THE PRACTICAL USES OF VALUE ANALYSIS IN PROFIT IMPROVEMENT WITH PARTICULAR REFERENCE TO FUNCTION COST ANALYSIS

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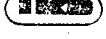

Value Control are associated with the IKO Consulting Group in Scandinavia.

THE PRACTICAL USES OF VALUE ANALYSIS IN PROFIT IMPROVEMENT WITH PARTICULAR REFERENCE TO FUNCTION COST ANALYSIS

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Continuity of profit making in a business depends on the technical excellence and availability of the products or services provided. Equally it depends on the ability to provide these at a cost which will sustain or improve profit margins in the face of competitive market pressures.

The elements of technical excellence, innovation and cost are interwoven and need to be considered together. Whilst technological change is today handled in a highly sophisticated and involved manner, improvements in the provision and use of cost information have not proceeded at the same rate.

The common belief that consideration of cost must lead inevitably to the degradation of the product or service is wrong. Design in any of its forms involves a balance of marketing, technical, aesthetic and economic considerations and it is incomplete if any of these are neglected.

If then we are to keep abreast in profit improvement it is necessary to take an integrated view of innovation and cost and examine the failings in some of our common attitudes towards them.

* Innovation for its own sake has too little encouragement except perhaps for key products. Most changes are initiated by customer demand, by failure in service or by pressure from competitors.

* The pressure of immediate problems and a shortage of time and resources inclines us to make a negative response to new ideas particularly where they apply to the longer term.

* Innovation is limited in use and associated mostly with 'things'. It is not always appreciated that it is equally possible to develop creative ideas for improving packaging, maintenance, capital projects, overheads and administrative procedures.

* It is often thought that innovation will only come from the specialist in any particular field. In fact, it is just as likely, given the right climate and information, that the embryo of an acceptable new idea may come from an imaginative mind uncluttered by the disadvantages of knowing what *cannot* be done as a result of overwhelming experience. The idea that a quaint person called an inventor produces a new article in its ultimate form is anyway a myth. In practice most original ideas are raw and ill prepared and a team is required – whether or not it is recognised and organised as such – to develop, improve, productionise, market, sell and service the idea. At each of these stages further innovation and cost control are as vital to profitability as the original concept itself.

* Cost is rarely used methodically in the evaluation and balancing of alternative ideas. The truth is that cost analysis is not a very sophisticated tool except in its use for financial and other management purposes. To the chemist, engineer or architect realistic cost estimates may not be available for use during his creative work. Most commonly cost is provided in the form of an estimate at the end of each stage and after basic technical and cost-creating decisions have been taken.

These limitations in innovation, attitudes, organised team work and cost control have greatly influenced the direction and development of value analysis in recent years.

Value analysis itself is a good example of an idea which was initially raw and ill prepared. Like so many good ideas (plastics, computers and work study are others) it was oversold and not sufficiently integrated with other techniques, procedures and plans.

Essentially, value analysis still follows its original concepts but during the past few years greater emphasis has been given to the development of certain of its aspects and those which follow are the more important.

* The need for clarification and direction by Management of short and long term objectives and of the plan by which these should be reached.

* The need for careful selection of suitable and significant items for study.

* The development of systems and procedures which lead to the avoidance of unnecessary cost in the first place.

* The more careful use of teams and team time.

* The fact that value analysis is essentially an in-company activity helped initially by the value analysis specialist but not controlled and often not led by him.

* The fact that value analysis describes a way of working rather than a separate new technique.

There is sufficient experience available to see that value analysis, properly organised and used, can make a major contribution to product cost control and to Profit Improvement Programmes. As a way of thinking and working, its applications are unlimited.

APPLICATIONS

Some of the more recent applications of value analysis in Dunlop and other companies are interesting because of their breadth. It is not intended to give here a series of detailed case studies but to explain generally some of these applications and the results achieved.

Products

Examples of product value analysis are shown elsewhere in this journal and there is sufficient written and known about the subject to make any further explanation unnecessary. There are however, two significant facts which have emerged from these studies.

First, the concept that value analysis is only suited to mass production is wrong. It is equally possible to achieve product improvement and lower cost on items produced in small batch or 'one-off' quantities. This is because the design life is usually greater and the pay-back, although less on an annual costing basis, is likely to be effective over a longer period.

Second, it is beneficial to integrate value analysis procedures, particularly the preparation of function and cost layouts, into the marketing, research, development and design process, see figure 1.

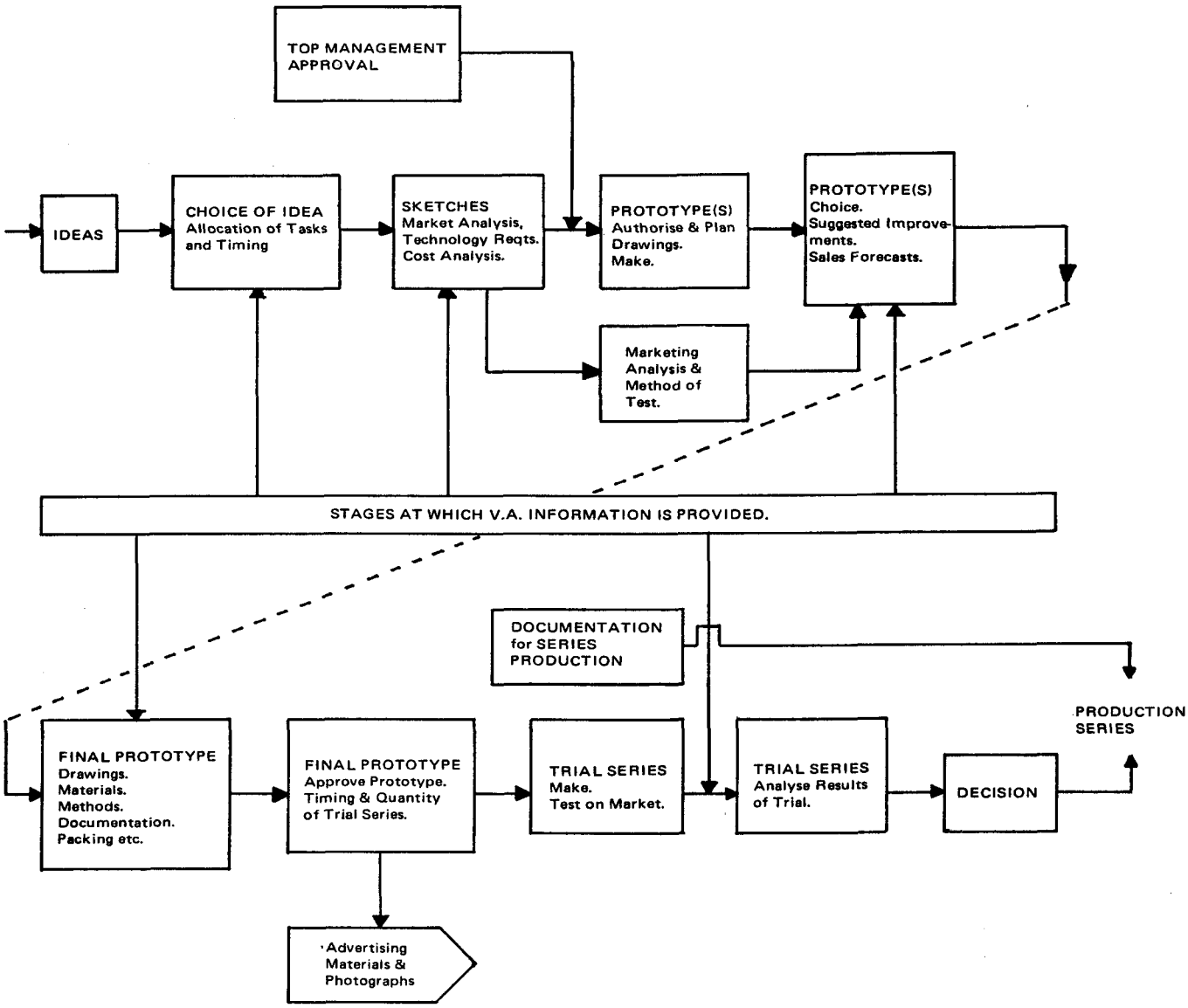

FIGURE 1

Stages in the design and development of furniture showing where value analysis information is provided and informal teams used.

Comparative Cost Data

As an adjunct to the use of value analysis in product design, comparative cost information can be presented in graphical form, to show the relative cost of alternative components, materials, processes and finishes. These are prepared to provide design and technical people with quick reference cost information relating to everyday problems and decisions. The examples shown in figures 2 and 3 are from Dunlop Companies.

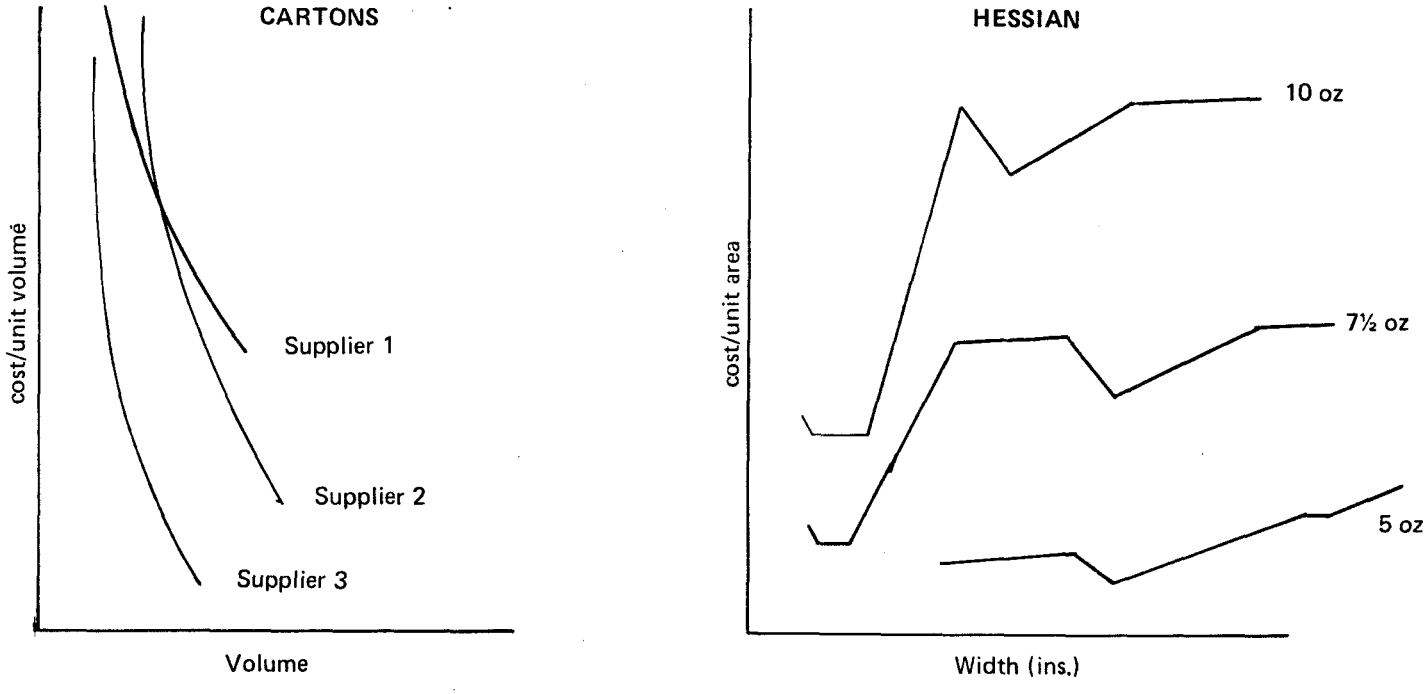

FIGURE 2

Comparative cost curves for cartons and hessian used for packaging.

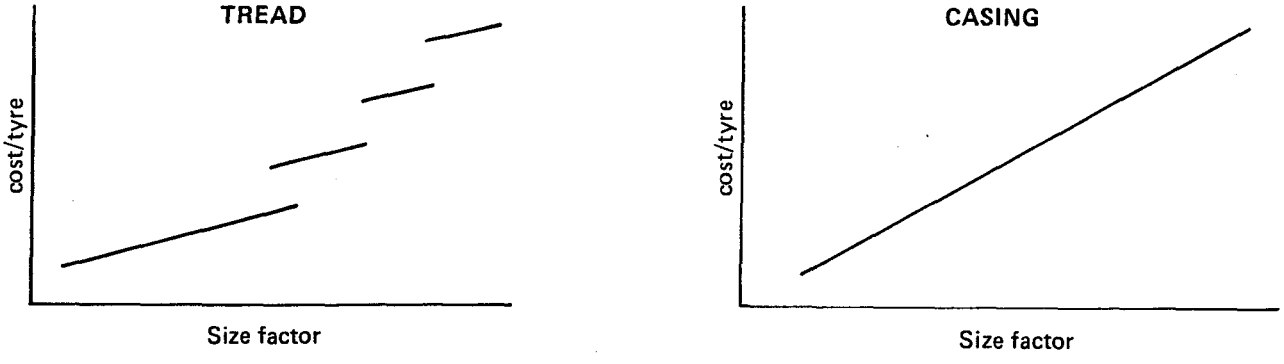

FIGURE 3

Comparative cost curves taken from studies carried out on Car Tyre Components

Capital Projects — Buildings, Plant & Equipment

In some industries, notably chemicals and petroleum, the annual investment on capital projects is high and attempts to obtain more plant for the capital available have led to a number of effective value analysis studies. Of necessity these have been concurrent with the development and design of the buildings and plant, since post-design studies are of limited value. Normally the objections to cost control studies in this field are that delay to 'on-stream' dates would offset the direct savings which might be achieved and that teams do already give consideration to cost.

These arguments are to an extent contradictory and their protagonists are generally assuming that through value analysis a totally new system of design and cost control would be introduced. This is not the case, however. The real question is how far existing procedures and methods can be economically improved, especially by the provision of better cost information at the right time and by the introduction of systematic procedures for identifying functions and costs, for generating ideas and for collecting experience and views.

Functions

Cost Element	NITRATION	SEPARATION	WASHING	ACID TREATMENT	Total Cost £
CIVIL	10900	5000	11500	8500	35900
MECHANICAL	17700	9100	21500	26000	74300
INSTRUMENT	3700	300	1700	1100	6800
ELECTRICAL	6000	2800	6400	6300	21500
Total cost of function £	38300	17200	41100	41900	138500

Cost disproportionate for function

	Stabilise 'N'	Transport 'N'	Form Emulsion	Flush Out	Move Emulsion	Separate Streams	Provide Safety	Contain Product	Total Cost £	Total Cost %
HOT WATER	1230	1230	5190	200	200				8000	
WATER EDUCTOR		50	800						850	
WATER TRANSFER	50	50	100						200	
AIR INJECTOR			455						455	
SEPARATOR						1950	4900	3900	10750	
SODA SUPPLY	4200	3500	6500	1550	600				16350	
SODA EDUCTOR		50	600						650	
AIR INJECTOR(S)			345						345	
SODA TRANSFER	250	3000	250						3500	
Total cost of function £	5730	7880	14190	1750	800	1950	4900	3900	41100	
%	14	19	35	4	2	5	12	9		

Cost disproportionate for function. Study of this function reduced overall plant cost by 6%.

FIGURE 4

Examples of cost analyses of a Process Plant and Building made at the scheme stage and based on estimates. The example shows how high cost functions are traced.

Results vary, but is is clear that those with the greatest effect are obtained in the early conceptual stages of the scheme or design. Ideas which can be implemented by the use of a rubber and pencil on a flow diagram are far more acceptable than those requiring major redesign and contractual changes at a later date.

In one example the analysis of total potential cost included not only the process plant but also the building and the projected maintenance costs. This analysis led to changes in design which reduced plant dimensions and in turn reduced the building size and cost.

In addition, the analysis of maintenance costs drew attention to the number of electric motors used and these were reduced from 56 to 28. As a result there was a further reduction in capital cost. An important point to note, however, is that even an increase in this area would have been accepted in view of the effect on total operating cost. The overall savings on the project were 17% against initial sanctioned expenditure.

In another example the functions of the walls of a building were identified as 'protect operatives' and 'support roof'. The total cost of the function 'protect operatives' included in addition to the walls the cost of fume extraction and ventilating equipment. From the analysis the solution became clear — as most good solutions are once they have been found. It was to support the roof with steelwork and eliminate the walls. Operatives and plant are protected largely by the roof and people in this industry are accustomed to working in the open. Deletion of the walls also eliminated the need for a large proportion of the fume extraction equipment and all the ventilation plant.

The significant outcome of these studies is that preparation of the *total* cost implications of any design or layout will influence the final design of the scheme if cost information in appropriate form and detail is provided at each design stage, see figure 4.

Maintenance

Examination of overall cost has frequently brought out very clearly the effect that plant and equipment design has on ultimate maintenance costs.

Of course, managements are usually aware of high maintenance costs and understandably they are indignant at the suggestion by an outsider that he would be able to make improvements and at the same time satisfy the many other considerations relating to plant operations.

The approach used in value analysis is not along these lines. High cost areas, once identified are tackled by teams of people who are familiar with and indeed responsible for the design, operation and maintenance of the plant, so that it is reasonable to expect that proper consideration is given to all related aspects.

It would not normally be the purpose of value analysis to make a general appraisal of planned maintenance procedures, nor to attempt to review the total maintenance activity. The approach would be governed by the high cost and apparent poor value areas located by analysis.

As an example, an examination of the cost of maintaining a number of furnaces was initiated by an analysis of the frequency of use of replacement items. To the cost of the most commonly used items was added an estimate of the labour involved in replacement, the loss of production due to down-time and the effect a reduction in down-time would have on the capital costs of any intended future extension to the plant. As a result changes were made to the design of components which selectively altered their life and improved their overall value. In some cases this entailed an increase in the first cost of a particular item where it was calculated that the total effect would be an overall saving in operating cost.

In a similar way in the textile industry, where value analysis has been used, modifications and improvements have been made to items of proprietary machinery in order to reduce product breakage and waste.

Of course, value analysis is not the only way to bring about such improvements. What value analysis does, however, is to identify and improve as many items as possible by a concerted systematic effort rather than as the normal operating circumstances permit or dictate.

Overheads

General items of overhead expenditure — power supply, protective clothing, grease and lubricants, handling equipment, cleaning materials and services, to name a few — are rarely exciting and frequently of very limited technical interest. Nevertheless, they represent together a considerable proportion of expenditure in many organisations. Systematic analysis and selection, followed by short studies can be rewarding and it is particularly important that the effort given is proportionate to the potential result. In some companies a list of items in descending order of cost is selected and everything over a specified annual figure, say £500 or £1000, is subjected to a 'mini-study' by teams trained in the procedures, see figure 5.

			£
Packaging:	Cartons	£38,000)	
	Crates	£ 3,000)	46,500
	Labels, paper etc.	£ 5,500)	
Small tools:	Drills		21,300
Bobbins:	(Annual repair & replacement cost)		16,400
Ceramic fingers:	(Machine maintenance & replacement)		12,300
Ball & roller bearnings:	(Machine maintenance & replacement)		6,400
Furnace liners:	(Replacement)		6,200
Pallets:	(Annual repair & replacement)		6,200
Technical literature			6,000
Protective Clothing			5,200
Water softening chemicals			5,100
Lubricants & greases			5,100
Mercury:	(Replacement)		5,100
Fire precautions:	(Maintenance & replacement)		4,900
Paint thinners			3,600
Inspection and work cards			3,300
Stillages:	(Annual repair & replacement)		3,200
Brushes			2,100
Scrap & waste disposal			2,100
Hand rags			2,000
Adhesive tapes:	(Various types)		1,800
Canteen equipment:	(Replacement)		1,800
Cleaning materials:	Soap, powders & liquids		800
Test boxes			600
Marking Inks			600
Stencils			500
Electric lamps			500

In this example a minimum cost level, worthy of study, of £500 has been used. The level usually depends on the size of the company.

Some items may justify further breakdown to show the cost of each type used, e.g. Packaging cartons and ball and roller bearings.

Many of the items only justify 'mini' studies and two or three may be tackled at one team meeting.

FIGURE 5
Cost Analysis of Indirect Materials

In the Dunlop Companies, studies of this type have already been made with success on steam and other serivces, heating costs, bobbins, protective clothing and packing.

Once again, there is nothing novel in the attempt to reduce costs in these areas but the use of an analyst to prepare a list of items for management selection, to collect and process the necessary supporting information and to keep the work moving, provides sufficient formality to ensure continuity and measurable results. It is the involvement of those mostly concerned with or affected by the problem which is paramount. This will ensure that ideas are not improved from outside but are developed from within the organisation, with all the benefits which follow in achieving the acceptance and effective use of the changes.

Administration

In recent years value analysis procedures have been used with success to study simple administrative systems and procedures. Of course it is important that such studies are combined as far as possible with O & M and Work Study activities, since the basic scheme description and its measurements should be prepared by people experienced in this work.

However, value analysis in administration has generally been successful because the study was completed quickly and avoided too much detailed measurement and analysis. Once again the involvement in a team of those familiar with the operation of a system or procedure can be of great assistance in the implementation of the ideas and in overcoming initial minor difficulties.

Some of the administrative value analysis projects studied in the U.K. and Scandinavia in 1970/71 were as follows:—

SALES ORDER DEPARTMENT ROUTINE
ROUTINE FOR PREPARING QUOTATION
ROUTINE FOR PREPARING ESTIMATES
ROUTINE FOR ISSUING PRODUCTION ORDERS
ROUTINE FOR RECEPTION OF GOODS
ROUTINE FOR RETURNING UNSOLD GOODS
SECURING PAYMENT
EFFECTIVENESS OF TECHNICAL STAFF—TIME UTILISATION
EVALUATION OF USE OF A PRINT ROOM
HOW TO INCREASE PRODUCTION CAPACITY
HOW TO IMPROVE DELIVERY DATES
ROUTINE FOR HANDLING LOAN APPLICATIONS (Bank)
HANDLING EMPLOYEE DISCOUNTS
ROUTINE FOR RECEPTION & SAFEKEEPING OF STOCKS & BONDS
ROUTINE FOR ISSUING FOREIGN CHEQUES
ANALYSIS OF COMPUTER EFFECTIVENESS

In most of these examples, the prime objective was to improve the speed or effectiveness of the routine or procedure or to create time for other duties. Reduction in staff was not a prime objective unless alternative work was available.

In one recent project the delivery time for large process measuring equipment was the subject studied by a team of four people, with the freedom to use their creative ability. An alternative routine was developed in a total time of 24 man hours. The change was implemented within two weeks and reduced delivery time from 26 to about 17 weeks.

In this type of work an initial step is often the determination of the cost or time content of the various functions of the department or system and for this purpose a cost or time model is produced, see figure 6.

Item		£ (Rounded figures)	
1.	Salaries — Sales	74,000	16%
2.	Advertising	36,500	8%
3.	Purchases — Local	31,000	7%
4.	Carriage — Inwards	30,000	7%
5.	Carriage — Outwards	30,000	7%
6.	Rent	30,000	7%
7.	Salaries — Operating	30,000	7%
8.	Delivery Van Expenses	20,000	4%
9.	Wages Unproductive — Distribution	20,000	4%
10.	Customs Duty	20,000	4%
11.	Landing Charges	20,000	4%
12.	Car Expenses — Sales	13,000	3%
13.	Computer	13,000	3%
14.	Travelling Expenses — Sales	10,400	2%
15.	Productive Wages — General	7,000	
16.	Printing and Stationery	5,200	
17.	Pensions etc. — Sales	4,300	
18.	Telephone charges	4,300	
19.	Insurance	4,000	
20.	Management Expenses	3,700	
21.	Sundry Expenses	3,500	
22.	Maintenance and Repairs	3,200	
23.	Fuel, Light and Power	3,000	
24.	Depreciation	3,000	
25.	Packing Inwards	3,000	
26.	Packing Outwards	2,400	
27.	Pensions etc. — Operating	2,400	
28.	Lost and Scrapped Goods	1,500	
29.	Stamps and Telgrams	1,300	
30.	Travelling Expenses — Home	700	
31.	Travelling Expenses — Operating	700	
32.	Car Expenses — Operating	700	
33.	Bad Debts	600	
34.	Cables	600	
35.	Rates and Taxes	500	
36.	Pensions — Distribution	400	
37.	Legal Expenses — Sales	200	
38.	Pensions — General	200	
39.	Gratuities and Subscriptions	200	
40.	Medical Expenses	100	
	Total:	£434,600	

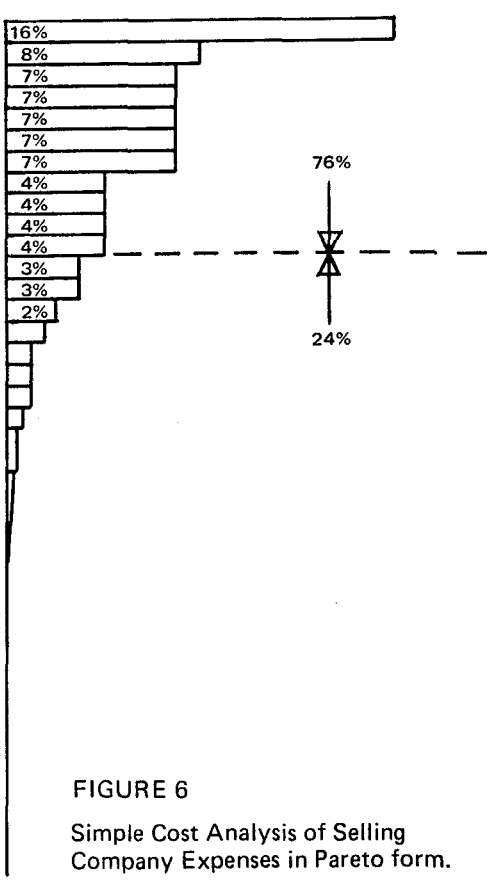

FIGURE 6

Simple Cost Analysis of Selling Company Expenses in Pareto form.

From this model (figure 6) a function cost analysis can be developed:

Item	Function: Obtain Products	Advertise Products	Sell Products	Store & Protect	Control Stocks	Control Distribution	Distribute Products	Manage Business	Obtain Payment	Cost £000s	%
1 Salaries - Sales		25	25			24				74	16
2 Advertising		36.5								36.5	8
3 Purchases - Local		7	6	7	5	2	2	2		31	7
4 Carriage - Inwards	30									30	7
5 Carriage - Outwards							30			30	7
6 Rent			13	13				4		30	7
7 Salaries - Operating				6	10	10		1	3	30	7
8 Delivery Van Expenses							20			20	4
9 Wages - Unproductive - Dist.							20			20	4
10 Customs Duty	20									20	4
11 Landing Charges	20									20	4
12 Car expenses - Sales			13							13	3
13 Computer					2			9	2	13	3
14 Travelling Expenses - Sales			10.4							10.4	2
15 Productive Wages - General	7									7	—
16 Printing & Stationery		2			0.2			1	2	5.2	—
17 Pensions etc. - Sales			4.3							4.3	—
18 Telephone Charges	1		1			1		1.3		4.3	—
19 Insurance				4						4	—
20 Management Expenses								3.7		3.7	—
21 Sundry Expenses				0.5	1	1		1		3.5	—
22 Maintenance & Repairs				3.2						3.2	—
23 Fuel, Light, Power			0.5	2				0.5		3	—
24 Depreciation			0.5	2			0.5			3	—
25 Packing - Inwards	3									3	—
26 Packing - Outwards							3			3	—
27 Pensions - Operating				0.4	0.5	0.5		1		2.4	—
28 Lost & Scrapped Goods								1.5		1.5	—
29 Stamps & Telegrams			0.2				0.1	0.5	0.5	1.3	—
30 Travelling Expenses - Home								0.7		0.7	—
31 Travelling Expenses - Op.				0.1	0.2	0.2		0.2		0.7	—
32 Car Expenses - Operating				0.1	0.2	0.2		0.2		0.7	—
33 Bad Debts			0.6							0.6	—
34 Cables	0.6									0.6	—
35 Rates & Taxes			0.1	0.2				0.2		0.5	—
36 Pensions - Distribution							0.4			0.4	—
37 Legal Expenses - Sales			0.2							0.2	—
38 Pensions - General	0.2									0.2	—
39 Gratuities & Subs.								0.2		0.2	—
40 Medical Expenses								0.1		0.1	—
Cost of function	81.8	70.5	74.8	38.5	19.1	38.9	75.4	28.1	7.5	434.6	
% of Total Cost	19	16	17	9	4.5	9	17	6.5	2		

FIGURE 7
Function cost analysis of a selling company.

Cost Area	Function: interpret order	obtain information	ascertain stock	prepare documents	maintain records	prepare correspondence	supervision	personal needs	cost
senior clerk	270	360	90			540	180	360	£1800
clerks	150	600	750	300	300	450	150	300	£3000
stationery				1800	450	750			£3000
services									
sh/typist				80		640		80	£800
typists		140	140	840		140		140	£1400
typist/clerk		130	65	260	130			65	£650
telephone		550	220			330			£1100
cost of function	420	1780	1265	3280	880	2850	330	945	£11750
% of total cost	3.5	15	11	28	7.5	24	3	8	
high or low		H				H			

FIGURE 8
Function cost analysis of a department

Description: 500 Invoices per Week / Item	Function: Invoice & Tax	Classification	Debtor Accounts	Tax Accounts	Abstract of Accts.	Stock Lists	Product Group Stock Lists	Customer Group Stock List	Credit Notes	Cost of Item £	Cost of Item %
PUNCH	42									42	15
READ IN	17									17	6
PROCESSING	28	14	14	0	28	28	28	28	14	182	65
AMORTISATION OF INITIAL COST OF PROGRAMME (£4480)	11	2	4	2	2	4	2	2	2	31	11
INTEREST on (£4480)	3	0.5	1	0.5	0.5	1	0.5	0.5	0.5	8	3
Cost of Function	101	16.5	19	2.5	30.5	33	30.5	30.5	16.5	280	100
% of Total Cost	36	6	7	1	11	11	11	11	6		100
Mark 'high' or 'low'		H					H	H			

FIGURE 9

Function Cost Analysis of a Computer

This form of analysis provides a visual measurement of the overall functions and cost of a department or procedure. In Figs. 7, 8 and 9 high cost items and their breakdown are visible in the horizontal columns. High cost functions and breakdowns are visible vertically. If it is accepted that understanding and measuring a problem are essential to finding a sound alternative, it will be accepted that an analysis of this type can help those involved properly and equally to understand the problem. In the process it will also highlight disproportionate costs and provide the motivation for a team to find an alternative solution.

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In briefly illustrating the breadth of the applications of value analysis there is a danger of implying that it is a total answer to all problems. This is not intended and great care is required initially to identify significant cost areas and then to ascertain that value analysis is the best tool to deal with them.

Value analysis has now been in use long enough to have had the benefit of being subjected to the criticism and improvement which comes from experience. Its strengths are in the processing of cost information into a form suited for use by technical people and in the provision of a common systematic procedure which both motivates people and provides a method of working. It can bring together, when necessary, a team representing many parts of the company and give them freedom to put forward their ideas on any suitable subject.

It is unlikely that future economic, technological and human problems will be solved without the wider participation of people at all levels. Relatively few of these people have so far received any training, guidance and experience in the use of simple systematic problem solving procedures, group behaviour, creative thinking and the better use of cost information. It is in this field that value analysis has a part to play. It is pointless to develop the wider use of objectives and controls within management unless those subordinates who will be affected and ultimately responsible for achieving change know how to develop new ideas whilst at the same time considering their effects on the overall profitability of their company.