Engineering Industry Training Board

COURSES FOR MANAGEMENT
Value Engineering

MANAGING DIRECTORS & DIRECTORS

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Value Engineering

What is Value Engineering? Is it a new science, or a better way of presenting old methods?

This Manual was prepared by Value Control Ltd. as a hand-out for a series of Value Engineering Conferences for Directors, arranged by the Engineering Industry Training Board.

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VCL

The Present Position

Value engineering techniques originated in the United States.

Changes to engineering products were brought about during the second world war due to a shortage of previously available materials and skills. As these became available again after the war, designs were examined with a view to reverting to the original specifications. In many instances it was found that the changes were not only lower in cost but were more satisfactory from the customer's point of view.

As a result, efforts were made to produce procedures which would make improvements of this type happen by intention and not as a result of extreme circumstances. It was realised that to do so the function required of the product had to be considered as well as its cost. Hence, the expressions VALUE analysis and VALUE engineering.

These procedures, first developed by the General Electric Company of America, were subsequently employed by the American Department of Defense, and used on their shipbuilding programmes of the 1950's and subsequently on the aerospace programmes.

Development and growth in the United Kingdom and Europe has mainly taken place during the past decade. In some cases there have been failures due to inadequate organisation and training, overselling or misapplication. These have been offset, however, by the many successful applications which with experience and perspective gained have made it an extraordinarily effective tool in product cost control and profit improvement.

Some authorities and companies include value engineering clauses in major contracts, and others are following suit.

More recently the Elstub Committee was commissioned by the Minister of Technology and the President of the Society of British Aerospace Companies to report on the Productivity of the National Aircraft Effort. It was found that the industry's value engineering practice was comparable with the best in the U.S.A. and it was also suggested that the Engineering Industry Training Board could play a part in encouraging more value engineering courses and in stimulating the entire engineering industry to make use of them.

Although the quotations introducing each section of this booklet are extracted from the report of the Elstub Committee, it is believed they equally apply to other forms of engineering.

TERMINOLOGY

Both the terms Value Analysis (VA) and Value Engineering (VE) are widely used.

Value Analysis is used in connection with the study of items of overhead expenditure and products already in existence.

Value Engineering is the study of designs and systems prior to the issue of final production drawings.

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SECTION ONE

WHAT CONTROLS COST?

"Not all the firms found it easy to quantify the savings achieved by value engineering, but the Sub-Committee concluded that wherever the activity has been determinedly organised and properly applied, it has produced a return of between five and ten times the cost of carrying it out."

What Controls Cost?

The purpose of value engineering is to help maintain or improve profitability in spite of increasing costs and competition.

Many factors affect profitability

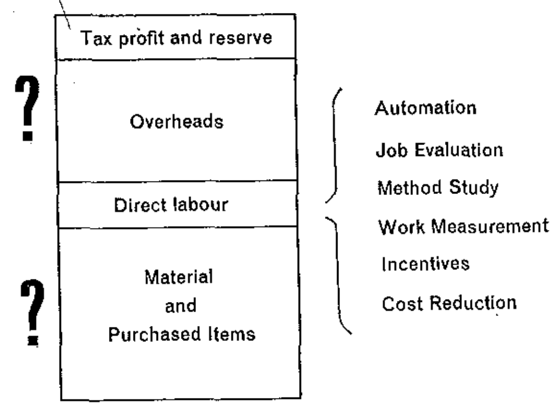
Whilst there are many factors which influence the profitability of an engineering company, the technical excellence, availability and price of its products are all of prime importance.

The product will be of value to both the customer and the supplier if the technical or functional requirements are provided at the right time and at an acceptable price, and if the cost of manufacture allows profit to be made.

EXISTING TECHNIQUES

Examination of the management techniques which are used in engineering for profit improvement indicates that the principal target has long been the cost of direct labour.

Direct labour is not the largest item of cost



Whilst it is important for labour costs to be controlled, materials and overheads each represent a larger proportion of the total cost and also justify intensive study and control.

In many companies the various procedures and methods used are already carefully scrutinised (by O & M, Work Study, etc.) to ensure they operate smoothly and efficiently. In addition, the specified materials and components are probably purchased at the most competitive prices.

Early decisions affect final costs

However, it will be recognised that in the engineering industry, as in many manufacturing industries, costs are controlled not only by the efficiency with which the methods are executed and the materials purchased, but by the *decisions* taken during marketing, research, development, design and detailing. A high proportion of product cost is generated in these stages by the choice of product specification, choice of design approach and the materials, dimensions, shapes, methods and finishes specified. Once drawings are produced, a cost path as well as a design path is established which can only be partially affected by the methods and techniques which are used subsequently.

THE REASONS FOR UNNECESSARY COST

Cost information

There is little doubt that engineers, designers and draughtsmen are well aware of the need to minimise cost, and in most instances they are anxious to receive and use better cost information. However, there are other reasons why unnecessary cost occurs in the products they are specifying.

User's needs

For example the needs of the user are not always clear. Where there is a lack of information, then it is inevitable that the exact requirements of the customer or user will be exceeded.

New processes

New lower cost products, processes and materials become available at a confusing rate, and quickly render existing design concepts obsolete.

Time

Many designs evolve over a period of years, and the lack of time which persists in most engineering organisations encourages these design approaches to be perpetuated even if in modified form. Clearly, whilst it is not practicable to question every design, if those areas of significantly high cost likely to be repeated in the future are not regularly reviewed, the amount of unnecessary cost contained in them will increase as the design approach, materials and methods used, become out of date.

Ideas

Lack of time also can lead to a lack of ideas and adoption of the first solution which will satisfy technical requirements, irrespective of its ultimate cost.

Wrong beliefs

Proposed solutions to problems and new ideas are frequently rejected because of erroneous but sincerely held beliefs. For example, a material can be dismissed as unsuitable or a tool cost assumed to be too high to justify a suggested change.

Good ideas are often discarded without proper consideration and examination of today's facts. (The use of a notched belt to drive the valve gear of an internal combustion engine has been considered and rejected many times as impracticable although today it is commonly used.)

Emergencies

Most companies are faced with emergency measures at some time when a material, machine or supplier readily available is accepted as a temporary solution regardless of cost and continues in use after the emergency has been overcome.

Changed Circumstances

Circumstances can also change. The fact that a feature is no longer required is frequently not known or overlooked. Costs are incurred in providing these features which are due to historical requirements of test, development, manufacture or procurement, but which are no longer relevant.

Attitudes

In all aspects of life, mental attitudes affect the speed at which change can take place. Fear of failure resulting in a loss of status or ridicule, and a subconscious reaction to change in favour of well-established practices will restrain people from thinking and from proposing or accepting new ideas. These restraints in the creative ability latent within a company control the rate of innovation, profitability and sales.

These reasons for unnecessary cost probably apply to most aspects of human activity. They will and do occur in well-organised companies having skilled management and technical staff, and do not necessarily reflect on any one individual or group of individuals.

CONCLUSIONS

These arguments suggest:—

1. That the decisions made prior to production/process planning largely control works cost.
2. That better cost and other information should be provided as a service during the design process.
3. That the cost problem cannot be solved by any one discipline and that effective corporate team work and communications are necessary for its control.

Clearly, a procedure which will meet these requirements must provide cost information and other facts, must question everything of significant cost and must encourage new ideas to be put forward and considered in a positive way by all those involved with the product and its cost.

Of course, there is nothing new in the suggestion of people of differing disciplines, meeting to examine and reduce the cost of the products and systems around them, but cost reduction alone is likely to be insufficient in the future. Experience has shown that technical and marketing requirements (functions) must be defined and examined *at the same time* as cost. In addition, if the time of the team or group involved is not to be wasted, systematic procedures and disciplines are necessary which will isolate significant areas of cost or poor value and concentrate attention upon them in such a way that lower cost alternatives can be generated, evaluated and put into effect quickly and without excessive risk.

Value engineering is a convenient name to identify the systematic disciplines and procedures which can effectively provide this form of product cost control.

SECTION TWO

VALUE ENGINEERING PROCEDURE

"It cannot be carried out in a haphazard manner; it is essentially a team effort involving carefully selected representatives from the main departments of a company who have been thoroughly trained in the basic value engineering techniques."

Value Engineering Procedure

THE MEANING OF VALUE

What has been stated implies that even in very advanced and competent companies, unnecessary costs are being generated. Further, that if we are to remedy this condition we must make a different approach in which both the functions and their costs are considered together to provide an overall improvement in value with benefits to both the user and the supplier of the product.

What is VALUE? Basically, it is a form of measurement which most people use every day when they are spending their own money. For most things we buy, we make comparisons between alternatives and relate what we get to what we pay. What we get embodies FUNCTIONS which can be specified in terms of technical performance, reliability, life, appearance, maintainability, safety, weight, etc. Value is measured by the relationship of these functions to the cost of providing them.

In value engineering practice, areas of poor value are identified by analysis and studied at a very early stage in the design cycle, and at various stages right through manufacture to distribution and operation. At each stage the *overall* effect of any change is considered.

Usually, this will result in a reduced cost, an improvement in the effectiveness of the functions, or both. In some instances the cost may be *increased* if this leads to changes in the product which enhance its value to the user for which he may pay more or which may lead to increased sales turnover; improved delivery, for example.

Quite frequently the *cost* of a design or item is confused with its value. It does not follow that this cost is justified because of the materials and methods actually employed. Only when we consider the functions performed can we establish the true value.

> For example, during the study of a machine gear box, the total cost of the elements which contributed to the function "provide lubrication" was found on analysis to represent 23% of the total cost.
>
> The team, comprising design, production, purchasing, estimating and sales staff, familiar with the product, considered this to be too high a proportion, even though the materials, methods and labour times were reasonable for the specified design. This awareness of poor relative value motivated the team to re-think the problem using value engineering procedures. They developed new ideas and improvements resulting in a new design which effectively performed the function for 11% of the new total cost.

THE ELEMENTS OF VALUE ENGINEERING

Initially then, value engineering does not question the manufacturing methods, although these are ultimately considered. Instead it questions the concept—the means by which the necessary functions are performed. For example not "how do we best machine a radius" but "what is the function of the radius".

Function must be questioned

In different ways it asks these basic questions:—

What is it?

What does it do?

What does it cost?

What else will do the job?

What will that cost?

To illustrate this difference in approach another example can be quoted from the shipbuilding industry where the cost of decking on a particular ship had been subjected to previous cost-reduction investigations. These had yielded changes which resulted predominantly in improvements to the manufacturing methods used.

During a recent *value engineering* study, detailed analysis indicated an area of high cost previously accepted as necessary, namely the curvature of the deck itself.

When the *function* of this feature was questioned it was discovered that the shape was a solution resulting from ancient limitations and that its functions could be performed today by quite different means. This permitted a flat deck to be used making substantial savings in constructional costs throughout the cross section of the ship.

The questioning of function is one part of value engineering. What are the essential elements?

Leaving to one side the organisation and direction of the overall value programme, which is explained in subsequent sections, the elements of value engineering can be adequately explained under six headings.

Selection
Information
Analysis
Teamwork
Procedure
Attitudes

Selection

Not every product is suitable

Value engineering need not be applied to everything. The products, assemblies, components and systems selected for study should result from a careful analysis of the costs, quantities produced, future sales life and technical complexity. The areas selected are those which should yield the greatest results for the least time and effort and with the minimum risk.

Information

Collation of facts important Difficulty is experienced in most companies in collecting adequate information on the subjects to be studied. Information is, of course, an essential ingredient and time must be allowed for the relevant costs, specifications and requirements to be collected, analysed and prepared ready for the use of the designer or team. This is usually the task of a skilled value engineer or co-ordinator, who is frequently the only full-time person involved.

Analysis

The basic forms of analysis The analysis of information takes two basic forms in value engineering: Cost Analysis and Functional Analysis. These two forms are used extensively either separately or in combination (Function/Cost Analysis) to select items for study, and during the course of the studies, to indicate significant cost areas in the product or assembly.

COST ANALYSIS is the most usual preliminary to selecting and fixing the scope of a study. The individual costs of the component parts of the subject are tabulated to an appropriate degree of detail. From such an analysis of an assembly or system the areas or individual items which appear to be of disproportionate cost and offer potential for study and improvement, can be selected.

Parts or assemblies	cost £
banjo assembly	1·07
valve body	6·62
spring	0·39
diaphragm assembly	2·14
cover	2·24
lug	0·10
nuts, bolts and washers	2·34
assembly cost	4·58
total	£19·48

Fig. 1. Cost analysis of the aircraft air valve shown in fig. 2.

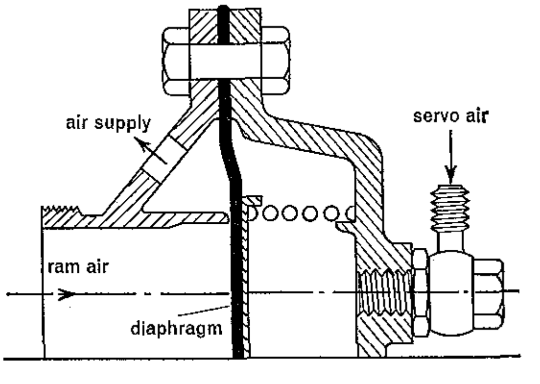


Fig. 2

Lucid definitions desirable FUNCTIONAL ANALYSIS requires accurate definition of the functions performed by the subject under investigation. Properly to understand the subject, the definition of functions must be lucid and precise. So for this reason it is considered desirable to describe a function by two words, a verb and a noun. For example, a pencil "makes mark" or a bolt may "join parts".

Functions for a more complex item are illustrated in the function/cost analysis charts on page 13, which also relate to Fig. 2.

FUNCTION/COST ANALYSIS is one of the most potent weapons in value engineering's armoury. It is particularly valuable in the study of complex

parts	stop air	sense ram air	sense servo air	sense cabin air	connect parts	provide mounting	resist corrosion	provide support	provide interchangeability	no function	£ total cost	%
banjo assembly			·2		·4				·47		1·07	5·5
valve body	·4	1·0			2·82	·8	·2	·8		·6	6·62	34·0
spring										·39	·39	2·0
diaphragm assembly.	·6	·1	·1	·1	·94		·2	·1			2·14	11·0
cover			·4		1·2	·1	·1	·34	·1		2·24	11·5
lug										·1	·1	·5
nuts, bolts and washers					2·14		·1		·1		2·34	12·0
assembly					4·58						4·58	23·5
total	1·0	1·1	·7	·1	12·08	·9	·6	1·24	·67	1·09	19·48	100·0
% total	5·1	5·7	3·4	·5	62·0	4·6	3·1	6·4	3·4	5·6		
high or low					H					H		

Fig. 3. Completed function/cost analysis matrix for the air valve shown in fig. 2. The breakdown of the total cost features in the second column from the right.

parts	stop air	sense ram air	serve servo air	sense cabin air	connect parts	provide mounting	resist corrosion	provide seal	provide interchangeability	provide testing	£ total cost	%
cover and connection	·15	·25	·50	·10	·25	·30		·15	·06		1·76	25·5
body assembly	·15	·20	·25	·45	·45	·40		·25	·03		2·18	31·5
diaphragm assembly	·15	·10	·25	·20	·25	·10		·20	·03		1·28	18·5
valve assembly	·05		·05	·05	·15			·31	·05		·66	9·5
fasteners, nut bolts etc					1·04						1·04	15·0
total	·50	·55	1·05	·80	2·14	·80		·91	·17		6·92	100·0
% total	7·2	7·9	15·1	11·6	30·9	11·6		13·2	2·5			
high or low					H							

Fig. 4 Results of a function/cost analysis carried out on the redesigned air valve.

Poor value is indicated by analysis

subjects as an aid to the designer and quite separately as a means of locating areas of poor value in the overheads sector and in some administrative procedures.

Function/cost analysis requires proper training and practice, but it can briefly be explained as follows:—

Each part of a system may contribute to more than one function, or looked at another way, each function will have a number of parts contributing to its cost. For example, a gauge body may "withstand pressure" and "resist corrosion" as well as contribute, with other parts, to the functions "permit servicing" and "connect pipes". It is possible, therefore, to estimate how much of the *cost* of each part contributes to each function.

The illustration (Fig. 3) shows how this analysis is made in practice with the aid of a matrix. It will be seen that the components are listed vertically and the functions horizontally. The estimated or known cost of each part or sub-assembly is shown in the righthand vertical column.

Informed but approximate estimates are then made of how the cost of each item can be allocated to the functions to which it contributes.

The total cost of each function is found by adding together the cost elements in each vertical column. Each total is usually converted to a percentage of the total cost.

In this way a comprehensive cost and function/cost analysis is provided for the designer or team to make comparisons and to decide if the cost of any of the functions is disproportionate.

In the example Fig. 3, the function/cost analysis showed that several elements were redundant. The unit was redesigned, using value engineering procedures, particular attention being given to the "connect parts" function.

The unit cost was reduced from £19 to £7. (See Fig. 4).

The method also applies to systems and processes

Analysis of this type has two main purposes. Firstly, to provide a complete understanding of the problem, since in making the analysis it is necessary to identify the purpose served by each element of cost. Secondly, to indicate significant areas of poor value for subsequent consideration. In the case of the example illustrated, a product formed the subject for analysis, but the basic technique is equally applicable to the analysis of systems and processes as is shown in the following example.

cost area	interpret order	obtain information	ascertain stocks	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			

Fig. 5 Function/cost analysis—Sales Export Department.

Teamwork

Not a substitute

The element of teamwork in value engineering is not intended as a substitute for individual skills. However, there are clearly many occasions when the requirements and knowledge of different disciplines should be considered in parallel at an early stage in the design or re-design. A team may be used formally and meet at regular intervals, as is often the case when examining existing products, or less formally and as circumstances demand when controlling the cost of a new scheme or product.

Combining skills improves results

The effectiveness of value engineering teamwork results from using the people who are normally concerned with the product and concentrating their collective abilities and experience in a free but orderly manner on the selected problem and its information. The composition of a typical team engaged on a new engineering design project might be:—

Team composition

Research/Development Engineer.
Design Engineer.
Production/Methods Engineer.
Cost Estimator.
Value Engineering Co-ordinator.
Marketing, Finance, Purchasing, Quality Control, Service and other specialists might be co-opted as required to deal with specific problems, as may be a customer or supplier. It should also be said that a team member who knows little or nothing of the product but is a creative person can be an advantage to the team.

The composition of each team will differ according to the nature of the project under study. The members should be of sufficient seniority to be able to speak authoritatively for their respective departments and see that any actions agreed to are carried out.

Part of everyday work

They will not be engaged full time on the project, but will integrate the work with their normal duties. They would be responsible for making investigations between meetings, of any points arising which affect their specialist fields.

Co-ordinator leads the way

It is probable that most organisations will appoint a value engineer or a small group to manage and co-ordinate the various value activities. The co-ordinator is a very important member of each team. He will be responsible for guiding and organising the work of the team, for collecting and analysing information, running some meetings, progressing the work allocated to team members and maintaining proper controls and records. It is his job to see that results are achieved. One Italian company calls him an "Animator"!

Procedures

Common procedure saves time

Many meetings held in companies are one-sided or time wasting because the participants are not usually trained in, or even aware of, procedures for the corporate handling of problems. The procedures used in value engineering have been devised with a view to controlling and concentrating the scarce resources in skills and knowledge, in the most effective manner. On each selected project the team follows six basic steps or phases:

1. Information
2. Speculation
3. Evaluation
4. Investigation and Planning
5. Implementation
6. Summary

1. Information

In this phase the scope of the study is established and the necessary costs and other information are collected, analysed and prepared by the co-ordinator, often in conjunction with the engineer or designer. It is also during this phase that the necessary functions are described and the areas of high cost or poor value identified by cost analysis and function/cost analysis techniques.

2. Speculation

At this point the team is selected and made familiar with the problem and the result of the analysis. Agreement is reached on the areas to be studied and the approach to be used. Each member is allowed to speculate freely and to use his creative ability to generate alternative ideas for performing the required function(s) at lower cost.

Judgement is suspended; ridicule, criticism or evaluation is not permitted *until the supply of creative ideas is exhausted.* Unusual ideas often prove to be the most valuable and encouragement is given to the team members to use their imagination, so that extreme ideas are put forward and recorded.

During training, team members are made aware of the disadvantages of knowing that "something cannot be done", also that ideas are not the privilege of any particular group or skill.

3. Evaluation

When all ideas have been recorded, each is reviewed in turn and briefly explained. An assessment of the relative cost of each is made on the *assumption, at this stage, that the idea is practicable.* Other factors, such as weight, reliability, proximity to patent, are sometimes included in this first part of the evaluation, but cost is mostly used. The purpose of this preliminary cost rating is to establish the sequence by which the various ideas are to be studied by the team in their effort to find the lowest cost means which will perform the required functions satisfactorily.

The team then make a systematic assessment of the overall advantages and disadvantages of each low cost idea. Attempts are made to overcome or minimise the disadvantages and any action to do this is recorded. Having taken both cost and function into consideration, the lower cost solutions which are best from all points of view, are selected for further development.

4. Investigation and Planning

The selected idea or ideas will be thoroughly investigated by the design engineer, supported by the team members and the co-ordinator who provide test results, cost estimates, supporting information, quotations, samples, etc. Following management approval (if required) the implementation of the proposal will be planned.

5. IMPLEMENTATION

This step will depend on the nature of the proposal. In the case of an existing product, assembly or component, the value engineering co-ordinator will progress the introduction of the idea through normal channels and, if necessary, arrange for further team meetings to deal with any problems which arise.

For new products, the designer or draughtsman will be responsible for incorporating the changes into the new design in the normal way.

6. SUMMARY

The outcome in terms of performance and cost will be prepared and circulated if necessary. Information collected during the study will be examined with a view to extracting useful cost and other data for future reference. A systematically maintained record of value engineering project data is of great assistance in reducing the work load of future studies, and also for reference purposes by design and estimating departments.

These steps provide an easily understood common procedure for handling problems which is readily accepted by engineering staff. The collection and analysis of information prior to the meeting, the separation of evaluation and criticism from the speculation or ideas stage, and the use of cost as one of the factors in selecting the alternatives, all provide disciplines which are easy to understand and make the team effective

Attitudes

This is the last of the essential elements which were listed but it is not the least important.

Team work engenders confidence

Reference has been made to the various causes of unnecessary cost and to the fact that these are mainly the result of negative attitudes and fears. One of the advantages of the team approach and the procedures mentioned above is that it helps to break down many of the fears and inhibitions which prevent so many people from thinking creatively and making their best contribution. The team approach makes everyone feel that they are *involved* in the business, and by coming into contact (sometimes in larger organisations, for the first time) with people of different skills, experience and point of view, feel that an enrichment of their daily work has taken place. The positive attitudes which proper training and guidance can bring about at the operating level must be a reflection of similar attitudes from senior management.

These six elements have been used to briefly illustrate the basic principles or value engineering. There are, of course, many other details which require explanation for those in the actual studies.

SECTION THREE

MANAGEMENT'S ROLE

"The Sub-Committee found that the status of the value engineering organisation in a company, in particular the level to which it reported, seemed to influence the proportion of suggested changes . . . ."

Management's Role

SUPPORT AND DIRECTION

Initial direction must come from the top

The support and direction of directors and senior managers is essential for the satisfactory introduction and operation of a value engineering programme. This support should not only be given, it must be seen to be given. Value engineering means change—change in methods of working, in thinking and in the procedures used. People look for a lead and respond to instruction, hence it is necessary for management to demonstrate its backing by continuing involvement in the control of the overall programme.

IMPLICATIONS

Value engineering should be a company policy

The management team must fully understand the implications of the introduction of value engineering into their business. This means that it should seek explanation of the technique and its potential, together with some specialist advice on the way in which it may best be introduced and developed. It should then be possible for them to determine the long term objectives, the areas of initial application and to produce an outline policy and programme.

RESOURCES

Investment necessary but remunerative

Management must be prepared to make a small but adequate investment for the high returns which are obtainable from value engineering. They will need to sanction the allocation of some personnel and other resources to service the operation, and introduce certain minor administrative changes. For example, it is possible that in the long term, the existing cost estimating facilities would be inadequate to supply the information vital to an improved product cost control system. Also, a competent person will be necessary to manage the value engineering programme to co-ordinate the day-to-day activities and arrange the supply of information and data.

STEERING COMMITTEE

Direction of VE team by Steering Committee

It is possible for the value engineering programme to be the direct responsibility of the managing director or general manager; or of a divisional or departmental head. This will depend very much on the company. The first two alternatives work satisfactorily in many small companies, but another solution lies in using the existing management team as a Steering Committee to control the corporate programme. This committee would have a technical director or general manager as chairman and the heads of the main departments as members. Initially, it would meet at monthly or six-weekly intervals, or, alternatively, include value engineering as an item at other regular management meetings. The total amount of time required will not normally exceed twenty hours in each year.

The collective purpose of the committee would be to review progress and to direct and guide the value engineering programme to achieve greater profitability in the short and long term.

In detail, they would be responsible for the following:—

To agree on objectives and the overall plan

To approve and authorise studies and their sequence

To allocate personnel

To sanction expenditure on capital and other items

To approve training of personnel

To examine results regularly

To take corrective action in the event of any difficulties affecting the implementation of these results.

SECTION FOUR

VALUE ENGINEERING PROGRAMMES

"We recommend that value engineering should be practised by all companies in the aircraft industry and also by their suppliers through all stages of engineering from concept to development, manufacture and in-service operation. The earlier it is applied, of course, the better, so that re-design, re-development and re-tooling are kept to a minimum."

Value Engineering Programmes

There is ample evidence to suggest that most engineering companies can achieve a substantial reduction in annual expenditure, by introducing a controlled value engineering programme, or where some form of programme exists, by strengthening it, and enlarging its scope.
A comprehensive programme would probably be aimed at the following areas.

VALUE ENGINEERING—NEW PRODUCTS

1. NEW SCHEMES: Progressive value studies of all new major schemes and designs.

2. FAMILY GROUPS: Value studies of existing typical design approaches, standards and specifications likely to be incorporated in future new designs or contracts.

3. COMPARATIVE COST DATA: Preparation of comparative cost information, probably in handbook form, for day-to-day use by design and other personnel.
Examples follow, see page 25.

VALUE ANALYSIS—EXISTING PRODUCTS & SYSTEMS

4. EXISTING PRODUCTS: Value studies of selected existing products, assemblies, components and methods, to provide short term savings and other improvements.

5. OVERHEADS: Value studies of selected overhead cost areas such as patterns, tooling, inspection, power, packaging, maintenance and some office procedures.

6. PURCHASING: Value studies of supplied items and materials. The possible inclusion of value engineering clauses in some contracts placed with subcontractors.

The exact requirements for each of these areas and the degree to which each is developed will depend on the individual company and its business.

Starting a Programme

Many companies commence by studying a few existing products to gain experience and confidence and extend the work to new designs in due course. Other companies have considered it worthless to change existing products when these are of a "one-off" and highly technical nature, since this would involve considerable expenditure, requalification and risk.

Clearly, each company must decide its own programme, and the rate at which it is introduced.

No two companies alike

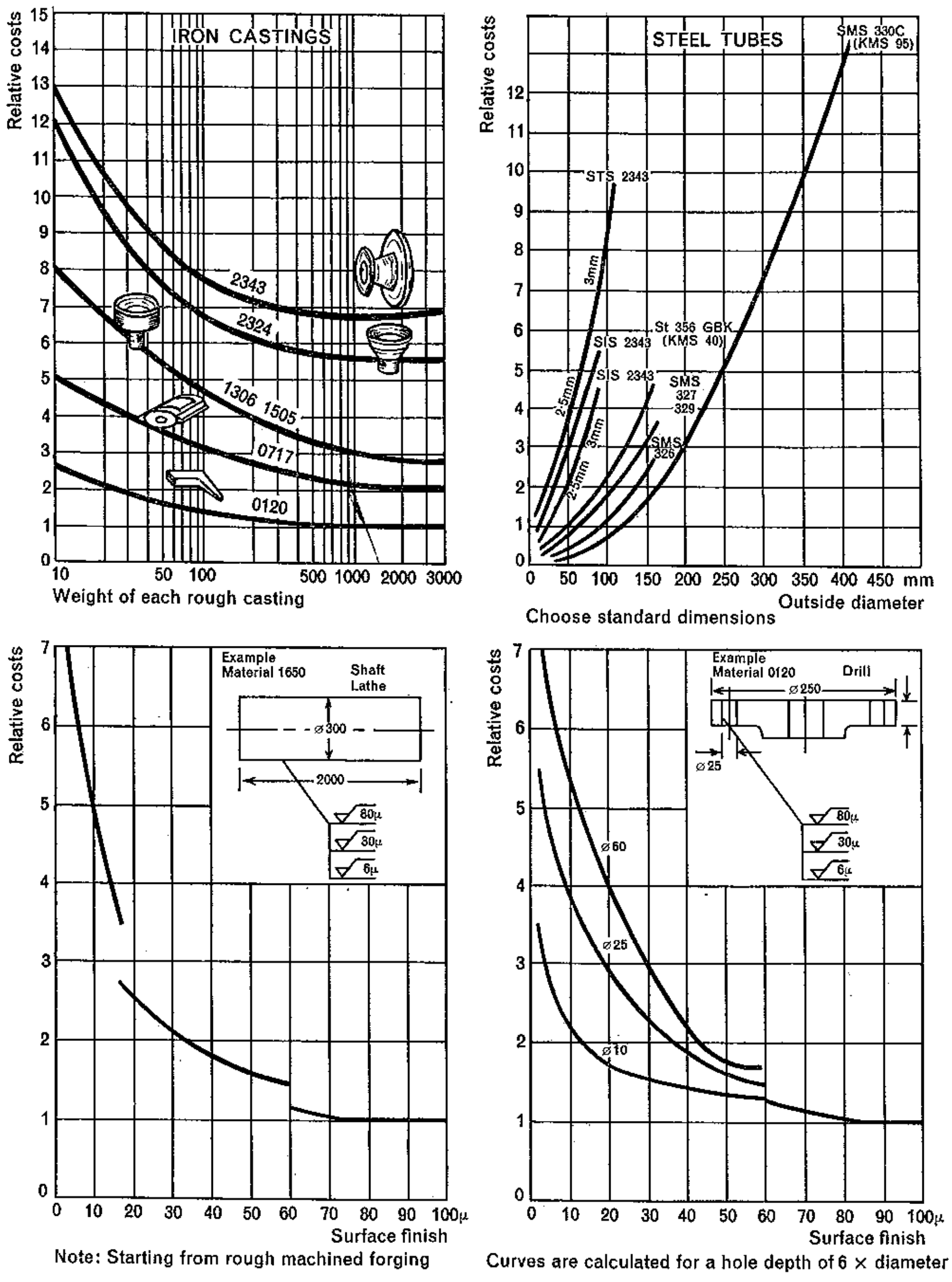


Fig. 6 Examples of cost data for use by engineers.

In the long term the objective should be to integrate value work into the normal design procedures so that, as far as possible, products are "right first time". Too timorous an approach will result in a small group who permanently "re-think" existing products.

Cost avoidance is the main objective

PILOT STUDIES

Some companies have chosen to begin the work with a sample "Pilot Study". This requires all the ingredients of a larger and subsequent programme:

Management involvement and control
Expenditure analysis and selection of projects
Collection and analysis of associated information
Team selection and training
Team meetings
Summary of results

However, the study is in miniature and usually runs for a limited period of 3–4 months. It permits management to gain experience of the problems as well as the conviction and opinions of their technical staff before becoming committed to a larger and permanent programme.

In a recent pilot study in an engineering company, the technical staff involved numbered 25, and represented development, design, drawing office, production, sales, purchasing, estimating and costing departments. They worked in teams of about five and each team was asked to comment on the project work undertaken and the possible future use of value engineering in the company. Their comments are summarised below:

It is possible to reduce cost without affecting the performance and reliability of the product. In some instances these were improved. (Overall reduction of cost of production on five random projects was 11%.)

Teamwork with members of other departments had created a better understanding of how to handle common problems and had improved communications, cost consciousness and attitudes. As one team put it, the first reaction to a new idea had changed from "It can't be done" to "What will it cost?"

The cost of change following studies of existing products, particularly those of low volume, might not be economic. Value engineering should be introduced at an early stage in the design of new products.

All levels should have an understanding of value engineering procedures.

Value engineering should be given a clear directive and should receive continuing support from senior management in order to maintain the interest and enthusiasm of those directly involved.

Validity of value engineering generally accepted

Such views are common. Given proper training and guidance in the early stages, there is little difficulty in convincing the majority of technical staff of the validity of value engineering procedures and that the overall effect will be a saving in time as well as cost. Most engineers are deeply concerned with the future success of the company, with which they associate their own personal fulfilment and security. The concern expressed in the final comment is common and implies both their misgivings and needs.

THE MAIN REQUIREMENTS

Whichever way a programme is introduced and whichever product or overhead cost areas are tackled initially, there are common requirements.

1. All of the senior levels of direction and management should understand the broad purpose and procedures of value engineering.
2. They should carefully examine the ways it can best help their business and if they decide to go ahead they should determine a basic plan of objectives, a programme to achieve these objectives and the ways in which the results are to be measured.
3. The product range and other expenses should be carefully analysed to select the most suitable areas for study in both the short and the long term.
4. A suitable experienced co-ordinator (or co-ordinating group) should be appointed to manage and co-ordinate the work. A full-time co-ordinator is preferable, although in small companies he may only be justified on a part-time basis.
5. Staff from all levels, who will be involved with the studies directly and indirectly, should receive formal training or appreciation courses.
6. In time, if not initially, the programme should be aimed more at avoiding unnecessary cost in new products than in reducing costs in the existing. (Investigations of existing products are restricted because of the need to accept basic design approaches and the cost and risk of change and requalification, which is influenced by existing stock levels, tooling, spares requirements, interchangeability, existing catalogues and licence arrangements.)
7. Progress and results should be reviewed regularly and a report made to and acted upon by the management.

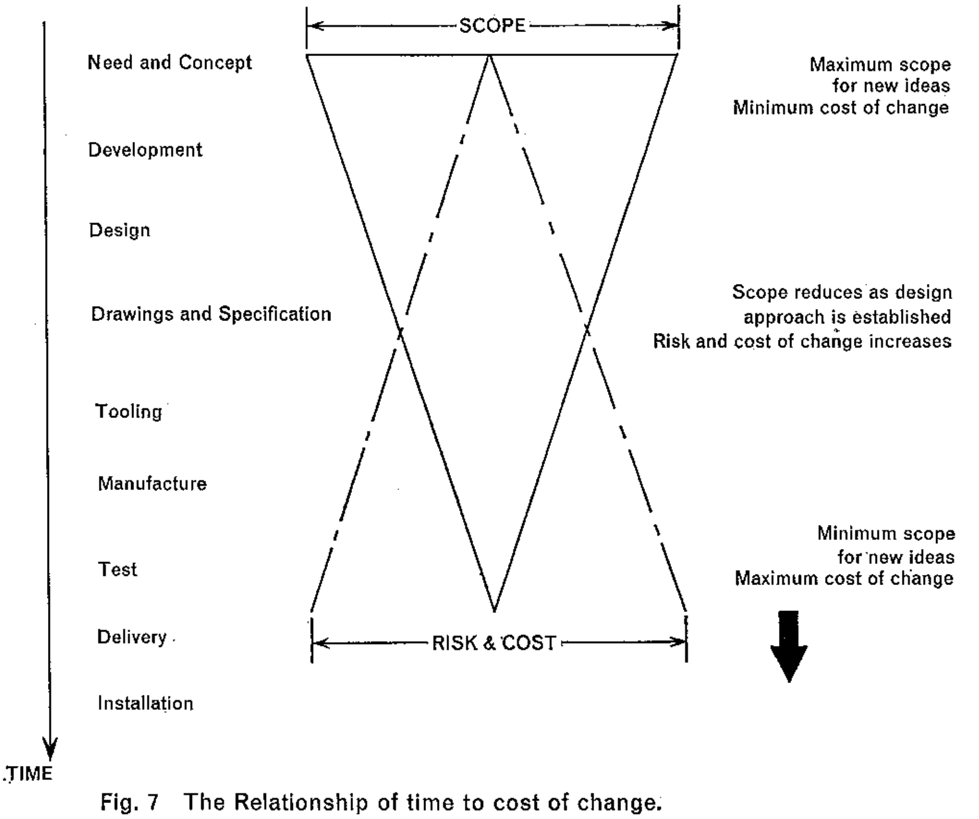


Fig. 7 The Relationship of time to cost of change.

8. If value engineering is promoted as part of corporate profit improvement effort, it should be combined with certain other schemes and practices which have similar objectives. For example, some of the ideas expressed in Company Suggestion Schemes can be channelled more successfully through a value engineering team—which includes the originator—than is probable through some of the usual channels.

CONCLUSIONS

Results of value engineering

In conclusion, value engineering is not a gimmick nor is it a technique which should be handled within the confines of any one department. It is a company-wide activity which can produce changes in attitudes and provide a way of handling significant problems effectively. It encourages people to think and use their creative abilities, and to effectively communicate with each other to improve their overall effectiveness and the profitability of the Company.

Throughout, it introduces significant cost information in a usable form at the time it will most influence decisions and ultimate cost. Value engineering is justified by this factor alone.

Fundamentally there is nothing new in value engineering. Existing knowledge and procedures have been put together to provide a more systematic and disciplined approach than hitherto.

It would be foolish to suggest that these requirements have not been recognised and met to an extent by most companies. The point is, in a dynamic situation in which both cost and competition will continue to increase, can the present methods of cost control remain as they are or are they capable of further improvement?

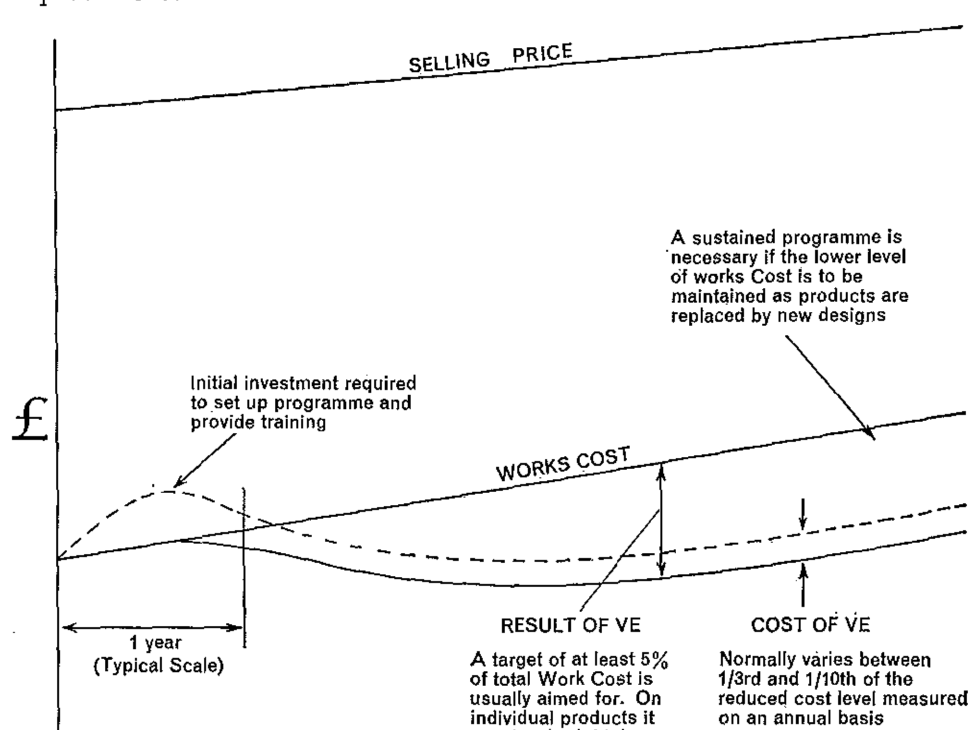


Fig. 8 The effect of value engineering on works cost.

SECTION FIVE

TRAINING REQUIREMENTS

"When they first adopt the techniques, companies need a formal value engineering organisation to arrange training for all their staff who are in a position to influence cost. When sufficient people have been trained, however, it may be preferable to disband the formal organisation and to depend on the individuals to apply the discipline in the course of their normal work, supplementing this by ad hoc groups to look at particular problems as they arise."

Training Requirements

REASONS FOR TRAINING

Training is important for two reasons:

To convey the basic procedures and techniques and to give practice in the use of them.

To convey an understanding of the philosophy of value engineering and to gain the participants' conviction of its applicability in the circumstances peculiar to their own company.

FORMS OF TRAINING

Appreciation Courses

Appreciation courses vary in duration from two or three hours to one day, and differ in content according to the audience.

MANAGEMENT APPRECIATION

Usually of three or four hours during which the broad philosophy, procedures and implications and the various organisational patterns are explained and discussed.

MIDDLE MANAGEMENT, TECHNICAL AND ADMINISTRATIVE STAFF

Usually of a day's duration with a more formal and detailed explanation of the philosophy and procedures. Reference is made to the organisational requirements but time is given to practical group work on a pre-selected project.

STUDENTS, CRAFTSMEN AND JUNIOR STAFF

These may be of one or two days' duration, but can also take the form of a series of lectures over a period, as a part of normal training.

Formal Training

Longer courses are desirable for those who will be involved directly in their day-to-day work or as formal team members. These courses are usually of four or five days' duration, and are available as either external or in-plant courses. External courses provide the advantage of mixing with other companies and seeing a wide range of problems and application of the procedures.

Many organisations such as consultants, colleges of technology and technical colleges provide courses of training.

In-plant courses are more effective once a programme is under way and permit the participants readily to obtain any additional information which may be required for the practical work which is undertaken.

The number of participants can vary up to a maximum of about 35 at one time. The participants are usually drawn from different disciplines with approximately a half from the engineering departments—R & D, design and drawing office—and others from production, manufacturing, purchasing, estimating, marketing, sales, quality control, industrial engineering or other departments, as may be appropriate.

These courses normally have three phases:

1. An explanation of the philosophy and procedures.
2. Practical work by teams of four or five—representing different skills—on "live" projects chosen from production or from new products and schemes. Each team is expected to summarise the results of its investigation and to make a short presentation of their findings to the other groups during the course. Most teams locate potential savings greatly in excess of the total cost incurred by their attendance at the course.
3. A brief discussion of the problems and considerations in organising and implementing value engineering procedures.

Courses of this type are most effective if the projects worked on are carefully chosen and justify continued team study soon after the formal training. In this way training becomes an integral part of the programme and can be used to launch worthwhile product studies.

It is, of course, preferable to commence a series of courses of this type when the broad organisational details of the value engineering programme have been established and the services of a co-ordinator or co-ordinating group are available to ensure proper continuity.

Co-ordinator and Team Training

It is obvious that the co-ordinator has an important part to play in achieving success.

He should receive training in advance of other staff, preferably together with two or three members of key departments such as design, production engineering and purchasing who will provide support during the early phases.

In addition, it is worthwhile for the co-ordinator to visit a few other companies to observe their team procedures, and to examine the various forms of value engineering organisation and practice.

Co-ordinators management potential

The co-ordinator must be clearly a person of some management ability and standing as well as having analytical and technicial skills. The introductory stages of value engineering are probably the most difficult and maturity, flexibility and a broad outlook are essential. Co-ordinators are often chosen because of their senior management potential. Establishing an effective programme is a task which can provide a challenge to him and at the same time develop his ability through an understanding of the different disciplines and company procedures which the work provides.

An experienced man may be recruited from outside the company, but it is equally satisfactory to appoint and train someone who is familiar with the company and its products.

In the latter case particularly, the co-ordinator as well as the teams will benefit from the guidance and experience of a specialist organisation in the early stages of establishing organisational procedures and documentation, providing formal training and establishing adequate standards of team approach and behaviour.

In this situation, the role of the consultant is a diminishing one as the co-ordinator gains experience and confidence. Ultimately the co-ordinator should be able to manage and develop the entire activity himself, taking specialist advice and assistance if required.

REFERENCES

Value Analysis. Seminar Notes. British Productivity Council, Vintry House, Queen Street Place, London, E.C.4.

16 Case Studies in Value Analysis. British Productivity Council.

Techniques of Value Analysis and Value Engineering. L. D. Miles, McGraw Hill.

Value Analysis. W. L. Gage, McGraw Hill.

Value Analysis—The Rewarding Infection. J. F. A. Gibson, Pergamon Press.

Value Engineering. R. S. Mandelkorn, Chapman & Hall Limited.

Value Engineering in Manufacturing. American Society of Tool and Manufacturing Engineerings. Prentice Hall Inc.

Value Engineering—A Challenge to Management. L. W. Crum, Royal Aeronautical Society, Management Studies Group, London.

Cost Reduction. The Institute of Cost and Works Accountants, 63 Portland Place, London, W.1.

An Introduction to Value Analysis. British Institute of Management.

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