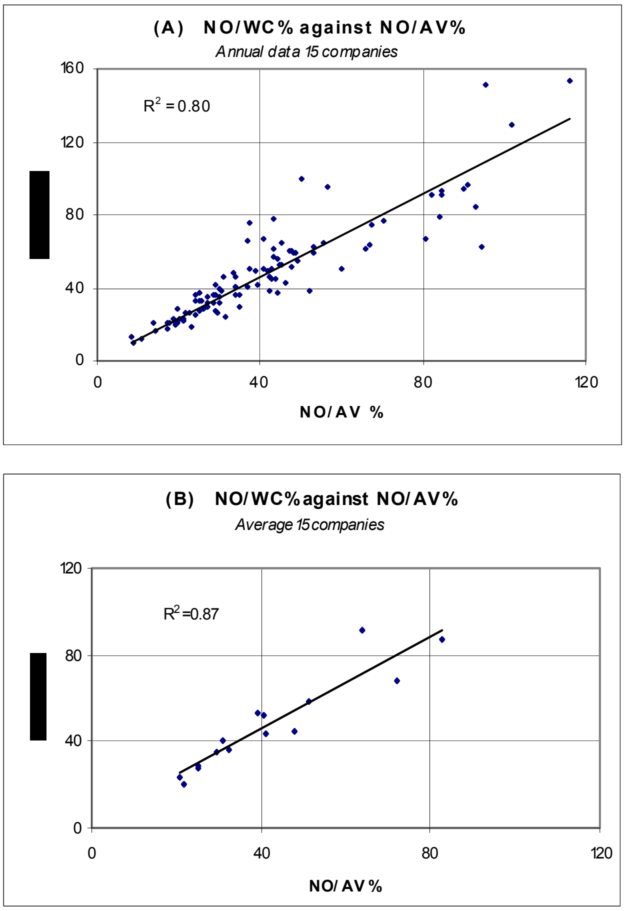
At figure 9 'best-fit' relationships between net overhead/wage costs and net overhead/added value have been added to the charts of the form:

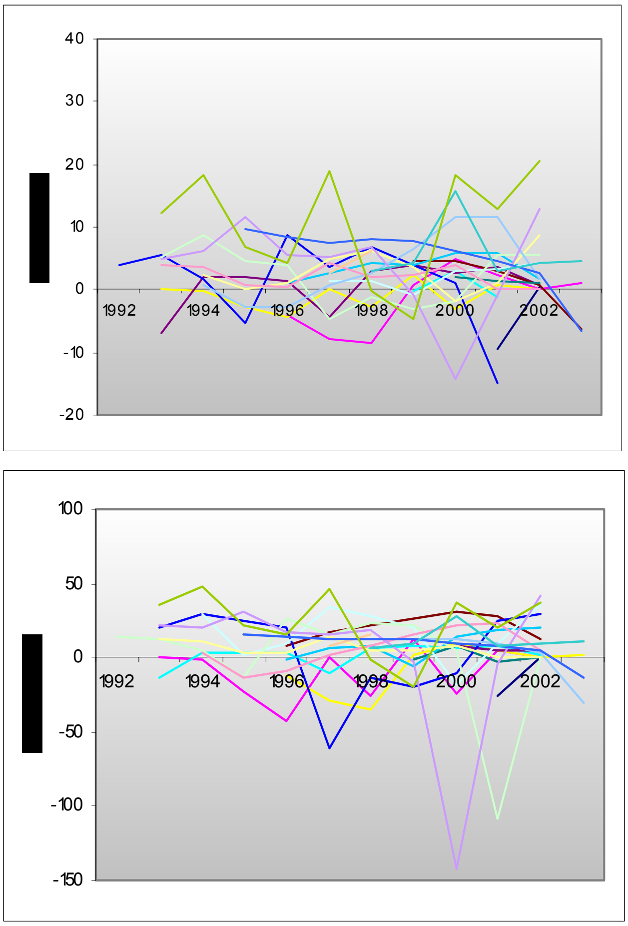
$$\frac{NO}{WC} = f\left(\frac{NO}{AV}\right)$$

The slopes of the lines appears to be constant. They are likely to be a function of the added value/wage cost (AV/WC) mark-up ratio. The latter is unsurprising, given that wage costs constitute the major part of added value. The correlation coefficient is improved if the averages for each company are plotted instead of individual annual data, as per chart B.

Figure 9. Relationships of Net Overhead
(Ex D&A Interest and R&D)
to Wage Costs and Added Value

Figure 10. Profit before Tax as function of Turnover and Added Value
Annual data 19 companies





Profits

If all of the above leads the reader to take a cautionary view concerning the safeness of relying on averages and trends for calculating the potential for a contribution to overhead, then the position for estimating profits is several times worse. Profit is calculated after deduction of all costs, and its variability will be a function of the combined variability of all the costs deducted, the level of output, and output prices. Figure 10 illustrates the variability of profit before tax as a proportion of turnover and added value for a selection of firms (not annotated).

The charts show a significant amount of scatter. In the case of the profit/turnover ratio, this is on average of the order of twice the mean. That is, for a company with a mean percent ratio of say 2.5% profit/turnover, 2/3rd of the results might occur with in a band of –2.5% up to +7.5%. In the case of profit/added value, scatter is about three times the mean. Thus for a company with a mean percent ratio of say 5%, 2/3rd of the results might occur within a band of –10% up to +20%. Clearly, however, some firms experience scatter significantly outside this level. Caution should be exercised therefore in forming a view on an average level of profit to be assumed.

Overhead Recovery

Where the Court deems that a contractor is entitled to be compensated in some way for owner-caused delay, there are a number of issues to be addressed concerning recovery of costs, overheads and profit.

First, mostly in the case of shorter-term delays, in addition to the costs of payment of direct labour resources for being idle, head office employees might be involved in some additional costs such as overtime, travel and consultancy.

The latter costs centre very much around a limited number of people. They are more likely to be relatively easy to highlight and detail, though this does depend upon the records that a contractor has kept.

Second, more particularly in longer-term delays, of unknown duration at outset, the question to consider is the quantification of the potential loss of opportunity for a contractor to undertake other worthwhile projects, which will, it is to be hoped, eventually contribute towards recovery of overheads and to profit. It is to be assumed that the Court will look for some evidence of the results of the consequences of a delay in terms of reduced project cash flow or tenders not taken up.

Referring to the schematic diagram at figure 5, while costs may be expended on employment of people in selling, R&D and administration functions, these are not being covered during the delay, and an employer might be under pressure to reduce them. Borrowings might rise entailing increased interest to be paid. Other costs such as rent and utility costs would continue. Clearly if the contract took a major part of total turnover for a company, as can happen in large scale engineering contracts, then an enforced delay outside of its control could have serious consequences for a contractor in terms of profit and cash-flow.

Additional points arising from the research in this paper are first, that variability of data is likely to confer only limited links between some financial variables, and little for others. Thus simple solutions are likely to be more beneficial. Second, factors favoured as being more closely linked to net overheads are added value and wage costs. Overheads for a contractor that subcontracts 80% of its work are less likely to be related to turnover than to added value or own wage costs.

Third, where liability to recovery of profit and non-wage items has been agreed, inclusion of items such as D&A must be considered. A more longer-time form of expenditure for the future is that of R&D, where returns may potentially be high, but are regarded as speculative. It might be difficult for a firm to quantify the lost opportunity of a return on an investment in R&D foregone from a contract delay. Specific consideration of items such as depreciation and R&D expenditure might be beneficial.

Where liability to recovery of profit and non-wage items has not been agreed, then it might be argued that only head office executive manpower and other costs directly involved or tied up by the contract can be included, with the rest of overheads being excluded.

Overhead/Profit Formulae

The use of formulae to estimate the lost opportunity to recover overheads and profit associated with a project delay has been common for many years. The formulae are generally simple to use, and are favoured by contractors. They may not find favour with owners, on account of the difficulty in proving that such opportunity losses have resulted from a delay.

The formulae used fall into two schools; those structured around the time lost from a delay, such as Hudson, Eichleay and Emden, and those structured around a cost basis, such as Ernstrom, Carteret and Allegheny[2]. There is no one formula agreed by practitioners. The mathematical form of the first school is as follows:

$$\text{Overhead (+profit) owed} = B \times \frac{O}{T} \times \frac{t_d}{t_c}$$

where B represents billings/contract value, O represents company overheads (sometimes including profit), T represents total company turnover, t_d is the delay period and t_c is the contract period.

In the Hudson formula, the original contract value is inserted for B, the ratio of overhead (+profit if necessary)/turnover is that specified in the original contract (and does not therefore necessarily relate to actual performance of a contractor in the conduct of its business. This is also its main disadvantage. t_c is the original planned contract time.

In the original Eichleay formula, actual contract billings are inserted for B, and the ratio O/T is that of actual overheads over the contract period (including the delay) divided by total company contract billings over the same period. t_c is the actual contract time (including the delay). The weakness of this formula is that for delays of any significant length, the level of overhead claimed is effectively watered down, and an under-claim may occur. The formula has since been modified[2] and now has similarities to the Emden formula.

In the Emden formula, B is represented by contract value, as with Hudson, but the ratio O/T is represented by the average rate of overhead (+ profit) to turnover as shown in the company accounts. t_c is the original planned contract time.

2. Overhead Formulae
Hudson
J F Finnegan, Ltd , V . Sheffield City Council, 43 Build. L.R. 124 (Q.B. 1989)
Eichleay
Eichleay Corporation, ASBCA No. 5183, 60-2 BCA (CCH) ¶2688 (1960)
Eichleay Modified
Capital Electric Co. V. United States, 729 F.2d 743 (Fed. Cir., 1984)
Emden
Alfred McAlpine Homes North, Ltd. V. Property & Land Contractors, Ltd. 76 BLR 59 (1995)
Ernstrom
The Construction Lawyer, Volume 3, Number 1, Winter 1982
Carteret
Carteret Work Uniforms, Inc., ASBCA No. 1647, 6 CCF §61,651-1951 (1954)
Allegheny
Allegheny Sportswear Co., ASBCA No. 4163, 58-1 BCA (CCVH) ¶1684 (1958)

In all of the time-based formulae it is assumed that no contribution may arise from the contract during the whole of the delay. In real life however a delay might not always have such an dramatic on/off effect, but exhibit more gradual build-ups and resumptions. Detail of this can often be obtained via appropriate PERT/CPA analysis.

In contrast to time-based formulae, the Ernstrom formula is based on a supposed direct relation of overheads to labour costs. Thus:

$$Overhead\ \ Owed = \frac{O}{L_a} \times L_d$$

where O equals actual total overhead for the contract period (all projects), L_a the total labour cost for the contract period (all projects), and L_d the labour cost during the delay. A possible problem with this formula is in deciding which labour costs should be applied. Should the total labour costs be included, including all subcontract labour, or should they relate only to direct labour costs inside an added value definition?

Carteret and Allegheny assume that there is a difference between the overhead rate during a delay period and the planned or actual rate. Carteret applies the differential to the cost of work during the delay period, and Allegheny applies this to the original contract value. These are complicated formulae to apply. One problem is that if no differential overhead rate can be shown, then no loss in opportunity can be shown to have occurred. Overhead rates might have declined in the delay period, because a contractor had pruned costs to mitigate potential losses.

Added Value Formula

A possible approach to calculating the lost contribution to overheads and profit is by reference to added value. To illustrate the principles the following company and project data is assumed:

Company Accounts 1 Year	
	£M
Turnover	1000
Total Subcontract/Bought-out costs	700
(of which overhead bought-out costs £30m)	
Added Value	300
Total Wage Costs	250
(of which direct wage costs £200m, overhead wage costs £50m)	
Depreciation	15
Profit b Tax	35
Net overhead ex depreciation	80
(of which wage element £50m and bought-out element £30m)	
Overhead, profit & depreciation	130

Project Account 2.5 years	
	£M
Subcontract/bought-out cost	134
Direct wage cost	40
Total Direct Cost	174
Overhead, profit, depr mark-up	26
Contract Value	200

A mark-up of 14.94% is applied to total direct project costs to equate to contract value, thus recovering overheads (both wage and bought-out elements), depreciation and profit.

If overheads within the company historical account can be split into own wage costs and bought-out costs & services *(£50m and £30m in the above example),* then these can deducted respectively from total wage costs and from total subcontract/bought out costs, to produce net figures *(£200m and £670m respectively in the example),* equivalent in definition to the direct wage cost and subcontract/bought-out costs in the contract. Deduction of the net subcontract/bought-out costs from turnover and project value produces the following 'adjusted' added value figures:

Company adjusted AV = £1000m - £670m = £330m
Project AV = £200m - £134m = £66m

It is assumed that an owner-caused delay of six months occurs to the original 2.5 year project and that the contract allows for recovery of a contribution to overhead, depreciation and profit.

The structure of the added value formula proposed is similar to that of the Emden formula:

$$\text{Overhead (+profit) owed} = B_{AV} \times \frac{O}{AV} \times \frac{t_d}{t_c}$$

where B_{AV} is the estimated adjusted added value of the contract, O/AV is the historic overhead/adjuested added value ratio for the company, t_d is the delay period and t_c is the original contract period. Substituting in figures, Overhead (+profit) owed:

= £66m x (£130m/£330m) x (0.5/2.5) = £5.2m

For comparison, under the Emden formula:

$$\text{Overhead (+profit) owed} = B \times \frac{O}{T} \times \frac{t_d}{t_c}$$

hence Overhead/profit owed:

= £200m x (£130m/£1000m) x (0.5/2.5) = £5.2m

The two advantages of using an added value formula are:

First, added value is more closely related to overheads than turnover, given that in the process plant contracting business a significant amount of work is subcontracted.

Second, in considering contracts that do not necessarily fit a contractor's historic added value/turnover pattern. A contractor might take on a project where it provides either more or less of the added value than it normally does (with either a smaller or greater subcontract cost), and likely entailing an appropriately greater or lesser management input. In the event of an owner-caused delay a greater or smaller recovery in overhead (+profit) levels might be indicated. Thus in the example chosen, if the estimated adjusted added value of the £200m project had been either £80m or £50m instead of £66m, using the added value formula, overhead/profit recovery calculations would have been as in the following table:

Added Value	Overhead Calculation	Amount claimed
£50m	£50m x (£130m/£330m) x (0.5/2.5) =	£3.94m
£66m	£66m x (£130m/£330m) x (0.5/2.5) =	£5.20m
£80m	£80m x (£130m/£330m) x (0.5/2.5) =	£6.30m

Which allow for a reduced or increased recovery depending upon the added value content.

Under the Emden formula, using turnover as a base, the same overhead recovery figure would have arisen regardless of the added value content of the project, bestowing a potential advantage/disadvantage either to the contractor or to the owner in the dispute, depending upon the project resource make-up.

A potential disadvantage of the added value formula is that it may not be possible to divide up historical records of overheads to separate out own wage costs from bought-out costs & services. In this situation the only recourse is to use a historical company added value definition. Substituting in figures, the estimated Overhead (+profit) owed:

= £66m x (£130m/£300m) x (0.5/2.5) = £5.72m

This clearly is an overestimate of the lost contribution, arising from the different definitions of project and company added value used. The options in this case are:

- Retain the added value formula, recognising its potential to over-estimate when subdivision of overheads is not possible, but allowing for different contract mixes.
- Abandon the added value formula in favour of Emden, recognising the more tenuous relation of overheads to turnover, and its inability to cater for different contract mixes.
- Use both formulae, and make adjustments to reflect the most likely position.

Summary & Conclusion

Recovery of contribution to head office overhead in owner-caused delay situations has been a part of dispute resolution procedures for many years. A number of formulae have been in common use to simplify estimation of the contribution. They do not, however, take particular account of the differing natures of the key players in the market, and the variable added value that each contributes to final output.

This paper sets out to illustrate some of the dynamics of the market in terms of added value, and to show how these relate to disputable items such as overheads and profits. A selection of different types of company—engineering consultants, contractors, manufacturers and constructors—was used to illustrate the principles. Analyses were carried out to try to pin-point the major sources of potential errors attached to added value, overheads and profit.

Following a brief overview of traditional formulae, a new formulae is proposed, linking recovery of head office overheads to added value. It has advantages in using data more closely related to overheads and in being able to adjust for different project added value contents, but these can only be fully realised if overheads in company accounts can be broken down into wage and non-wage elements. If this is not possible, then use of the formula alongside a traditional formula such as Emden is preferable.

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