Vol: 1 No: 5 February 1969

VALUE ENGINEERING

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Pergamon Press

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is to encourage the wider use of value analysis/engineering techniques throughout industry.

Value Engineering

provides a link between those who are practising and studying the subject all over the world.

It is the POLICY of the journal

to contain information which promotes the wider and more efficient application of value analysis/engineering methods.

Its ABSTRACTING SERVICE

will draw attention in a conveniently summarised form to the main publications on the subject throughout the world.

* * *

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Titles sometimes do not cover all the aspects of the subject referred to in an article, book review or abstract, and in order to assist readers with their information retrieval problem key-words have been placed at the top of each item in the journal.

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In this issue:

Value Engineering Cost Effectiveness . . . A Tool for the Designer too
A. J. Dell'Isola
Director of the Value Engineering Division, Louis C. Kingscott & Associates Inc.

What is cost effectiveness and how does it affect the designer? The breakdown of total costs is illustrated and the eight factors to be taken into account by designers in selecting their materials are then considered.

Information Processing and New Ideas – Lateral and Vertical Thinking
E. de Bono
Department of Investigative Medicine, University of Cambridge

The author differentiates between lateral and vertical thinking. He believes that education only teaches vertical thinking and goes on to discuss the nature of vertical thinking – how the brain operates and how creative behaviour may be increased. Lateral thinking is then described and the four main categories of this type of thinking are set out.

S.P.C.L. – A New Approach to Value Engineering
D. F. Spear
Chief Value Engineer, Standard Telephones and Cables Ltd.

Single Product Cost Leadership is described as applied to Standard Telephones and Cables Ltd. Several value engineers are concerned that the ideas and methods of Value Engineering have developed so little in the twenty years since it was initiated and the nine-step procedure adopted by STC is outlined. In noting that STC will soon have reached a savings of £1 million readers will realise the intense practical nature of what the author has to say.

Organising the V.E.-Effort in a Company
J. Burnside
Director and Chief Consultant, Value Improvement Ltd.

In the last of three articles on the problems of establishing V.E. in a company, the author deals with records – Historical, Statistical, Analytical and Product Report Records. A moving period chart is advocated showing savings, expenditure and investment, but also allowing for the introduction of new products and the phasing out of old ones.

A New Breed . . . The Value Managers
Lt.-Colonel Bert J. Decker
Director of Project 3000, Millard Fillmore College, State University of New York at Buffalo

All history has taught us is that we cannot behave very scientifically about anything until we can measure it. For the first time in history, just over twenty-one years ago, man advantageously defined value in measurable, demonstrable and verifiable terms and Value Managers were born.

Value Engineering – Dynamic Tool for Profit Planning
George H. Fridholm
Chairman of George Fridholm Associates

Indication is given of how vital it is for businesses to keep abreast of the latest 'tools' for increasing their profits. Value Engineering is one such 'tool' and, as well as improving the profits, it is useful for training staff; it aids employees to see project functions in relation to each other within the project; to see the interrelationships of departments in a company; and to appreciate the importance of knowing costs.

Factors Underlying Successful Value Engineering
Brian F. Blundell
Chief Designer, Rotofinish Group of Companies

It is stressed that the correct approach to V.E. is fundamental and that full consideration must be given to the human reactions of all who are touched by the project. The author emphasises how much the success of the project depends on the value engineer's objectivity and he then discusses lateral and vertical relationships, before recommending the art of listening be cultivated by value engineers.

An Application of Value Analysis to Building
Nigel Pearson
Work Study Officer, Mitchell Construction Co. Ltd.

This article discusses those areas of building in which the principles of Value Analysis may, with profit, be applied. The author stresses V.A. as applied to the service aspects – on the site processes – and goes on to discuss problems arising in connection with the allocation of resources to which V.A. questioning techniques can be applied.

Developing and Organising an Effective Value Engineering Programme—Part 1: The Fundamentals of V.E.
B. G. Matossian
Founder of B. G. Matossian and Associates

In the first of three articles on the development and organisation of a V.E. programme, the author draws attention to the fact that 95 per cent of management techniques deal with the activities which account for only half the turnover of a business. The remaining 5 per cent of techniques (which include V.E.) place greater emphasis on materials and components which make up the other half of turnover. Considering that one half is catered for so effectively it is in the area of materials that there is room for the biggest economies to be made.

CHECKLISTS

Cost Reduction Program Checklist
V.E. Workshop Seminar Checklist

BOOK REVIEWS

The Mechanical Behaviour of Engineering Materials (Biggs, W. D.)
How to Launch a New Product (Leduc, R.)
Selection of Materials and Design (Wolff, P., Kennedy, A.; Inglis, N., Broom, T. and Arrol, W.)
A Programmed Introduction to Critical Path Methods (Cambridge Consultants (Training) Ltd.)
A Simple Introduction to Capital Expenditure Decisions (Garbutt, D.)
How to Get the Better of Business (Webster, E.)
Left Luggage – From Marx to Wilson (Parkinson, C. Northcote)
Business Cycles and Manufacturers' Short-Term Production Decisions (Moriguchi, C.)
Planning your Business (Prepared by Irish Management Institute and Advisory Service of Irish National Productivity Committee)
Technical Information Sources – A Guide to Patents Standards (Houghton, B.)
Manufacturing, Planning and Estimating Handbook (Wilson, F.) (ed.)
Thinking and Reasoning (Wason, P. and Johnson-Laird, P.) (eds.)
An Introduction to Workshop Processes (Gwyther, J. L. and Page, R. V.)
Workshop Processes and Materials for Mechanical Engineering Technicians: 2 (Rankin, J. A.)
Human Resources for Industrial Development (International Labour Office)
A Penguin Survey of Business and Industry 1967/68 (Robertson, A.) (ed.)
Design Engineering Handbook – Electric Motors (Weaver, G. G.) (ed.)
Design Engineering Guide – Stress Analysis (Product Journals)
Manufacturing and Machine Tool Operations (Pollack, H. W.)
Human Relations in Modern Industry (Tredgold, R. F.)
The Genesis of Modern Management (Pollard, S.)
Achievement Through Work Study (Webb, S.)
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An Introduction to Cybernetics (Ashby, W. R.)
Industrial Training Handbook (Barber, J. W.) (ed.)
Framework of Technical Innovation (Parsons, S. A.)
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Science and Technology in Europe (Moonman, E.) (ed.)
Invention and the Evolution of Ideas (Schon, D. A.)
Effective Communication (Learning Systems Ltd.)

ABSTRACTS [55] to [62]

In future issues

The Resource Stewards – A Survey of Value Analysts and Engineers
by 'Antipodean' (Parts 1 to 6)

The Challenge of Value Engineering Training for V E
by Frank R. Bowyer, Consultant, Value Engineering Ltd

Developing and Organising an Effective V E Programme Parts 2 and 3
by B. G. Matossian, Matossian and Associates

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The Regional Editor for Europe

Mr P. F. Thew

Mr Thew, who has contributed the Editorial to this issue, began his career as an electrical inspector with Standard Telephones and Cables. Following a period in the Royal Navy he spent five years as a transformer designer.

In 1956 he became General Manager of an electrical sign company. From 1958 to 1961 he was a Production Manager with The Plessey Company.

Returning to S.T.C. in 1961 he spent six years introducing Value Engineering activities to the many divisions of that organisation.

In November 1967 he transferred to the European staff of I.T.T., Standard Telephones parent company, to continue the good work on the continent.

Mr Thew is married with two small children and lives on the edge of the battlefields of Waterloo. He has written many articles and talked to many learned bodies on Value Engineering and was a founder-member of the Value Engineering Association.

The Challenge of V.E.

Mr F. Bowyer, who is contributing this most interesting series of articles, unfortunately was unable to prepare the fourth article in time for inclusion in this issue.

It is hoped in the March 1969 issue to continue Mr Bowyer's articles.

Operational Research Quarterly

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It publishes Leaders on subjects of current general interest, and reviews important new publications. Special conference issues are also published from time to time.

Papers published recently

K Simmonds: Competitive bidding: Deciding the best combination of non-price features.
J A Faulkner: The use of closed queues in the deployment of coal face machinery.
M H J Webb: Advertising response functions and media planning.
M Radnor, A H Rubenstein and A S Bean: Integration and utilization of management science activities in organizations.
W T Thorneycroft, J W Greener and H A Patrick: Investment decisions under certainty and variability – some practical experiences of using forecasts and probabilities.

Back issues are available, either singly or in complete volumes, from 1950 to 1967. Write for further details of these and an inspection copy of the current issue.

Editorial:

Mr P. F. Thew is the European Regional Editor of Value Engineering. *He is the Manager of Industrial Engineering at I.T.T. Europe Inc., and has kindly accepted the invitation to write the Editorial. Readers, Mr Thew....*

Value Engineering in the Common Market

Within the past ten years we have seen Value Engineering develop through three main stages. Firstly, there was the up-graded cost improvement activity. Parts were modified to ensure lower manufacturing costs. Phase two was the redesigning of existing products to achieve the same function at lower cost. Now we have the third phase where products are value-engineered to arrive at the right cost the first time around.

The time has come to review the role of Value Engineering in the future of the world and particularly in the evolving Europe. There is little doubt that the pattern of Europe will change in the next twenty years to a common community. Slowly but surely barriers – economic, political and nationalistic – will fade away. Countries will then be less inclined to produce uneconomically for their own needs when they can purchase with advantage from their next door neighbour.

Countries will excell in the products for which they have a natural or very strong traditional advantage. Others will develop special skills to fill voids not previously filled by their sister countries. The situation will be dynamic with emphasis and bias constantly changing during the period of transitional adjustment.

In practical terms it will mean that the market for the best value product will expand enormously. Products offering below standard value will be forced out. Value will become increasingly important to both survival and advancement of the producers. Change will be compounded under these circumstances for both good and bad value products.

The product initially offering the best value in Europe will naturally look forward to expanding its market volume. This will in turn reduce the unit cost which will further improve the value which will further expand the market; saturation of the available market being the final restraining factor.

For the product offering lower value the spiral will run down rather than up. Volume will drop forcing prices up which will further restrain volume. Some products will be forced out of existence; others will be restricted to the limited market of the individualist who is prepared to pay for something different.

Value Engineering must therefore move into a fourth phase – *Competitive Value Engineering.*

Previously V.E. activity has been mainly restricted to manufacturing, purchasing and design engineering. In future it must surely extend into market research, national ability research, and many other allied functions.

Initially the problems will be very complex and they will undoubtedly provide a restraining influence. The important thing is to recognise the pattern of the future and be prepared for it. Two typical examples of the evolution are the washing machine and the refrigerator. Italian companies now manufacture these for most of the countries of Europe.

Factors affecting European product rationalisation within the short term are fairly easy to predict. Labour skills, labour availability, labour costs, natural resources and the natural market may be judged. Each country has its special mixture of these factors; some having an obvious bias and some being as yet undecided.

Scandinavia with its natural resources of timber will obviously continue to play a large part in the paper-making industry. Germany with its vast experience and skill, coupled with its large home market will be predominant in machine tools. Italy with its already gigantic motor industry will continue to be one of the top suppliers of Europe's motorcars. All these are obvious examples of a fairly clearly defined pattern of things to come, but what of the other countries?

The Southern European countries, such as Spain and Portugal and Southern Italy, are beginning to play a part in industrialised Europe. Compared to the north labour is more readily available and cheaper per hour. However, it is generally less experienced and inclined to a lower productivity than in the north. But this pattern is changing and many products with high labour content are now being manufactured in these countries with advantage.

These and a thousand other factors will provide the flames that will forge the new industrial Europe!

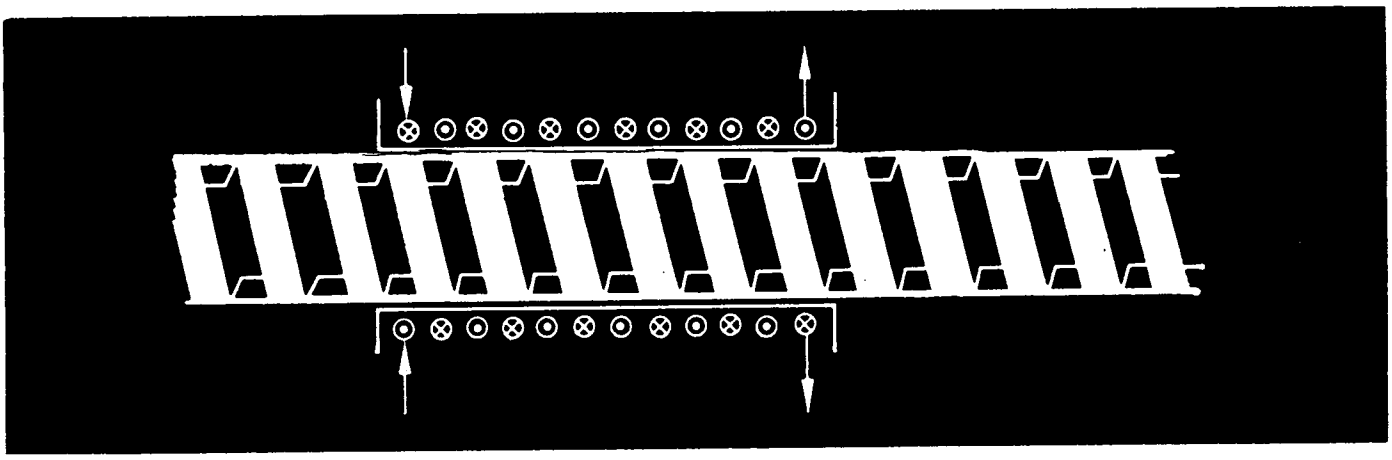
What of Britain's role in this evolution? On the one hand she has the traditionally excellent products such as aero engines, power stations, pottery, woollens, etc. Then come the products which have a mixed – but generally modest – reputation such as cars, aeroplanes, machine tools, electronics and many others. Finally, there is that vast range of products and services for which Britain has such a mixed reputation.

Now surely is the time for Europe in general, and Britain in particular, to plan its position in the industrialised world of the future. Success will depend upon value offered.

The role of Value Engineering during the past ten years has been very important. During the next ten years Value Engineering may be the difference between national prosperity and economic disaster.

ANNALS OF THE CIRP

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The International Institution for Production Engineering Research (CIRP) is comprised of prominent research workers in production engineering from seventy-five countries. Its primary aim is to promote, by scientific research, the study of mechanical processes of all solid materials, including checks on efficiency and quality of work.

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Applications – Construction Industry – Cost Effectiveness

Value Engineering Cost Effectiveness . . . A Tool for the Designer too

by A. J. Dell'Isola*

Cost effectiveness is a relatively new term which has been developed principally through the Department of Defense's emphasis on cost reduction and the systems concept.
In essence, cost effectiveness is the optimisation of the total cost of a facility or system for a specified number of years.
By total cost is meant the owner's ultimate cost to construct, operate, maintain and replace a facility that is designed for a specific life cycle.
After illustrating the break-down of the total costs, the author lists eight factors to be considered by designers in selecting their materials.
The article ends with a plea Value Engineering must *receive serious consideration, and with the evidence of seven case histories to support Mr Dell'Isola's contention.*
This is the first of several articles on the application of V.E. in the construction industry.

Figure 1, graphically illustrates the approximate breakdown of the total costs of a typical facility over a normal life cycle. It is important to note that the initial cost of a facility is less than fifty percent of the life cycle costs. Yet initial cost considerations predominate in most design decisions. It is, therefore, interesting to look into the breakdown of the first block of Figure 1, Initial Costs. Figure 2 is a breakdown of the elements of this cost. The breakdown of other costs in the total cost parameter are similar, but usually do not involve additional real estate costs. It is evident that knowledge of the elements of costs are essential for any understanding of the cost effectiveness approach.

Fig. 1

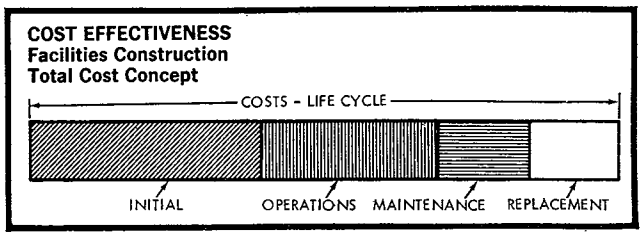
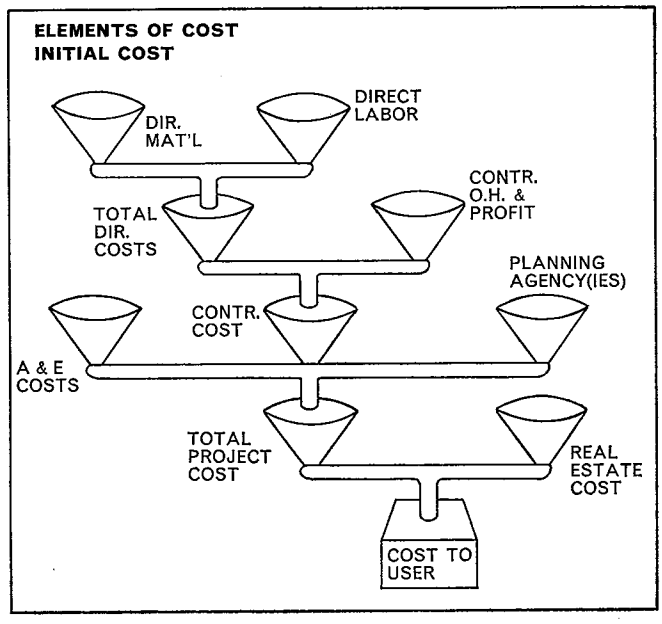


Fig. 2



Factors to be Considered

In a cost effectiveness analysis of the selection of major design materials, a number of factors are involved. A listing of some of the principal factors will serve to indicate the complexity of the problem and the amount of effort required to arrive at economical and meaningful decisions. Each of the factors require investigation, evaluation, and input from various sources.
This list is presented to promote thinking about the present material selection methods outlined in this paper and to question whether proposed improvements can assist in arriving at more effective decisions.

* ***Mr A. J. Dell'Isola is Director of the Value Engineering Division of Louis C. Kingscott & Associates Inc., Architects and Engineers, 901 National Press Building, Washington, D.C. 20004, U.S.A. Formerly he was in charge of the V.E. Program with the Navy and the Army Construction forces. A graduate of M.I.T. and a registered civil engineer he is one of the main forces in the promotion of Value Engineering techniques in the Construction Industry in the United States. Grateful acknowledgement is made to*** **Building Construction** ***for permission to publish this important article.***

Material Selection Factors to be considered by designers:

Availability of required design data on the material

Initial and installation cost of a particular material

Operational and maintenance requirements

Source and availability of material

Construction contractor's reaction and know-how

Conformance to a standard specification, or availability of sufficient data to develop performance specifications

Impact on design. For example, use of aluminium wire for electrical circuits may necessitate specifying larger size conduit and even increasing slab thickness.

Impact on safety and fire protection requirements.

The Material Selection Process

The present methods of material selection in the construction area primarily involve the project architect-engineer, who selects materials which conform to the design criteria of the owner. The architect-engineer is responsible for determining which materials are most suitable from the point of view of economy, function, and maintenance.

Generally, the selection of the bulk of the material is done by the architect or engineer working on a particular aspect of a design. For example, the electrical engineer selects such items as conductors, conduits, and panel boxes. The architect selects the materials for such items as windows, doors, hardware, and exterior finish.

In certain major areas, economic studies are conducted – fuel selection and structural system for example. However, in most instances, any selection of material or any studies are made by an individual or by a group of individuals within the same discipline. Normally, no formal job plan is followed, and no full-time employee is available to organise and coordinate activities or follow through on any new ideas generated. In view of the factors listed previously, material selection is a challenge.

Figure 3, represents graphically where the owner's money goes over the life cycle of a typical facility. It is interesting to note that the architect-engineer represents the smallest monetary area. This fact warrants some thought, especially since the decisions the design group make have the greatest impact on total costs. Figure 4, is an approximate curve which shows whose decision governs the expenditures of funds, and illustrates the importance of the designer's decisions. For example, if the architect specifies pre-cast concrete panels for the exterior of a hospital which cost $450 per panel installed, the contractor can influence the cost of the panels only a few percent during the construction phase, and the maintenance and operations contractor can influence M & O costs only slightly when he arrives on the scene.

Fig. 3

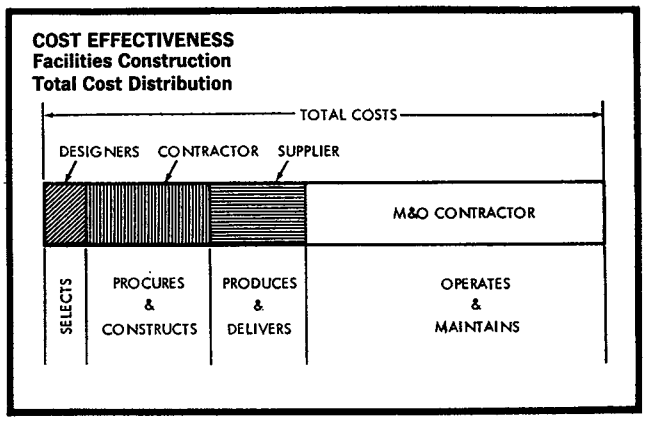
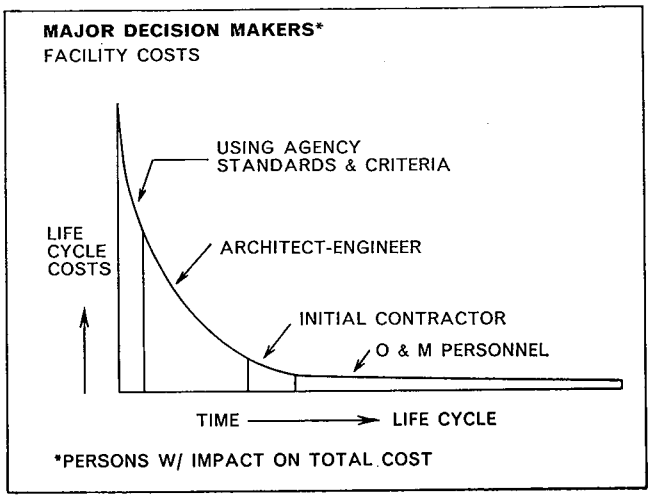


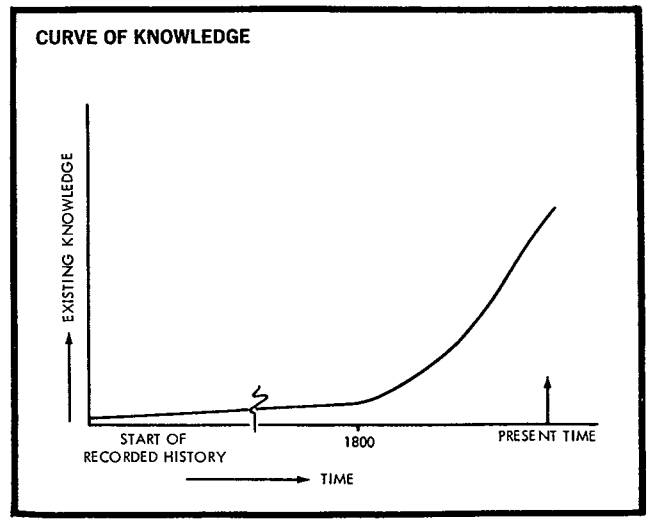
Fig. 4



A Fresh Approach

The construction industry is the largest industry in the United States, with over 70 billion dollars in annual expenditures – and the volume is expected to double within the next ten years. In addition, there is the technological explosion to be considered. Figure 5 illustrates the approximate rate of accumulation of knowledge and represents a forecast of what the future holds. Although the above statements concern the construction industry as a whole, building construction will parallel or exceed the general growth trends.

Fig. 5



Can the building industry meet this challenge with today's tools? Available information indicates that new tools are required. And one need only to look at some of the defense industries to find them. For example, in every major defense industry – such as weaponry, aircraft, and space – new tools are being used. One of these tools is Value Engineering.

How does the Value Engineering-cost effectiveness approach differ from what is presently being done in construction?

First, in the Value Engineering-cost effectiveness approach an organised full-time professional effort is being devoted to supplement the analyses of cost over the life cycle of a facility. In defense industries, savings of $10 for every $1 of expenditures are expected. In the construction area, there is a great deal of concern over rising costs and cost effectiveness. But, who has been assigned the continuing responsibility to cover this area? And, has there been any time and money set aside to do an effective job?

Second, this full-time effort has the support of top management. It seeks to arrive at decisions by using a team approach utilising creative problem solving techniques on a formal, organised basis. In the team approach, a group of trained, multi-discipline personnel are gathered together, and an organised effort is made to bring out their latent creative ability. Various high-cost areas of the design are challenged by the group, and many ideas are generated for alternate solutions. It has been proven, by the Creative Problem Solving Institute of Buffalo University, that more and better ideas are generated by this approach than could be ordinarily generated by one individual or by a group of individuals not trained in creative problem solving techniques. In addition, one of the principal causes of unnecessary costs – lack of communication among disciplines – is overcome. The use of a multi-discipline team approach to decision making is the real core of this method. Admittedly, this will require changes in present philosophy. But, in view of the challenge confronting the industry, changes will be required to cope with the future.

Third, public and private agencies should adopt the principles of incentive contracting. For example, the Department of Defense has solicited the assistance of defense contractors through the use of incentive provisions in procurement contracts. In the competitively-bid, fixed-price contracts, presently being used by most organisations, successful contractors are invited to submit change proposals which reduce costs. All approved savings are then split 50–50 between the government and the contractors. This provides contractors with a clear incentive to create savings, and provides organisations with a positive method of getting contractor input.

As an extra bonus, organisations can use any information submitted by contractor proposals on subsequent designs and realise 100 percent of any savings. However, it must be pointed out that in today's typical environment, a contractor can actually lose money by making suggestions which substantially reduce construction costs.

For other types of negotiated contracts – e.g. C.P.F.F., cost plus fixed fee – used for architect and engineering contracts, the Department of Defense has included 'program requirements' as part of the contract. Here, design and development contractors are paid an extra fee to conduct separate cost effectiveness analysis on their designs and to submit proposals which generate economies during the design and development of a particular item. The sharing arrangement for any savings realised through this effort is approximately 10 percent for the contractor and 90 percent for the government. The sharing arrangement is less in this case because – unlike the voluntary contractor participation under a fixed price contract – the government pays for the extra effort.

As a result of these program requirements, designers have funds available for cost effectiveness studies on any key material selection decisions which have a significant impact on total costs. They have funds to challenge any government criteria and specification which represents poor value in regard to total costs. This fact is especially interesting if one tries to recall how many times a designer has successfully challenged existing criteria under today's approach.

A closer look at the Value Engineering-cost effectiveness program provides a method by which architect–engineer costs can be increased a small percentage to create a larger percentage decrease in total cost. To date, program requirements for hardware or systems design oriented contracts have ranged from 0·1 to 0·5 percent of total costs. The savings (target goal) projected for this effort is ten times that cost, or approximately a 1 to 5 percent reduction in total costs. For example, for a C.P.F.F. contract for a facility costing $10 million, a program requirement would range from $10 to $50 thousand, with a target savings in total costs of from $100 to $500 thousand. As a result of the incentive contracting program in DoD, all defense procurement contractors had approximately 1000 change proposals approved, resulting in $36 million in savings to the government. Since 1965, all Defense fixed-price construction contracts over $100,000 have included the incentive provision inviting contractor participation. To date, over $2 million in savings – representing over 400 approved change proposals – has been shared with construction contractors. It is recognised that the amount is not staggering, but it is a beginning.

A better idea of the existing savings potential can be gained from a look at the results realised for two hospital projects. On both projects, full-time government engineers were present to work with the contractor and expedite the processing of any proposals submitted. The assignment of full-time personnel appears to be mandatory if results are expected, for experience indicates that there is little contractor participation without the presence of a full-time engineer. The contractor on one $4·5 million hospital submitted 13 proposals of which 6 were approved for a gross savings of $40,000. On the other $2·5 million hospital the contractor submitted 9 proposals of which 6 were approved for a gross savings of $20,000. Here again the savings are not staggering, but when projected against the overall volume of the construction industry, they become more significant. Specifically, considering the over $70 billion in total construction, the savings potential approaches $600 million.

Figures 6 to 9 represent typical examples of approved proposals. And, Figures 10 to 12 represent proposals recently developed by Louis C. Kingscott & Assoc., Inc. for submittal by contractors to contracting officers. These results are based on actions taken after contract award. No incentive program provision has been used in any defense construction contracts for architect–engineer services. This fact is a bit perplexing, in view of the fact that the program provisions may be included in defense architect and engineer contracts at the discretion of the contracting authority.

A Proven Tool

The cost effectiveness-Value Engineering approach to the selection of design materials is a proven tool for cost reduction. In fact, today, over 350 full-time specialists are working in this area in the Department of Defense. Other government agencies such as the Post Office Department, General Services Administration, and the Federal Aviation Agency have adopted the concept. In addition, various state governments – the first being Massachusetts – have established programs.

In the private sector, most major product manufacturers have adopted full-time programs. Foremost among these firms are Minneapolis-Honeywell, Joy Manufacturing, General Electric, Philco-Ford, and RCA.

The unprecedented challenge now confronting the construction industry requires new thinking to reduce unnecessary costs. One new thought is worth considering: If the architect–engineer could realise 10 percent of what he could save, and get an additional fee for an extra effort, how many facilities presently being awarded at or near budgeted amounts could be reviewed using the cost effectiveness approach to reduce total costs?

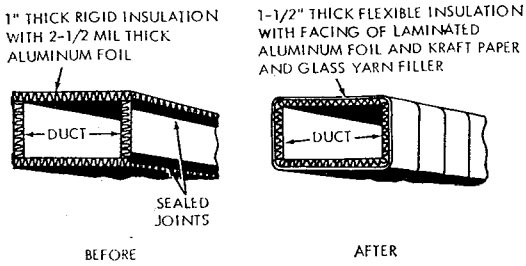
A fresh approach to cost reduction – cost effectiveness-Value Engineering – has been outlined and proved workable. *The acceptance and implementation of this approach must receive serious consideration.*

Case Histories

Figures 6 through 9 show typical examples of Value Engineering changes that have been accepted on specific projects. Figures 10 through 12 are examples of recent proposals developed by Louis C. Kingscott & Assoc., Inc. for submittal by contractors to contracting officers. On a cumulative basis, these seemingly modest cost reductions can have a tremendous influence on the total cost of construction. At this point, no incentive contracts have been included in typical A/E service contracts for defense construction. Results shown are based on actions after contract award.

Fig. 6

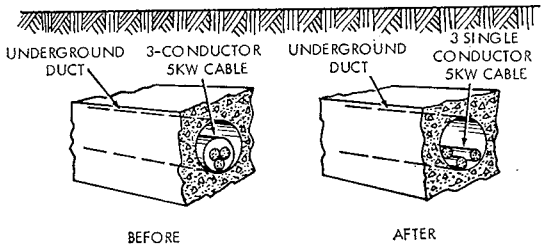
CRAWL SPACE DUCTS



VE CHANGE	SAVINGS
SUBSTITUTE 1-1/2" THICK FLEXIBLE DUCT INSULATION WITH FACING OF LAMINATED ALUMINUM FOIL AND KRAFT PAPER AND GLASS YARN FOR SPECIFIED 1" THICK RIGID INSULATION WITH 2-1/2 MIL THICK ALUMINUM FOIL FOR DUCTS IN CRAWL SPACE.	**$7,710**

Fig. 7

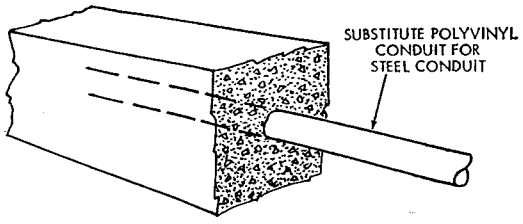
UNDERGROUND DUCT CONDUCTOR



VE CHANGE	SAVINGS
CHANGE 3-CONDUCTOR 5 KW CABLE TO 3 SINGLE CONDUCTOR 5 KW CABLES. INSTALLATION LABOR EXCEEDED EXTRA COSTS OF 3 SINGLE CONDUCTORS.	**$5,780**

Fig. 8

CONDUIT

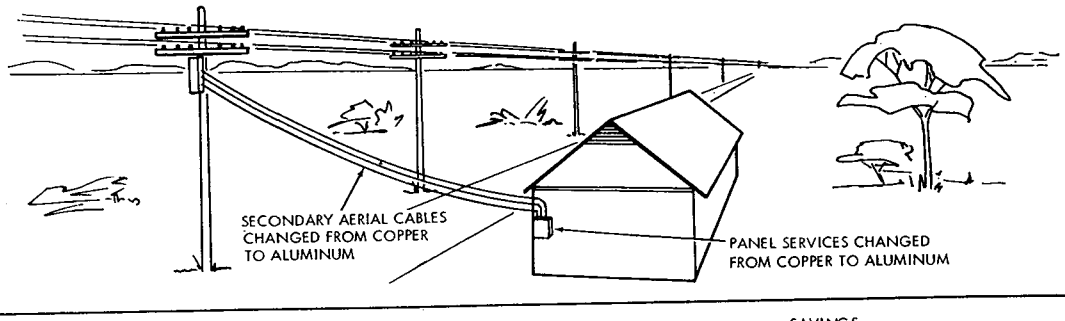


VE CHANGE	SAVINGS
SUBSTITUTE 4" RIGID POLYVINYL CHLORIDE CONDUIT FOR STEEL CONDUIT.	**$5,000**

NOTE: CHANGE OF GOVERNMENT CRITERIA WAS REQUIRED.

Fig. 9

ELECTRICAL SERVICE LINES

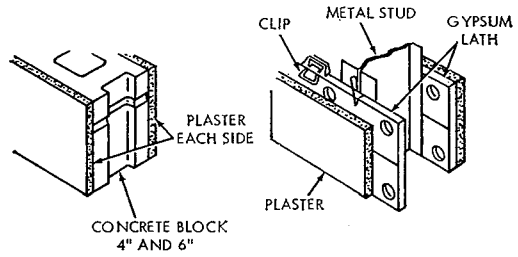


VE CHANGE	SAVINGS
SUBSTITUTE ALUMINUM FOR COPPER OF EQUIVALENT CAPACITY IN SECONDARY AERIAL CABLES, AND SUBSTITUTE #1 ALUMINUM FOR #2 COPPER FOR ALL PANEL SERVICES.	**$10,055**

NOTE: WAIVER OF GOVERNMENT CRITERIA WAS REQUIRED

Fig. 10

OFFICE AREA PARTITIONS

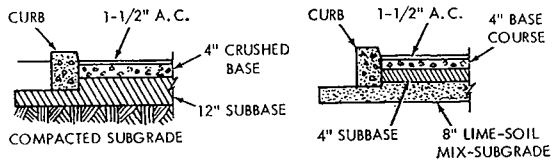


BEFORE: $10,562 AFTER: $7,707

PROPOSED VE CHANGE	SAVINGS
CHANGE FROM 6" CMU PARTITION WITH PLASTER ON BOTH SIDES TO METAL STUDS PARTITION, WIRE LATH AND PLASTER BOTH SIDES.	$2,855

Fig. 11

PARKING AREA PAVEMENT

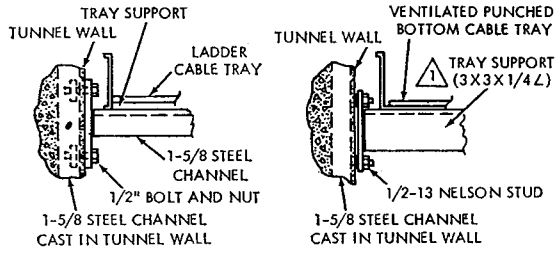


BEFORE: $2.20 SQ. YD. AFTER: $1.80 SQ. YD.

PROPOSED VE CHANGE	SAVINGS
CHANGE THE SECTION NUMBER ASPHALTIC CONCRETE PAVEMENT FROM 12" COMPACTED SUB-BASE AND CRUSHED ROCK BASE TO 8" OF LIME STABILIZED SUBGRADE, 4" OF SUB-BASE AND CRUSHED ROCK BASE. NOTE: CHANGE REQUIRED TO GOVERNMENT CRITERIA.	$8,000

Fig. 12

CABLE TRAY SUPPORT



BEFORE: $20,955 AFTER: $16,683

PROPOSED VE CHANGE	SAVINGS
CHANGE FASTENER DESIGN FROM BOLT PLACED THROUGH CHANNEL CAST IN WALL WITH CHANNEL TRAY SUPPORT TO NELSON STUDS WELDED TO WALL CHANNEL AND ANGLE TRAY SUPPORT.	$4,272

Miscellany

Man Wanted

The following quotation (author unknown) is taken from the *I.M.S. Clinic Proceedings 1967* (publisher's address is given on inside of the back cover of this journal):

'WANTED

A man for hard work and rapid promotion.
A man who sees things to do without the help of a foreman and three assistants.
A man who gets to work on time in the morning and does not imperil the lives of others by being the first out of the building at night.
A man who is neat in his appearance.
A man who does not sulk when he is working a little overtime in emergencies.
A man who listens carefully and asks only enough questions to insure carrying out instructions.
A man who moves quickly and makes as little noise as possible.
A man who looks you straight in the eye and tells you the truth every time.
A man who does not pity himself for having to work.
Apply anywhere – *the world is looking for such men.*'

Contagion of Reports

*Modern Records Management** refers to the mythical person who generated the Army's flypaper report.

Noticing the curling pieces of flypaper dangling over the mess tables, partly in fun and partly in protest against the Army's questionnaires and reports an officer drew up a form with eight blocks representing the flypapers on the right side of the mess hall and eight for those on the left. He gave an Army-style code to each of the blocks – X1, X2, X3, etc. for those on the right; Y1, Y2, Y3, etc. for those on the left. Then he counted the number of flies trapped on each flypaper, recorded these data in the corresponding blocks, gave the report a number, signed it, and mailed it to headquarters.

This he did every day for a week.

Eventually the reports landed on the desk of a technical sergeant who began to worry. Why wasn't he getting flypaper reports from other Army mess halls? Failure to submit a report called for a compliance order. So the order went out – and if you want to believe the mythical person, that's how the flypaper report became a standard one in the Army. The story is a myth, but the contagion of reports is real.

VALUE-ENGINEERING COURSES LED BY JOHN BURNSIDE

C Eng, MIMech E, MIMC

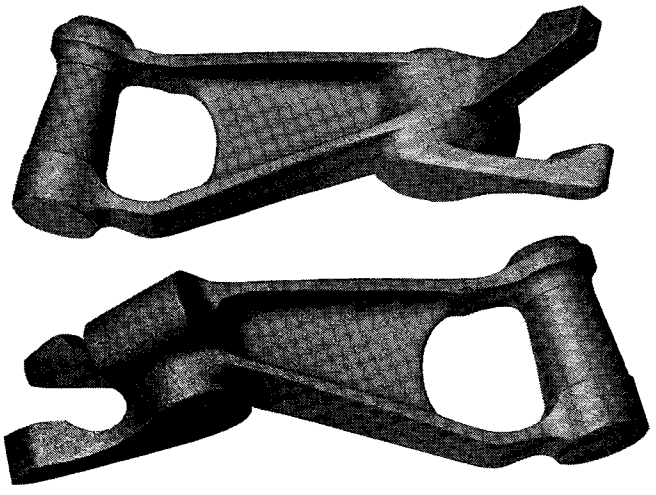
have increased profits reduced costs improved saleability

for leading companies in
motor vehicle manufacture
electrical engineering
hydraulics
machine tools
electronics
office equipment
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Reprint No. 1:5:3

Creativity – Lateral thinking

Information Processing and New Ideas—Lateral and Vertical Thinking

by E. de Bono*

'Vertical thinking is concerned with digging the same hole deeper. Lateral thinking is concerned with digging the hole somewhere else.' This is how the author differentiates between the two types of thinking.
Education, according to the author, only teaches vertical thinking because lateral thinking has always seemed impossible to teach. He then outlines why (with the increased interest in creativity and the computer) there is growing interest in the thinking processes.
Describing how the brain operates and how creative behaviour may be increased Dr de Bono goes on to discuss the nature of vertical thinking. It is sequential, based on the idea that one must not be wrong, works on the most promising approach, only moves in a planned direction, only considers the relevant, and tends to build up large established patterns.
To describe the lateral thinking process the author poses a number of problems discussing their solution and the difficulties which people normally encounter in solving these problems.
Finally, he sets out the four main categories of the techniques of lateral thinking, and the reader's attention is drawn to several books which Dr de Bono has written on the subject.

Education Teaches Only Vertical Thinking

Education has always concentrated exclusively on vertical thinking as indeed it does today. Vertical thinking is concerned with the development and utilisation of ideas. Lateral thinking is concerned with the making of new ideas.

You cannot dig a hole in a different place by digging the same hole deeper. Vertical thinking is concerned with digging the same hole deeper. Lateral thinking is concerned with digging the hole somewhere else. The aim of both is effectiveness.

Education teaches only vertical thinking because lateral thinking has always seemed impossible to teach. It has been supposed that nothing can be done about the generation of new ideas except wait for them to arise through chance processes and then develop them with vertical thinking. As a result of this attitude skill in vertical thinking has been developed to a very useful degree but skill in lateral thinking remains universally poor. With the advent of computer technology which will come to take over the vertical thinking functions of mind there has been an increased emphasis on lateral thinking and the more creative aspects of mind. In addition the increasing need for new ideas and the benefits of successful innovation both in products and in methods have focussed attention on creativity. As a result creativity has become fashionable and it is now no longer heretical to suppose that one might be able to do something deliberate to encourage creativity. Perhaps one does no more than just enrich the setting in which it might occur but then this is how an experiment produces new information. Because of this new attention creativity is in danger of becoming a suspect word.

* ***Dr Edward de Bono is at present engaged at the Department of Investigative Medicine at the University of Cambridge on problems on the behaviour of biological systems. He has also done research at the Universities of Oxford, London and Harvard. Dr de Bono lives at 41 North Road, Whittlesford, Cambridge, England.***

The increased interest in creativity has lead to a variety of theories. Such theories are usually descriptive and are based on empirical observation. Most of them do contain useful ideas. And most of these ideas are clothed in confusing and largely unnecessary concepts which betray the empirical nature of the theories. Along with the theories come various specific techniques for increasing creativity. Many of these techniques do work once one has practised them and acquired enough confidence in their use. Nevertheless creativity is in danger of becoming suspect because the emphasis has shifted too far from the original nihilistic attitude to a ready acceptance of what often must appear to be ritualistic gimmicks and self-sustaining descriptions. This is inevitable when practical demand outruns fundamental ideas.

Man deals with his environment in a physical manner. He selects units, separates them out and combines them in different ways to obtain useful effects. The process is practical and efficient. And one can see how it works. Traditionally it has always been assumed that man deals with information in the same way. It has been assumed that he actively selects and rejects pieces of information according to a frame of reference, that he combines the pieces together according to certain rules, and that he produces by design some useful answer. Logic and mathematics and computers have been developed to enable him to perform this function ever more efficiently. This type of behaviour might be called physical information processing since it is analogous to the physical manner in which a man might build himself a house.

The Operation of the Brain

It is highly unlikely, however, that the brain operates as a physical information processing system. It is much more likely that it operates as a biological information processing system. And the difference between the two types of system is fundamental.

The physical system works by active selection and rejection of information according to a fixed frame of reference. There is a separation of the processor and what is being processed. For instance in a computer there is the programme and the data, there is the central processor and the memory store for the data. In the biological type of system there is no separation of the processor and what is being processed. Nor is there any active

selection. Biological systems are passive and self-organising. The material organises itself. Processor and memory are the same. The system functions as a self-organising, self-maximising memory and not as a computer at all. It is the fixed defects of memory that give it a computing function. Biological systems are also iterative, adaptive systems and not formulated systems.

The brain behaves as an iterative, self-maximising, biased, two-stage memory system. Such a system has characteristic behaviour which is definable in functional terms rather than empirical word-descriptions. The natural behaviour of this type of system is essentially non-creative. Creativity is then not some strange and magical faculty but a defect in the functioning of the system – a temporary lapse of efficiency.

Increasing Creative Behaviour

Any attempt to increase creative behaviour depends for its success on interfering with the natural behaviour of the information processing system of the brain and this is usually done by manipulation of the environment since direct interference leaves one incapable of utilising whatever creative output may emerge. Logic and mathematics are highly developed algorithms for improving the natural behaviour of the brain. As methods they have been extraordinarily successful. Their only limitation is that they are essentially non-creative. They are aids to vertical thinking which is a matter of high-probability sequential development in which the next step depends on the preceding ones.

Logic and mathematics are always second stage information processing methods. So are computers though they may not always be. These second stage methods can only be applied after the first stage has been completed. In the first stage the brain chooses to look at the environment in a certain way, it may parcel it up into convenient units or extract certain patterns. This stage could be called perceptual thinking except that it involves more than sensory behaviour. Once the first stage is complete then the result is worked upon by the highly effective second stage techniques. But no amount of excellence in this second stage can correct errors in the first stage. The way a problem is looked at in the first stage will determine the outcome. The second stage processes will only determine whether that outcome is reached and how efficiently.

In contrast to the sophisticated second stage techniques the first stage is carried out by the natural and limited functioning of the brain without the help of any algorithms. Creativity occurs exclusively in this first stage. Lateral thinking is concerned with the first stage and is an attempt to improve the performance of the mind in this first stage by compensating for its natural limitations just as the developed methods of vertical thinking do for the second stage. Creativity may be the natural result of effective lateral thinking but it is not the specific aim which is effectiveness.

There are formal techniques of lateral thinking and those who have a practical need for creativity are often hungry for concrete methods of achieving it. In the long term view, however, it must be more useful to understand the basic principles since from these principles arise not only new techniques but habits of thinking that can make artificial techniques superfluous.

One can draw a picture on a white piece of paper by using black lines. One can also draw the same picture by blacking in the background so that the picture stands out as a white pattern on a black background. Instead of defining and describing lateral thinking in a way that can only make it seem esoteric it may be more useful to put it in perspective against the habitual mode of thinking. Instead of trying to impose something new one seeks to show how it relates to what is already available. It is important to outline this difference between lateral thinking and vertical thinking for not only does the mind use vertical thinking naturally (albeit inefficiently) but it is also trained to use it by education.

Vertical Thinking is Sequential

Vertical thinking is essentially sequential in nature. One proceeds step by step along a path. The path is sound and the validity of the conclusion is proved by the soundness of the path by which it has been reached.

Lateral thinking does not have to be sequential. One may jump and then fill in the gap. One may move from one point to another in a haphazard manner and then allow the points to coalesce into a pattern. One may jump to the conclusion and then rationalise a pathway. With lateral thinking the validity of the conclusion can never be justified by the method of reaching it. But once it has been reached the solution may well validate itself. Once a sound pathway has been constructed in retrospect to link the starting point and the solution then it cannot matter how this pathway came about: whether it was the result of steady sequential development or by jumping and filling in gaps.

One may have to be at the top of a mountain in order to find the best way up. Vertical thinking toils up from the foothills, often from an obvious but tedious approach. Lateral thinking takes a helicopter to the top and then looks around to find the easiest way up.

Being Wrong

Vertical thinking and indeed the whole system of education is based on the principle that one must not be wrong. The very essence of logic is that one cannot proceed by means of an unjustified step. Yet the fear of being wrong is the biggest bar there is to new ideas.

A step may be wrong when looked at from the present context but once the step is taken then the context changes and the step may be shown to be right. Even a step which remains wrong can still set off ideas or produce an outlook which can lead to a solution which would not otherwise have come about. Sometimes it may be necessary to go through an area that is wrong because only from beyond this area can one see the correct route. Naturally the wrong area itself is not included in the final pathway.

It is like building a bridge. The separate parts may not be self-supporting until the structure is complete.

Once one breaks through the barrier of being afraid to be wrong then one can entertain all manner of thoughts which would otherwise have been rejected too early. Some of these thoughts will change from being ridiculous at first to being useful. Others will continue to be ridiculous but can still set off sound ideas.

Certainly one does try and avoid being wrong when it comes to action but there is no reason why one should try and be right all the time in one's thinking. The only time one needs to be right is in one's conclusion and even then one must be very ready to accept that one is perhaps wrong.

The Generation of Alternatives

Vertical thinking chooses the most promising approach, singles it out and follows it as far as it goes. Lateral thinking is not interested in single approaches no matter how promising they may be. With lateral thinking one acknowledges the most promising approach but instead of following it one deliberately sets out to generate as many alternative approaches as possible. The method of lateral thinking is neither to find the best approach or to follow it but to generate alternatives. Success is measured by the number of alternatives that have been produced. Sometimes one of these approaches may itself constitute a solution. At other times the approach may have to be developed further by vertical thinking.

Vertical thinking can only move in a planned direction. Progress in vertical thinking means knowing where one is going and moving steadily in that direction. In lateral thinking one may move without any direction at all in order to generate a direction. One may not know where one is going until one has got there. One is looking for change not achievement. With both lateral and vertical thinking achievement is the ultimate aim but with lateral thinking one looks for achievement indirectly – through change.

Chance and Outside Influences

In vertical thinking one concentrates and excludes outside interfering influences. One considers only what is relevant. In lateral thinking one realises that the disruption of a particular fixed

idea may only come through a random intrusion so one not only welcomes such intrusions but actively seeks to generate them. One seeks to generate them by cross-disciplinary fertilisation or even by exposing oneself to such random stimuli as might be obtained by wandering through an irrelevant exhibition or even a place like Woolworths. There is no question of looking for something, only of accepting whatever turns up.

One seeks to encourage chance influences and chance juxtapositions. One cannot direct chance but one can provide the setting in which it can occur. And one can harvest it when it does.

Large Patterns

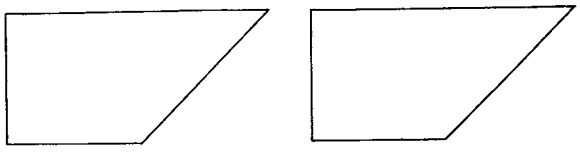
Vertical thinking tends to build up large established patterns since the use of large patterns speeds up both communication and information processing. With time the patterns get larger and larger. Lateral thinking seeks to break down established patterns into small units. One seeks to disrupt patterns so that the information released may re-form itself into new and better patterns.

These are some of the points of difference between lateral and vertical thinking. There are many others. The points outlined suffice to show that lateral thinking is very different from the type of thinking that one normally uses both as a result of education and as a result of the natural behaviour of the mind as a self-maximising system with a memory. Although the points seem to have been discussed in empirical terms they arise directly from the nature of this type of system.

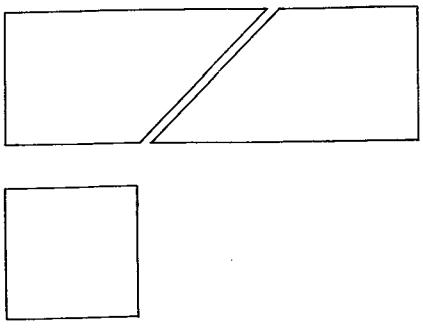
For instance in a self-maximising system with a memory the final arrangement of information must always be less than the optimum arrangement. As each piece of information arrives the state of the system is maximised not only in terms of the available information but also in terms of the preceding state.

Thus the sequence of arrival of information plays an important part in the final arrangement whereas the optimum arrangement should really be independent of the sequence of arrival and depend only on the information itself. This effect can be shown quite neatly with a plastic model.

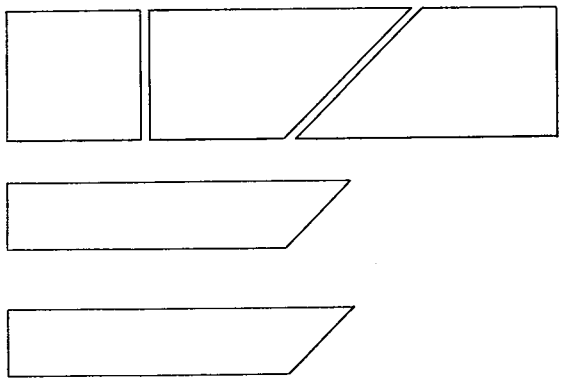
Below are shown two thin pieces of plastic which are given to someone with instructions to arrange them in a single shape which would be easy to describe to someone who could not see what was going on.



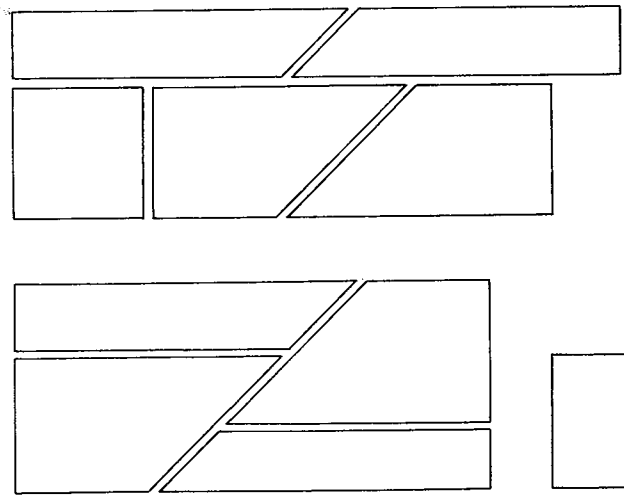
Naturally most people arrange the pieces to form the shape shown below. This shape is then described either as a simple rectangle or as a rectangle which is three times as long as it is broad. As shown below a third shape is added and once again the task is to arrange all the pieces to form a shape that would be easy to describe.



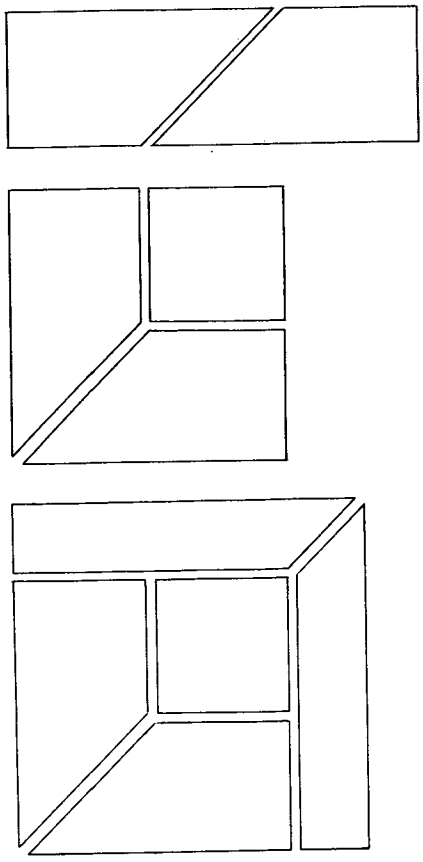
Some people have a lot of trouble with this and then kick themselves for not seeing the simple answer which others arrive at quite easily. This simple answer is the longer rectangle shown below. This is described as another rectangle or as a rectangle which is four times as long as it is broad. Two more pieces are now added.



Most people have a great deal of difficulty at this point. Many of them start off with a rush and then end up with one or other of the shapes shown below. Manifestly both of these are inadequate. Many give up and declare that it cannot be done.



And yet the correct answer is surprisingly simple. One correct sequence of shapes is shown below.

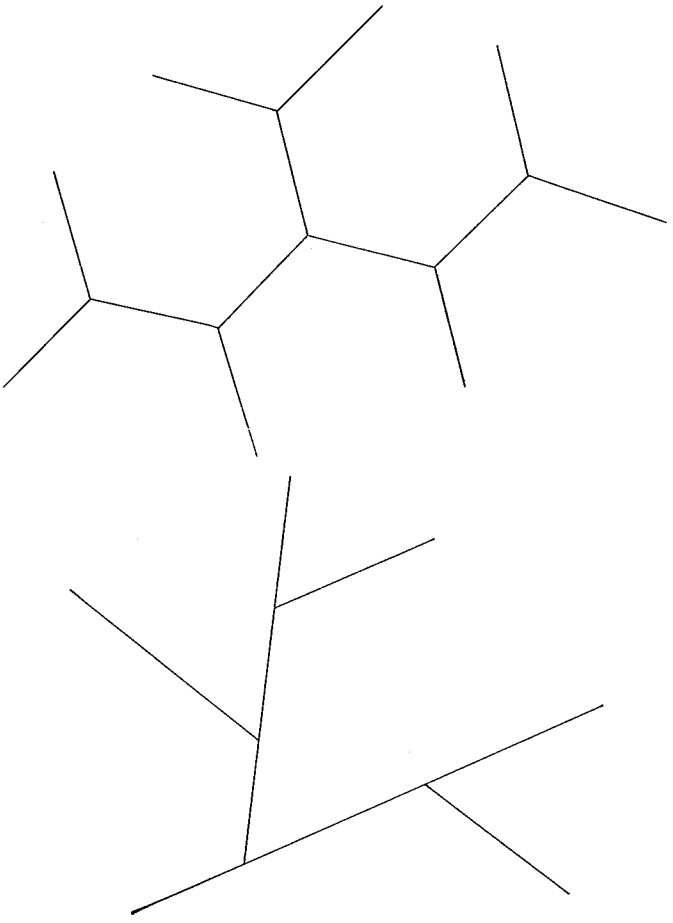


What this model illustrates is that the sequential arrival of the pieces has made the task much more difficult than if the pieces had all been produced at once. The rectangle is probably the optimal arrangement at the first stage. At the second stage the longer version of the rectangle is only the optimal arrangement when it follows the preceding rectangle otherwise the square is the truly optimal arrangement since with a square the shape is accurately described without any dimensions.

From the rectangle it is impossible to get to the next stage but from the square it is absurdly easy. The point here is that the natural behaviour of this self-maximising system with a memory leads to an arrangement that is justified but short of optimal. In fact it leads to a block. The sequence of the two rectangles is pure high-probability vertical thinking. Lateral thinking would acknowledge the possibility of the longer rectangle but would go on to generate alternatives and would probably turn up the square.

In practical terms this behaviour can result in the phenomenon of being blocked by openness. It is easy to see how one can be blocked by something being in the way. Paradoxically one can be more effectively blocked precisely because there is nothing in the way. If the road is wide and straight one can easily go shooting past the correct side-turning. This type of block is more difficult to cope with than when there is an obstacle. At least one knows where the obstacle is and can make special efforts to get round it. With the open road one has no idea where the significant side turning might have been and so does not know where to start looking.

Below are shown two types of branched pathway. With the first type one simply has to retrace one's steps to the junction which is indicated by a change of direction and then try the other branch. With the second type there may be no indication of a junction and even if one does go far back one is just as likely to shoot past the turning again.



In an experiment I gave two small boards each to some children. The boards had a small hole in one end and with the two boards went a piece of string. The problem was to assume that the floor of the room was a river and to try and cross it by making use of the boards. Most of the children solved the problem. They used the two boards as movable stepping stones. They would stand on one of the boards and move the second board ahead. Then they would shift to the second board, pick up the first board and move it ahead. Some of the children tied the two boards together with the piece of string. The others did not.

A second group of children were given only one of the boards. After a while a few of them hit on the idea of standing on the board and hopping across the room holding the board up against their feet by means of the piece of string which they tied to the hole in the end of the board.

The point here is that the second solution was much more effective than the first one. Yet the first group had no chance of reaching it since they were blocked by having two boards even though they could have discarded one of them. They were blocked by the adequate solution from achieving a better one. This is characteristic behaviour of this type of information processing system and it is hugely useful for adaptive purposes.

To Sum Up

The general techniques of lateral thinking fall into four main categories.

1. *Awareness:*
This involves an appreciation of the nature of the information processing system of the mind and an appreciation of the inherent limitations of this type of system. It also involves an awareness of the limitations of a training in vertical thinking.
Awareness can be acquired only by direct involvement and practice accompanied by insight into the processes involved. The theoretical framework is only useful for guiding such insight.

2. *Random stimulation:*
This means the use of outside, unplanned stimuli to provide events that do not follow the natural sequence of development of an idea. Such stimuli can be provided by others as in a brain-storming session, by cross-disciplinary discussion, by deliberate exposure to irrelevant stimuli or by the use of random word stimulation.

3. *Alternatives:*
This involves the deliberate generation of different approaches and different ways of looking at things. It may be helpful to decide beforehand on a quota that must be filled. This group of methods also includes the careful rotation of attention through all the parts of a problem.

4. *Alteration:*
This group of methods makes use of what is available in order to generate something new. It is rather like kicking off against the end of a swimming pool. There are various techniques such as reversing direction wherever a direction is implied, reversing a relationship wherever there is a relationship. It also includes arbitrary denial of things that are taken for granted. Another technique is to break large patterns down into as tiny fragments as possible. Relationships may be abstracted and then transferred to an analogy which is then developed and translated back again to see what happens.

These and many other techniques can be worked out in explicit detail and practical form. Many of them are in routine use already. The important thing, however, is to understand the basic nature of lateral thinking and how the nature of the system makes it so essential. The particular techniques then achieve their true perspective.

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Reprint No. 1:5:4

Basic concepts – S.P.C.L. – Electronic equipment

S.P.C.L.—A New Approach to Value Engineering

by D. F. Spear, B.Sc., M.I.E.E.*

The author describes S.P.C.L. – Single Product Cost Leadership – as it is applied in his company, Standard Telephones and Cables Ltd. It is a matter of concern to him and other value engineers that the ideas and methods of Value Engineering have developed so little in the twenty years since it was initiated.
Mr Spear outlines the nine-step procedure adopted by his company, and he points out that without effective management participation and without each step in the procedure being carried out little or no results will come from the efforts put in.
As in a few months' time Standard Telephones and Cables will have reached a savings of £1 million by the use of S.P.C.L. readers will realise the intense practical nature of what the author has to say.

It has often been said that any Company which is not changing and developing is in fact dying, and this is equally true in the field of technology, where lack of change and improvement is the hallmark of a moribund technique.

It must therefore be a matter of some concern to those concerned with Value Engineering, that the ideas and methods at present being taught have developed so little since Lawrence D. Miles initiated Value Engineering some 20 years ago. It is true that a little work has been done on Theoretical Evaluation of Function (T.E.F.) techniques, and these have added a little to the value engineer's armoury. It is even more true that all the basic problems of roadblocks, habits of thought, and all the obstacles to implementing new ideas are still with us. Nevertheless, in the period since Lawrence Miles first started his work we have entered the space age, and, in the field of electronics, not only have transistors largely made valves obsolete, but they are themselves being rapidly replaced by integrated circuits. Surely, in these circumstances, Value Engineering cannot remain static, static to the extent that one cynic has suggested that even the jokes used in some Value Engineering courses are the same as those that Lawrence Miles originally used at G.E. 20 years ago to illustrate his ideas. In view of this the experiences and ideas of one group of companies may be of interest.

Value Engineering was started at STC nearly ten years ago, and has operated on an organised, company-wide basis for the last five years. In the International Telephone and Telegraph (ITT) group, of which STC is a part, Value Engineering has been going on for considerably longer, and during this time, vast amounts of money have been saved. Nevertheless, over the group as a whole, it was felt that Value Engineering was not really producing the results of which it was capable, and ITT undertook a world-wide survey of the whole group to ascertain what was going wrong, with a view to taking remedial action. The conclusions of the survey were that three main problems occurred repeatedly.

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1. Many technically excellent Value Engineering exercises were being done on the wrong product, so that the valuable time of skilled engineers and other technical resources were being spent on exercises which yielded little or no return to the company. The product may have been the wrong one for a variety of reasons. Perhaps on a 'one-batch' product the Value Engineering exercise was started so late that it was impossible to complete the necessary work before all the parts were ordered. Perhaps on an apparently continuously running product, a management decision had already been made to phase it out in the interests of rationalisation. Perhaps the commercial arrangements applicable to the product were such that reductions in cost were of no advantage to the Company. Or, perhaps the exercise had been conducted on a product so technically advanced and near the limit of the 'state-of-the-art' that a vast amount of time and money had to be expended to achieve some limited and even doubtful results. Anyway, for whatever reason, it was obvious that the selection of products for Value Engineering demanded much more careful consideration than it had been given in the past.
2. Even when technically successful work had been carried out on the right product, there were a deplorably large number of instances where either the proposals had never been implemented at all, or more frequently, the implementation had taken so long that a large proportion of the potential savings had been lost. This appeared to be partly due to the usual roadblock attitudes, but mainly due to the fact that the changes produced by Value Engineering were superimposed on an industrial engineering and manufacturing set-up that was already very fully loaded with an existing programme of new products. The Value Engineering implementation was therefore carried out in someone's spare time, and as there wasn't much spare time, sometimes there wasn't much implementation. It was therefore clear that the implementation of Value Engineering proposals needed to be integrated into the overall business, engineering and manufacturing plans and control systems, and not treated as something outside them.
3. Examples of successful Value Engineering on mechanical products abounded, but examples of equally successful work on electronic equipment were comparatively few and far between. This was a very serious situation, because of the continued historical process of the replacement of mechanical and electromechanical devices by electronics. It may not be realised, for example, that a modern telephone exchange

consists basically, not, as formerly, of an assembly of electro-mechanical switches and relays, but of electronic data processing equipment, memory stores, electronic logic circuits, etc. As a result of this process not only are mechanical components being eliminated, but the resulting miniaturisation means that even the mechanical components that remain (cabinets, frameworks and panels, etc.) become much smaller for a given function, so that they now represent such a small proportion of the total cost that even if they were, by some miracle, completely eliminated, the effect on overall cost would be negligible.

In examining the reasons for the comparative lack of success in electronic applications, it appeared that the brainstorming sessions traditionally associated with the creative phase of Value Engineering had, in many cases, either failed to create any new ideas, or else had resulted in 'reinventing the wheel'. This is perhaps hardly surprising when viewed with the benefit of hindsight, since most members of a conventional brainstorming team, when presented with an electronic circuit, cannot understand what it does, still less can they understand how it does it, and even still less can they suggest an alternative means of performing the function.

It was clear, therefore, that different procedures for developing alternatives were needed.

In order to meet these three main problems, and other minor ones that were revealed by the investigation, ITT developed a new method of Value Engineering, called Single Product Cost Leadership (S.P.C.L.). As the name implies, the technique is based on taking individual products of a Company or Division and Value Engineering them to the stage that the selected product can be produced at a cost equal to, or less than, that of any of its competitors. A nine-step procedure or discipline has been devised, as follows:

Step 1 – Select Product
Step 2 – Determine Product Cost Objective
Step 3 – Analyse Product by Function Diagram
Step 4 – Determine Costs by Function
Step 5 – Review Specifications by Function
Step 6 – Develop Feasible Alternatives
Step 7 – Select Alternatives
Step 8 – Prepare Action Plan
Step 9 – Review Action Plan Progress

Some of these steps may appear obvious, and others obscure, so the action to be taken at each step, and the differences from conventional Value Engineering practice, will be outlined, step by step. Two things will perhaps become clear, firstly that the S.P.C.L. method is a management based technique, and that without effective management participation and control, nothing will be achieved. Secondly, the S.P.C.L. method is indeed an integrated procedure or discipline, in that failure to carry out any one step properly will render subsequent steps at best inefficient and at worst totally useless.

Step 1 – Select Product

The most important point to be established is that product selection must be done by the General Manager/Divisional Manager/Managing Director of the unit concerned. The title will vary with the size of the particular company or organisation, but the decision must be made or approved by the person, whatever his title, having responsibility for the overall profitability of the unit. This is basically because, when a decision is made to apply S.P.C.L. to a particular product, a decision has been made to invest valuable resources in the product, in the belief that this investment will result in a return to the unit concerned. But perhaps, just as important, is that unless the decision to carry out the S.P.C.L. programme is seen quite clearly by all concerned, to have been made by and to be supported by the unit manager, the programme is likely at best to be considerably delayed and at worst quite ineffective. The sort of things that happen when there is little or no top management support are familiar to all value engineers: the purchasing department is too busy to order the samples or obtain the quotation; the Accounts Department hasn't time to dig out the necessary figures; the Chief Industrial Engineer decides to borrow one of the Value Engineering team 'Just for an hour or two to solve a particular problem' and so on. Of course, the hour or two becomes a week or two, until the value engineer becomes just another industrial engineer doing a little Value Engineering work in his spare time. To repeat, no Value Engineering programme will ever be effective unless top management support is both given and seen quite clearly to be given through all the functional departments of the unit.

To return to the more technical aspects of product selection it is possible to tackle this in a variety of ways. It is possible that, with just a little thought, the correct product will be fairly obvious. If this is not so, it may be possible to make the selection with the help of a points rating system, by taking the various products of the unit concerned and allocating points to each for the various aspects to be considered, mainly sales volume (in money terms) both present and future – possible effect on sales of selling price reductions, competitive position of product, complexity of product (this will determine time required for S.P.C.L. investigation and implementation) and any special customer relationships or contractual arrangements. If even this procedure does not produce a clear answer, it may be worth while to ask the S.P.C.L. team to make a brief investigation of the contending products, produce an estimate of likely savings, dates and cost of implementation, and assess the merits of each investment on a discounted cash flow basis.

Having, by one method or another, selected our products, we can now move to the next step.

Step 2 – Determine Product Cost Objective

This is also a management decision, but is comparatively easy to determine, because it is, quite simply, the reduction in cost which will indeed produce cost leadership on the product in question. It is positively not a 'reasonable' cost reduction, indeed, on occasions it may appear to be decidedly unreasonable, but anyone faced with such an apparently unreasonable target must remember that, by definition, the cost required to be achieved is already being achieved in other companies, so that there is no fundamental reason why they should not achieve it too.

On the other hand, when setting cost reduction objectives, it should always be remembered that the extent of the reduction demanded will determine the time, cost and depth of the subsequent investigation. A cost reduction of, say 10% will probably be achieved by a comparatively quick, superficial exercise whereas if a reduction of 30% is required, a much more lengthy and fundamental investigation of the design of the product, and possibly of the company's overhead structure and allocation as well, will be necessary.

The problem of the overhead structure arises because, with large cost reduction targets, an S.P.C.L. team can readily find themselves in the position of the engineers who, in a recent exercise, were set the target of a 35% cost reduction on a semiconductor device. On examining the cost breakdown, they found that it was made up of 4% material, 14% direct labour, and 82% overheads. Clearly, this investigation had to include aspects of the company's activities other than the more usual ones.

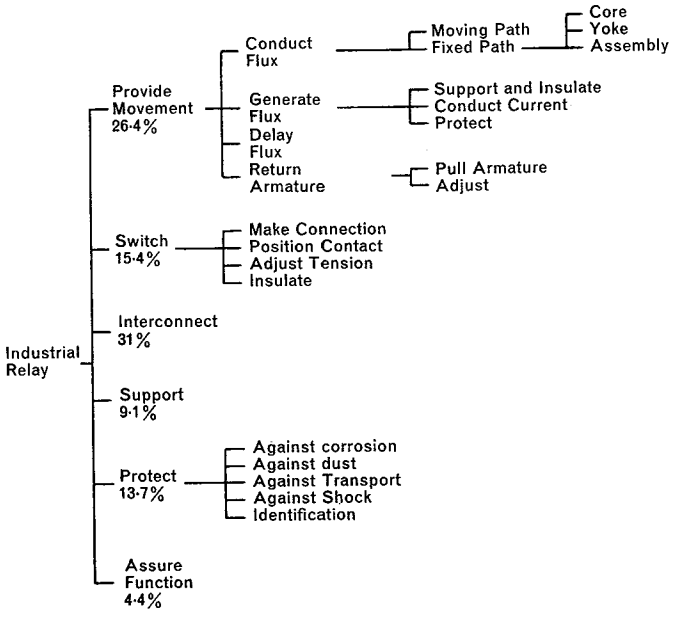
Step 3 – Analyse Product by Function Diagram

This, of course, is the stage at which the S.P.C.L. team proper starts work with a clearly defined objective. It will be noted that the method to be used for the functional analysis of the product is the functional diagram rather than the more conventional separation into primary and secondary functions. Experience has shown that on complicated equipment the isolating of secondary functions often does not lead to any very useful conclusions and that

it is more profitable to break down the internal functions and sub-functions of the equipment, all the way down to components if necessary, by means of a function diagram. In this way, when the various function and sub-functions have been costed, it is usually fairly clear where the high-cost, poor value areas are. The S.P.C.L. team will concentrate on these areas, having in mind that on a large equipment it is quite impractical to examine every detail, so means must be found for concentrating the effort where it will do most good.

For the benefit of those not familiar with functional diagrams an example is shown of a diagram of a fairly simple product, an electromagnetic relay. The various internal functions have been broken down and down into sub-functions, and normally each of these would be costed at Step 4, although in the example only the first stage breakdown costs are shown as a percentage of the total. However, in this case the first stage breakdown has already revealed a ridiculous situation, where the cost of the internal connections to the contacts and the operating coil (the 'Interconnect' function) is higher than that of the 'Provide Movement' function, which is the basic function of an electromagnetic relay. It is clear, therefore, that complete re-engineering of the interconnection system is necessary, and since the results of this may affect other parts of the relay, it is probably not worth proceeding further until this re-engineering has been done, at least in outline.

Industrial Relay



So far, reference has been made to 'The S.P.C.L. team' without saying who they are, but since the composition of the team is fundamental to the success of the operation, it would perhaps be appropriate to outline the basic requirements at this point. The requirement is that the team should consist of a design and an industrial engineer, allocated to work full time on the project. This compares with the normal arrangement where a value engineer, who is usually basically an industrial engineer, works on a number of projects at a time, and begs advice and assistance from design engineering as and when necessary.

Full time working is specified mainly to ensure that the project is completed with all possible speed. Many of these who have worked in Value Engineering must be familiar with the situation where regular meetings are held between groups of people who have been allocated to a project on a part-time basis, and although the meeting may allocate various tasks, when those attending the meeting return to their own departments, the pressure of day to day work is such that very little actual work is done before the next meeting, so that the same tasks are allocated again. In due course the tasks are completed, but the project takes many times longer than it need have done and if we are indeed dealing with the Company's most important product from a cost reduction viewpoint, it is quite unacceptable that time should be wasted in this way.

The design engineer has been made a permanent member of the team simply because, in a complex equipment, a high level of technical competence is needed at each stage. It will be quite obvious that such competence is necessary in order to prepare the function diagram, and it will become clear that it is even more necessary at subsequent stages.

Step 4 – Determine Costs by Function

In principle, this is a quite straight-forward operation of putting down costs against each function shown on the function diagram. However, the point should be made that what is required are real costs, not standard costs or any other accounting fiction. For example, it is obviously just as much a cost saving to make a change which enables a certain item, now made at twice standard cost, to be made at standard, as it is to halve the cost of an item already being made at standard. Therefore indirect costs, such as tooling, inspection, packaging, scrap and rework, etc., must be taken into consideration, and obtaining the necessary information may not be easy. Nevertheless, unless this is done, the present costs of the functions will be incorrectly assessed, and any decisions on alternatives based on them may well be incorrect.

Step 5 – Review Specifications by Function

The importance of specifications in determining costs is often minimised in Value Engineering but, in fact, the cost of a function may well be determined more by the specification attached to it than by the nature of the function itself. This will perhaps be fairly obvious in equipment made for Government agencies or to their specifications, for example aircraft or defence electronics, where not only is every detail of overall performance specified, but individual components and materials are also subject to exacting requirements and elaborate specifications. But the importance of specifications as cost determining factors extends outside these fields. If we prepare a list of primary and secondary functions of two motor cars, we will find that the primary and secondary functions of, say, a Jaguar and a Mini are identical. Everyone agrees that both these cars represent good value, although their prices are different by a factor of 3 or 4:1. The reason for the price difference lies, of course, purely in the specification (how fast, how much luggage, how quiet, how comfortable, etc.), and not in the functions, whether primary or secondary. Even more extreme examples can be found in other fields, the difference between a small mobile radio transmitter and a broadcasting station, which is almost purely a matter of specification, gives rise to a price ratio of at least 10,000:1, and so on.

Now it is true that in normal Value Engineering work it may emerge, to some extent by accident, that the reason for apparent poor value in a function is the specification attached to it, but it is felt that since, as indicated above, the cost determining effect of specifications may be overwhelming, definite, organised examination of specifications is essential.

In examining specifications the S.P.C.L. team will first of all consider whether the overall equipment specification is what the customer really needs, rather than what someone thought he needed, or even what someone thought he might like. This will involve liaison with marketing. Next, in considering internal functions of the equipment, the team will consider whether some comparatively minor aspect of the overall specification has caused particular functions to become unexpectedly expensive, so that a comparatively small reduction in the specification could give a

large reduction in cost. Again, liaison with marketing will be necessary. Finally the team will consider whether the specifications of internal functional components are consistent with the overall specification and with each other; in other words, whether we have achieved the equivalent of a Rolls Royce engine in a Ford car. It is not unusual for these comparisons and considerations to raise still further questions on the overall specifications, with yet more liaison with marketing.

Step 6 – Develop Feasible Alternatives

Having clarified any confusion that may have existed as to exactly what the equipment is expected to do, and obtained costs of all the sub-functions that enable it to do it, we come to the most interesting, and most demanding, part of Value Engineering, the development of alternatives.

This has been traditionally accomplished by the use of brainstorming techniques, but the S.P.C.L. method has modified these for reasons already outlined and has substituted development of alternatives by the S.P.C.L. team itself by searching and, if necessary, by innovation/brainstorming in discussion with each other.

Searching consists of examining each function and then determining whether it is being performed better elsewhere, perhaps in another product in the same Company, perhaps in a competitor's product, perhaps in an unrelated product in another industry.

Innovation, on the other hand, is the process whereby alternatives are devised 'out of the air' along any paths that a creative mind can devise. However, it has been found that when alternatives devised in this way have been brought into line with practical considerations of available components or processes, they have often proved to be a case of 'reinventing the wheel', and the same solution could have been found with the expenditure of less time and effort by search and comparison techniques.

Of course, during the search for feasible alternatives, the S.P.C.L. team will enlist the services of, and obtain advice from, those around them, purchasing men, other design and industrial engineers, estimators, production men and so on, but the responsibility for organising the effort is theirs. So it is at this stage that the quality of the engineers who make up the team will really show, and, as in most other walks of life, it is idle to expect first class results from second class men.

It will probably be appreciated that the ease or difficulty in developing the alternatives will depend on the quality of the work done at earlier stages. If the function diagram has been well conceived and properly costed, the areas of poor value will be clear, as was the case in the sample function diagram shown in Step 3, and alternatives may be almost obvious. If the confusions which so often exist on specifications have been resolved, again the action required will usually be fairly clear. The S.P.C.L. team works through these areas of poor value, clarified specification, functions until they have produced technically feasible alternatives which will exceed their cost reduction objective by some 25–30%, this safety margin being introduced because very possibly a number of alternatives which are technically feasible may not be acceptable to management for investment or other commercial reasons.

A report is then prepared to the Company management listing the alternatives, detailing their implications (implementation costs, time for implementation, changes in specification or appearance, effect on interchangeability, etc.).

Step 7 – Select Alternatives

On the basis of the report from the S.P.C.L. team the management of the Company or unit selects the proposals which are to be put into effect. It should be emphasised that this is a management decision, for several reasons. Firstly, there are decisions on investment in tools, machinery or engineering time to be made; secondly, the implementation has to be considered in relation to the unit's existing position, programme and commercial commitments. For example, two alternatives may be presented, one of which saves a certain amount of money and would take only a few weeks to implement, the other saves slightly more but would take several months to implement. Normally the first alternative would probably be chosen, but it may be that there are several months' stock of the part which is to be replaced in the stores anyway. So in fact, implementation cannot possibly take place for several months, no matter what is technically feasible, and the second alternative is the correct choice.

Because of the effects throughout the unit, selection of alternatives is ideally made by a selection committee consisting of the General Manager and representatives from Marketing, Production, Engineering and possibly Factory Services. The exact arrangements will obviously vary with the size and structure of the unit concerned, the important point being that the selection is a management decision, not a technical one.

Step 8 – Prepare Action Plan

When the decisions on alternatives have been made it is the responsibility of the S.P.C.L. team to prepare an action plan for putting the selected alternatives into effect. This plan is naturally prepared in consultation with the managers of the various functions concerned, so that when it is completed it specifies targets which everyone concerned accepts as reasonable and practicable. The plan should be fully detailed as far as dates and persons responsible are concerned for each stage of implementing each alternative, a typical section would read 'Preparation of Engineering drawings. To be issued by 15th January 1969. Responsible: John Smith'.

The plan, when complete, is sent to the General Manager for approval and for issue over his signature.

Step 9 – Review Action Plan Progress

Although the progressing of the action plan is in principle a management responsibility, the S.P.C.L. team is charged with reviewing the progress of the plan with the appropriate managers, with assisting in the solutions of any problems so far as they are able, and with issuing a monthly report to the General Manager on the plan's progress. If any slippage occurs, the report must also contain a new promise from the manager concerned.

Conclusion

The S.P.C.L. procedure is an attempt by the ITT group of companies to develop new methods of Value Engineering to meet the problems of Value Engineering work in complicated electronic equipment, and to improve its effectiveness in dealing with all types of equipment. If may be of special interest to those value engineers dealing with technically advanced devices whether in the electronic or any other field.

Before the general adoption of the procedure a trial project was put through in one STC Division and was outstandingly successful. It has now been generally adopted throughout the Company and is operating on a wide variety of items ranging from a small relay worth a few shillings each to very complicated equipments worth some £50,000 each. Until this range of projects has been completed it would be premature to suggest that no problems will be encountered but it is already clear that S.P.C.L. represents a considerable advance on earlier methods. In a few months time STC should have saved its first million pounds by the use of S.P.C.L., and this will perhaps be an appropriate time to review our methods to see if any further improvements can be made.

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Basic concepts – Management Appreciation – Methodology

Organising the V.E.-Effort in a Company

by J. Burnside, C.Eng., M.I.Mech.E., M.I.M.C.*

In this the last of a series of three articles on the problems of establishing V.E. in a company, the author deals with Records dividing them into Historical, Statistical, Analytical and Product Report Records.
He advocates the use of a moving period chart which shows both the net savings resulting from value engineering, the change costs incurred, and the return on the value engineering investment. Such a moving period chart allows for the introduction of new products and the phasing out of old ones.
The forms for analysis and for reporting results are also outlined.

The importance of a properly constituted programme has been mentioned in an earlier article as has also the organisation of the value engineering activity within companies of differing size. No discussion on organisation would be complete, however, without giving attention to the maintenance of records relating to value engineering.

Records take many different forms but broadly may be classified under the following headings:

1. Historical Records.
2. Statistical Records.
3. Analyses.
4. Product Reports.

Historical Records

Before any analysis can be commenced, a mass of information must be collected and sifted so that an accurate specification can be drawn up relating to the product under consideration. (This process is usually referred to as the Information Stage.) Historical records can play a large part at this very important stage in an analysis and full use should be made therefore, of any information available on past sales volumes, customers' reactions to the products, service reports, guarantee repair reports, cost information, etc. Going back in time frequently helps in arriving at a more balanced view of what future requirements will be.

Most historical records used in a company are initiated and maintained internally but since the records are generally used for a purpose other than value engineering difficulty is frequently experienced in reducing them to the form required and extracting the relevant information. Simplification of presentation should be aimed at to minimise searching time.

Of course some historical information is of interest to a whole industry and it is records of this nature that are most often overlooked. Data in these cases is nearly always grouped and tabulated, in some cases being accompanied by very detailed explanatory notes. This type of record is statistical in form and is included under the next heading.

Statistical Records

As far as value engineering is concerned statistical records take two distinct forms. Firstly there are historical data which are systematically collected not only by the Company, but also by trade associations, financial publications, consumer associations and various Government bodies. Data in these cases are presented in tabular form, graphically, or by means of charts (histograms and pie charts, for example). Great benefit can be obtained from full use of this kind of published data when drawing up the V.E. programme and preparing specifications.

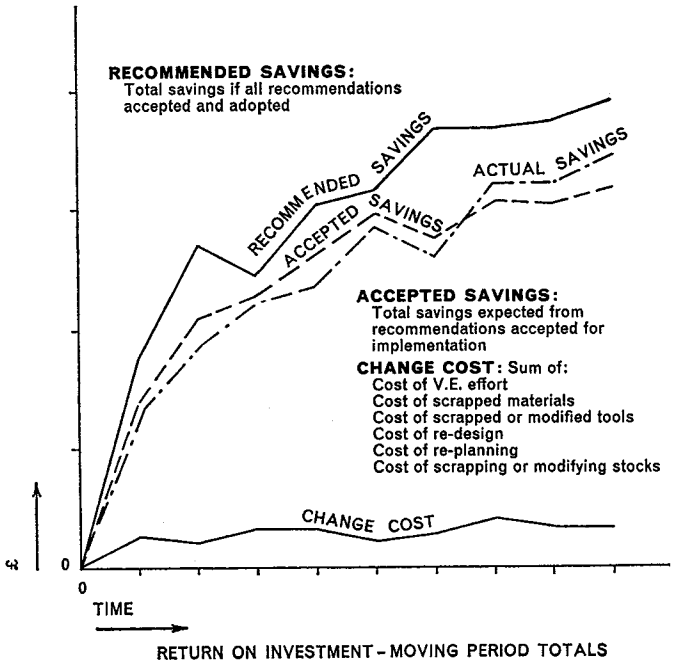
The second type of statistical records of interest to the Value Engineer are those which collectively show him and his management the results being achieved through value engineering. These records are compiled by the Value Engineer or by his department and are essential if the maximum benefit is to be obtained from value engineering. Incidentally, they also prove to a doubting management that value engineering really pays!

What kind of statistical information should the Value Engineer maintain? There is, unfortunately, a tendency for all engineers to develop a jackdaw complex which results in the accumulation of data which are rarely, and frequently never, used. Collection and presentation of data takes time and costs money and it is important, therefore, that some degree of selectivity be exhibited towards the mass of information flowing through the Value Engineer's office. Most companies employing a value engineering facility have rationalised the statistical information to be presented and are satisfied with (a) a moving-period chart which shows both the net savings resulting from value engineering and the change costs incurred and (b) the monetary return on the value engineering investment. The period is chosen to suit the complexity of the products being considered and may range from one month to one year.

Director and Chief Consultant of Value Improvement Ltd., Mr. Burnside is closely associated with the problems encountered in organising V.E. effort in a company. His two previous articles in this series appeared in the September and November 1968 issues of this journal. His address is Tack House, Longmore Street, London, S.W.1, England.

The advantage of a moving period chart is primarily that account can be taken of the introduction of new products and the demise of old ones. A typical moving period chart is shown in Figure 4.

Fig. 4



Analyses

For the purposes of value engineering certain procedures are always adopted for documenting a product analysis. It is important that after an analysis is completed a full record remains of all items considered and decisions taken during the analysis. This is necessary because at some future date a re-analysis will probably be embarked upon and a comprehensive record of the first analysis will ensure that the same ground is not covered twice. Complete documentation, while being time-consuming at the analysis stage, is time-saving later when the changes have been approved for implementation.

Most Value Engineers record analyses in three separate stages, perhaps using three forms. The first form relates to individual items and parts and gives a detailed account of material used, method and cost of manufacture and proposed savings through re-design. On documents of this type provision is normally made for subsequent re-appraisals. This is the Parts Analysis Form.

Where items together form a sub-assembly, details of the parts that go to make up the sub-assembly are entered on a second document – The Sub-Assembly Form – and cost information is transferred to this document from the Parts Analysis Forms. By adding up the costs for the complete sub-assembly, both before and after analysis, total profit improvement for that sub-assembly can be estimated.

Finally a Total Product Summary Form is raised giving details of all the sub-assemblies and other items which comprise the complete product. As before, a comparison between original cost and cost after V.E. is obtained by totalling the columns. Provision is also made on this document for further value engineering.
In some organisations all three records are incorporated into one document, a portion of the form being used for each record. Sometimes parts and sub-assemblies are recorded together and the total product analysis treated separately. How the recording is physically set down is of little moment. What is important is that it should be done carefully and completely.

Product Reports

No analysis is worth carrying out unless implementation is going to follow. To ensure that all the facts are conveyed accurately to the authorising body, in most companies action is taken, not on the total product summary, but on a special report prepared by the Value Engineer or his office. This report, usually termed an Analysis Report, contains recommendations on changes which have been shown to be worth implementing. In most analyses some prototype testing is commonly involved before the report is prepared. Reference to the results of the trials is then made in the report and, if adverse, this fact noted.

The Analysis Report is also a convenient vehicle for expressing the specification completely and including information relating to sales volumes, trends, competition, fashions, etc.

Under the heading of Product Reports must also be included Test Reports, Service Reports and Cost Reports. None of these originate in the Value Engineering Department but, nevertheless, they constitute important information for use by the Value Engineer. Without them his job would be made more difficult.

Test reports are prepared by the department carrying out testing of main ideas and would range in complexity from a simple tensile test taking only a few hours to complete to reliability testing of a piece of complex military equipment. It follows that the degree of detail covered by the report varies with the qualities being tested and the specification which has to be met.

With regard to service, particularly in domestic and industrial equipment, the Value Engineer must have access to information on service requirements and service performance. In the interests of economy it is inevitable that some change will be introduced which, despite satisfactory testing, in service will adversely affect reliability or ease of maintenance. It is obviously essential for the Value Engineer to be made aware of such instances. Most companies deal with this by product reports issued by the Sales/Service Departments.

Finally, the Value Engineer must know how accurately his profit improvement forecasts have been justified and to know this he must receive a feed-back of information from the Cost Office or Accounts Department. If he has been guilty of over-estimating savings in a particular area, the knowledge that he has done so will preclude him from making the same mistake again. By this means his standard of accuracy will improve and he will constantly be kept up to date on manufacturing and purchasing costs. Companies operating standard costing procedures can give a very quick and accurate service to the Value Engineer. Companies using less sophisticated costing techniques have to take a little more trouble but it is generally realised that measurement of savings is essential.

Conclusion

In this series an attempt has been made to guide companies wishing to set up a value engineering facility for the first time. In Part I a number of common questions were set down. It is hoped that now most of these have been answered.

Value engineering is an organised approach to get the same value for less cost and it is the Value Engineer's job to do this. It will be noted, however, that value engineering is a group activity and the Value Engineer depends for success on the participation by other departments as much as he does on his own skill.

Acknowledgements

The author wishes to thank Tack Management Training Limited, for their kind permission to reproduce diagrams from their course 'Value Engineering'.

Reprint No. 1:5:6

Creativity – Management Appreciation – Basic concepts

A New Breed . . . The Value Managers

by Lt. Colonel Bert J. Decker, U.S.A.F.R. (Ret.)*

All history has taught us is that we cannot behave very scientifically about anything until we can measure it.
We certainly cannot predict and control that which we cannot measure.
Just over twenty-one years ago man – for the first time in history – advantageously defined value in measurable, demonstrable and verifiable terms.
On that day value became measurable in precise scientific terms and Value Managers were born.

Value Managers were nonexistent prior to that semantic clarification concerning value. That is why they are a new breed. Since that time they have been oh! so! slowly! growing. None have yet reached voting age. Their only authority stems from their own individual creativeness. They battle a highly organised, highly effective, intrenched, authoritarian dynamic apathy called Modern Management. They have listed the causes of unnecessary costs such as split authority, split capability, split responsibility, failure to use available specialists, poor horizontal communications, etc. *These indicate that Modern Management is very effectively and efficiently organised to cause unnecessary costs and costly conformity.* Young, lusty, persistent, dynamic, and creative this new breed fights for both responsibility and authority. Their new profitable effective weapon is Verifiable Value.

Verifiable Value gives this new breed, *these eager Value Managers*, a measurable objective for optimising the innovation required by our fast-moving modern world and its restless push for profits. That is their creative challenge and profitable opportunity. For that bright goal, they reach, or they are not Value Managers.

This paper briefly covers what Value Managers must do to take advantage of the many opportunities offered by their purposeful definitions and verifiable concepts. It also touches upon the assumptions upon which they will most effectively operate and the many approaches open to them.

Verifiable Words

The first assumption upon which the Value Manager must operate concerns words. They must assume that words must not only be defined in measurable, demonstrable, verifiable terms, but that such definitions must have purpose *and use words* advantageously to the problem at hand. For instance, molecular agitation can be discussed and measured in three different ways; that is, in terms of volume, pressure, and temperature. Which way we use *or whether we use two or all three ways* depends upon our problem on hand and our purpose. Further, they must operate upon the historical actuality that all scientific and engineering activity hinges basically upon semantic verification and that all innovation stems from a basic and fundamental semantic clarification.

The Highly Applicable Value Concept

Value Managers must also assume that their value concept is a very broad concept. They must realise that Vmax $= \frac{f(r)}{\$min}$ is not limited to Product Value, but is also highly applicable to Organisational Value, Educational Value, Military Value, and even Political and/or Social Value. In fact, they must realise that the only constraint to the application of this helpful value concept is lack of imagination. It can be applied to any human activity which has purpose. Every purposeful activity of man contains a desire to improve value of some sort whether that value is defined or not.

Value Managers should also note the degree to which this value concept provides an advantageous definition concerning problem solving. If we assume that a problem is a set of unrealised human objectives and that every achievable human objective can be defined in terms of verifiable functions or is not achievable, then both 'Problem' and 'Solution' can be written in terms of value. If fact, we have a problem when there is uncertainty concerning the required functions and/or costs are excessive. In such a case, value is minimum. A solution to such a problem is when we maximise value. This can be symbolised as:

$$\text{Problem} = \text{Vmin} = \frac{f(r)?}{\text{Cost max}}$$

and/or

$$\text{Solution} = \text{Vmax} = \frac{f(r)}{\text{Cost min}}$$

Note that these definitions have purpose. They stress that the purpose of all problem solving is to 'improve value'. They also stress that to solve problems we must move from high-level

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This paper was originally presented at the Paul Revere Chapter of the Society of American Value Engineers meeting in Boston, Massachusetts, whose kindness in allowing its reproduction is gratefully acknowledged.

abstractions (objectives) to low-level verifiable functions, a function stated as a demonstrable verb and a measurable or countable noun. This is the first definition of this broad concept 'problem' in measurables and Verifiable Value has given it to us.

Creating Value

The value concept also makes it obvious that the function of a Value Manager is to 'create/value'. He doesn't manage value; he creates it. At least, he has it created. Perhaps, rather than a Value Manager, he should be called a Value Creator. In fact, the desired terminal behavior of everyone in the organisation should be defined as 'create/value'. If there is anyone in the organisation whose behavior does not directly or indirectly contribute to the creation of value, a Value Manager should rewrite their responsibilities and re-educate them.

As I said, no process, whether a human activity or an industrial man-machine process, can be optimised unless a measurable objective exists which is the result of that process. Now we certainly cannot specify in advance the measurables of an unknown, still-to-be designed invention. However, with our value concept, we can now establish measurables in terms of that unknown invention's most important characteristic; namely, value. Thus, our concept of value provides us with a measurable objective for optimising the many processes which lead to the required innovation in modern industry. This is a real breakthrough for the research in creative behavior which has merely started in the last twenty years.

Optimising Product Value

How do we prepare to do this? We start with the end objective and work backwards. 'Product Value' is the end objective, and we must work backwards ascertaining every successive approximation which leads to that specific Product Value. These successive approximations turn out to be the steps of the Value Engineering Job Plan. These steps we have optimised to some degree empirically by laborious trial and error analysis over the last twenty years. Personally, I have never seen a V.E. Workshop training session fail to improve value in the last decade. However, we are far from really optimising the V.E.J.P. process.

We have yet to optimise the V.E.J.P. steps because we have failed to describe each step in measurable, demonstrable, and verifiable terms. Until we do, we cannot determine to what degree each step does or does not contribute to the finally objective of Product Value. Further, we have not developed optimum means for reinforcing correct behavior in each step to assure that correct behavior is learned. Optimising the V.E.J.P. process is a research project in itself. This is a challenging opportunity for Value Managers. In doing so, we must reduce each V.E.J.P. step to our V.E. terminology; that is, each V.E.J.P. step must be advantageously defined as a verifiable function such as 'collect/data', 'list/assumptions', etc. Naturally, all such V.E.J.P. required functions must be defined using a demonstrable verb and a measurable, countable, or verifiable noun. Otherwise, we will never be able to verify that we have optimised the V.E.J.P. All this is no easy task.

Optimising V.E. Management

Nor have we optimised what I call Value Engineering Management; that is, the process with which we select, man, fund, implement, report, and evaluate the effectiveness of V.E.J.P. studies. Here again the V.E. functional approach is highly applicable. Every required V.E. Management step must be advantageously defined as a verifiable function. Only then will we be able to maximise V.E. Management value.

Tied into the V.E. Management problem, however, is the fact that effective V.E. *overcomes* the organisational constraints which cause unnecessary costs, but does nothing about *preventing* or *eliminating* such constraints. This need to eliminate the causes of unnecessary costs brings us to another important challenge and opportunity for the Value Manager; that is, Organisational Value. Creating Organisational Value is the most important function of the Value Manager.

Optimising Organisational Value

Organisational Value, of course, is viewed as the required organisational functions divided by cost. Naturally, such 'required organisational functions' must be only those essential to creating Product Value. Can you not see the empires crumbling when the essentiality of every organisational function is challenged and deemed nonessential if it cannot be verified as contributing to Product Value? They will crumble even more when we dare to ask what other ways might we provide those functions deemed essential.

When attempting to ascertain better and less expensive ways to provide essential organisational functions, the organisational constraints which value engineers list as causers of unnecessary costs also cause excessive conformity and are very much the result of how we organise and operate modern organisations. As said above, modern corporations are very effectively organised to cause such unnecessary costs and excessive conformity and this is the reason why we continually beef and moan about that infamous 'stupid system'.

When we do value engineer that 'stupid system' – what we will do is, as Percy Coomber says, formalise the very effective informal organisation which now gets things done in spite of the formal organisation – we will find ourselves changing the organisation in very radical ways and negating many conventional organisational principles. We will also find ourselves redefining and clarifying words like 'authority' and 'responsibility' and devising better and faster ways to make decisions. In fact, we will learn to use verifiable value in a much more effective way to reduce risk.

Let me give you several examples of how analysing organisational constraints to improve essential required organisational functions will result in radical changes. Consider the fact that unnecessary costs are caused by lack of knowledge which results to a deplorable degree from the fact that organisational people have a bad habit of hoarding knowledge. Hoarding knowledge in a modern corporation is to some a sordid necessity and a survival factor in the continual push for managerial power. It is a very sad situation actually which many creative and cooperative managers continually fight to overcome, but it exists and it does degrade value.

Another constraining factor in modern organisation is that we do not optimise the rewarding and reinforcement of all effective creative behavior in the organisation. In fact, we operate on the erroneous assumption that we each work for only one boss when, if we are truly effective in the organisation, we work for many bosses. For instance, a design engineer may work for the Chief Engineer, but to be truly effective he must work for the Production Chief, the Procurement Chief, facilitate testing, and design what sales can sell. He is actually working for everyone in the organisation. However, his immediate superior evaluates his behavior only as it relates to the superior's responsibilities. This results in much effective behavior not being reinforced, not being rewarded.

Now let us assume that we face actualities and recognise that in spite of that passé conventional statement that a man can work for only one boss, we operate on the assumption that a man can effectively work for several bosses on a time-sharing basis and by having the responsibilities under those several bosses clearly specified. This would result in a much more flexible organisation, an organisation which would have many more communications routes. Because of improved communications, knowledge could not be hoarded to the degree it is now. Information dissemination and effective behavior reinforcement would both be improved.

Optimising Organisational Value, however, is going to demand a very deliberate and laborious listing of every organisational function, and a comprehensive V.E. study by many people to

provide the organisational functions essential to Produce Value for the least cost. Further, one of the most difficult but very essential organisational functions is to 'provide/educated and trained personnel'. This leads us to Educational Value, one of our most important values in modern industry. No modern corporation can survive without creative educated people.

Optimising Educational Value

Our value definition, our value concepts, procedures, and approach are all highly applicable to Educational Value. This is the greatest challenge to the Value Managers. Further, at the rate that industry is getting into education and not only getting into education, but *improving* education, it is not going to be long before some corporations will be running their own colleges. Sheer competition will force this into being. Let me tell you why.

It is an unfortunate fact that the so-called 'high educational standards' in American education are based upon failure. A college teacher has 'high standards' if he flunks a large per cent of the students. Every college in this country with 'high academic standards' is difficult for students to get in, but more difficult to stay in. Colleges plan on picking the cream of the crop and flunking too big a per cent of that cream. There are exceptions, but very few. However, industrial education cannot afford failure. As a result, in general, industry has much more realistic and effective training and education. Most important, Value Engineering training, because it has had verifiable value as a measurable educational objective, has been an outstanding example of how effective industrial training can be. Value Managers have been brought up on such training. They will never be satisfied with anything less effective.

Summary

That then is the opportunity of this new breed, the Value Managers. They are the men who are learning firsthand how to apply the value concepts. Slowly, laboriously they will learn to apply their value techniques to every procedure known to man.

First, they will optimise the Value Engineering Job Plan in their efforts to maximise Product Value.

Second, they will improve V.E. Management by using verifiable value as a measurable target in optimising the selection, manning, implementing, and evaluating V.E.J.P. studies.

Third, in optimising V.E. Management, the Value Managers will learn even more about the organisational constraints which cause unnecessary costs and excessive conformity. This will allow them to use the value concepts to value engineer the whole organisation and vastly improve Organisational Value.

Fourth, while improving Organisational Value, the Value Managers will realise their most important problem is education and especially Creative Education. They will use the V.E. techniques to both optimise innovation processes and improve Educational Value.

When the Value Managers do those four things, they will be justified in calling themselves Value Managers.

Since only those thoroughly trained in the value techniques can hope to do those four things, the Value Engineers of today will be the Value Managers of tomorrow. You are the Value Managers. Go ye! And creatively conquer! All of the world seeks value. You alone of all the disciplines know the power and value of verifiable value and how to achieve it.

Go ye! And achieve it!

Value Engineering Association

Since the first issue of the journal (in April 1968) when the affairs of the 300-strong Value Engineering Association were given notice the composition of the Association's Committee has changed.

The newly appointed Committee is Messrs D. P. Vincent (Chairman), D. W. Walter (Vice-Chairman), J. F. Gibson (Treasurer) and J. G. Gill (Secretary).

The remaining members of the Committee are Messrs W. L. Gage, R. Dick-Larkam, R. Peter Ritchie, B. J. Watts and F. Moore.

The November Newsletter calls for correspondence on Value Engineering and associated topics. 'In this way it is hoped (it states) to provide another Forum for the exchange of ideas between people with common interests.' It is requested that correspondence normally be limited to 200 words.

The Midland Branch of the Value Engineering Association held a meeting on Thursday, 16th January (6.30 for 7 p.m.) at the Rolls Royce Social Centre, St. Peters Churchyard, Derby, at which Mr M. Williams of the Hawker Siddeley Group Ltd spoke on 'The Organisation of V.E. in a Major Engineering Company'.

On Monday, 10th February (6.30 for 7 p.m.) the Midland Branch will hold a meeting at the Chamber of Commerce, Edgbaston, Birmingham. The Speaker is to be Mr Howard Leslie of Value Engineering Ltd, and he will discuss 'The Problems of the Practising Value Engineer'.

The Value Engineering Association's other activities will include an Annual Conference to be held in London on 8th, 9th and 10th May 1969. This will, it is thought, fit in with visitors attending the World Conference on Productivity which is to be held in London in the following week.

The following Regional Committees of the Value Engineering Association have been set up:

Midland Region (comprising these provisional boundaries – Birmingham, Worcester, Warwickshire, Northampton, Leicester, Nottingham, Derby, Stafford, Shropshire and Hereford).

Eastern Region – Norfolk, Suffolk, Essex, Cambridge, Hertford, Bedford and Huntingdon.

South-Eastern Region – London, Middlesex, Surrey, Kent and Sussex.

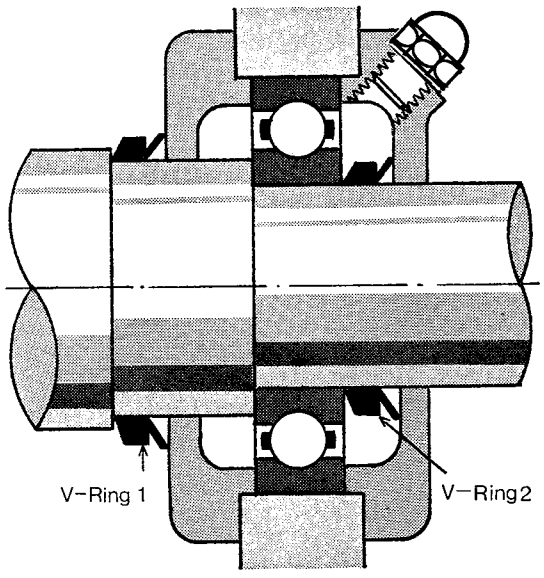
Western Region – Buckingham, Oxford, Berkshire, Gloucestershire, Somerset, Devon, Wiltshire, Dorset and Hampshire.

Twelve members were reported as having joined the Association: Messrs J. Baxter, W. D. Bullock, J. R. Clough, D. Davies, R. G. Frost, D. Loughton, R. J. Mackey, H. G. Mitchell, W. Miles, R. C. Rackett, C. H. Vessey, and D. J. Walker. British Aircraft Corporation (Holdings) Ltd has become a Corporate Member of the Association.

New members of the Association (which is trying to achieve a larger membership) are very welcome and correspondence concerning this and news items for the Newsletter should be sent to: Mr J. G. Gill, Secretary, The Value Engineering Association, c/o Glyn Mills & Co., Bankers, 25 Millbank, London, S.W.1, England.

How to make a 'Lubricated-for-Life' bearing with just 2 V-Rings

You probably know about V-Rings. They're those synthetic rubber, cleverly designed seals that are so easy to fit. Our drawing shows two of them in use. This design permits extremely long lubrication intervals to be used, depending on the fact that the bearing housing is virtually air-tight and the oxidising tendency of the grease is therefore reduced to a minimum. In many cases it is therefore possible to treat the bearing as if it is lubricated for life.
Another thing to remember about V-Rings is that they continue to operate satisfactorily even when the shaft has a pendular motion—they are also unaffected by shaft eccentricity and they are probably the only seals which can stand up to shaft misalignment. They are available from stock to fit *any* shafts, metric or fractional, from $\frac{3}{16}$" up to 40" diameter. Larger sizes can be made up to orders. All in all a very versatile design component. Why not write us for the latest information on V-Rings? You'll be interested in some of the applications ideas—and surprised.



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Reprint No. 1:5:7

Training – Management Appreciation

Value Engineering—Dynamic Tool for Profit Planning

by George H. Fridholm*

The author, drawing attention to the swift movement of events, indicates how vital it is for businesses to keep abreast of the latest 'tools' for increasing their profits.
Value Engineering is one such 'tool' and, as well as improving the profits, it is an excellent technique for training staff.
It aids employees to see project functions in relation to each other within the project; to see the interrelation of one department to another in the company; and to appreciate the importance of knowing costs.
Discussing first the objectives of the V.E. Seminar, Mr Fridholm then says that – from his experience – the participants will improve their habits and attitudes, think more creatively, and 'think function'. This latter will result in the development of new solutions to the problems of the business.

You walk into the Smithsonian Institution in Washington, and amid the assorted mementos of the nation's past, are two relics whose imprints upon history are still fresh. One is the first UNIVAC computer to be used commercially. It is a mere 18 years old and now a museum piece. The other is Friendship 7, Colonel John Glenn's Mercury capsule. It will be forever an historic symbol commemorating the plunge of the nation into the space age. It is six and a half years old, but it was a museum piece when it was only two and a half years old.

This dramatically demonstrates that what you and I think of as the future is not only here, but in part is already in the past. It shows how swiftly things are changing and it points very clearly to a great *need* – a need to gear ourselves for the change, and a need of *new tools* with which change can be accomplished.

It is easy to make plans and set goals based on past happenings and accomplishments. Instead, you should set your sights on the new horizons that are becoming sharp and clear, and meet the challenge with fresh approaches. It is vital that new techniques, new tools and new approaches be used to help you keep abreast of the latest developments in this fast-changing age.

Value Engineering is a dynamic, effective profit planning tool. By training your staff in Value Engineering techniques, you can improve all phases of your business – lead industry – better your products. And most importantly, dramatically improve your profit picture. The real difference in companies is their *people NOT* their *products*: Your people are your most important asset. And Value Engineering training can make your people more effective.

What is Value Engineering?

It is a set of techniques, an organised approach, to help you

recognise
define
solve problems.

It can help you improve

performance
schedules
cost
reliability
quality, any area that needs improvement.

The techniques can be applied to products, processes and services. The approach is to train key personnel to apply value techniques to projects for which they are responsible.

Value Engineering is Different

Value Engineering is 'Function' oriented.

You must ask 'What is the function?' of the product, process or service on which you are working. And after describing the function, you then ask, 'What else will do the job?' You must come up with new ideas, new concepts, to provide the function.

There are many other programs used for cost improvement. Work Simplification is applied to manufacturing methods. Producibility is oriented to best selection of machines and processes. Most cost improvement programs are 'part' oriented. And while all these programs do provide for manufacturing improvements, they are applied after the line is in production.

Value Engineering is function oriented and looks at a larger picture. It starts by examining the design concept from a functional approach. In addition, the methods, machines, processes and parts are all reviewed for possible improvement.

To develop new solutions to your problems, what you need is a new insight. Value Engineering, by defining the function, gives you this insight.

It sounds very simple, yet the tendency is to describe what a product, process or service IS rather than what it DOES. It takes effort and discipline to effectively develop this approach – but it is most rewarding since a better understanding of the entire project is obtained.

And now you ask – 'How can Value Engineering help me in my business?'

You need to answer a few questions.

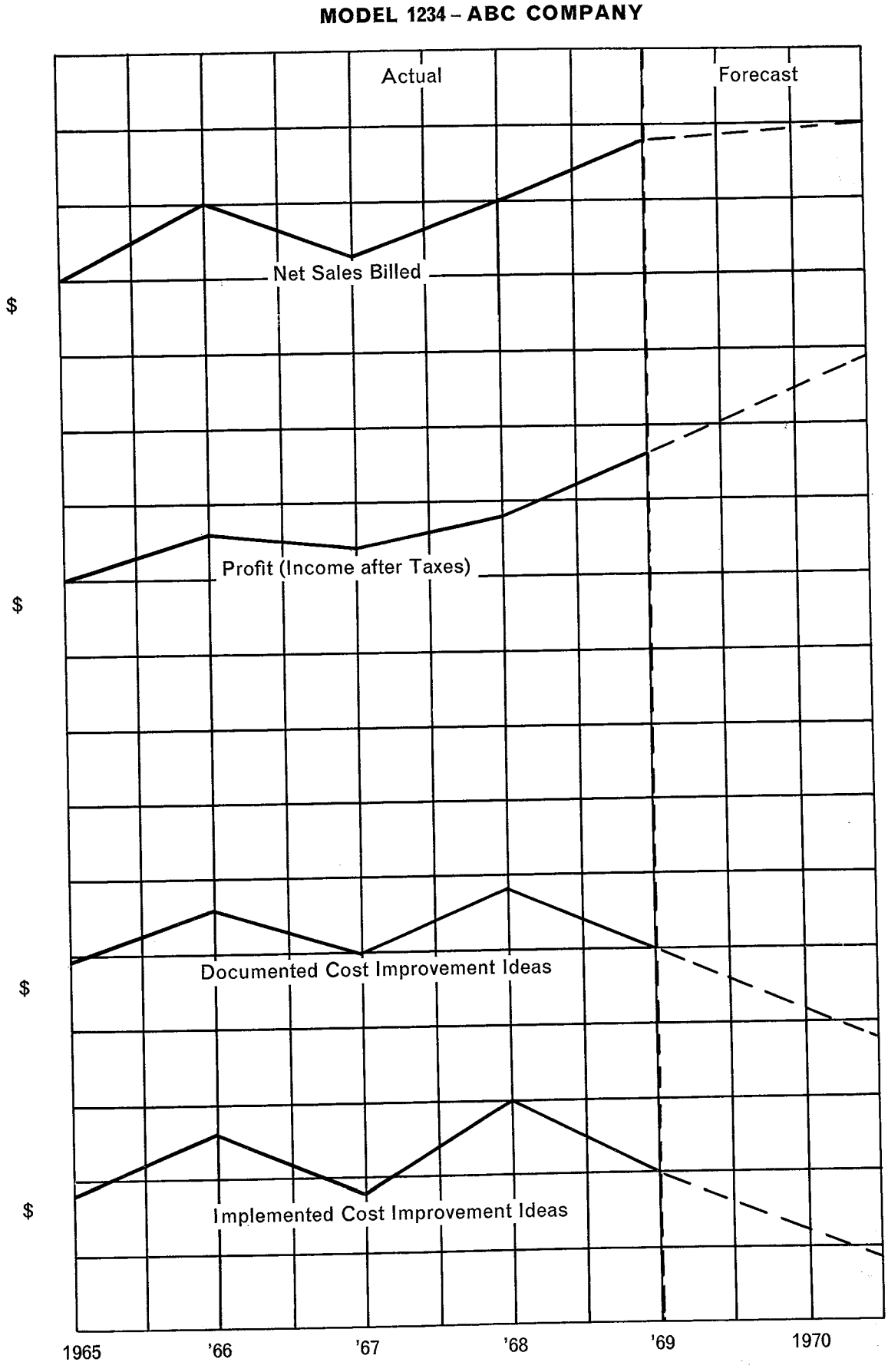
How do you plan for profit?

What is the ratio between your documented cost-improvement dollars and the cost-improvement dollars implemented?

How does this relate to profits and net sales billed?

* ***Mr George Fridholm, Chairman of George Fridholm Associates, is a consultant to business and industry in the fields of Value Engineering, product development, and creative problem-solving.***
Prior to becoming a consultant he spent twelve years with the General Electric Company in design engineering, in finance on special assignments, in manufacturing on computer applications, and as a value consultant.
His address is Burnt Hills, New York 12027, U.S.A.

Fig. 1



Value Engineering is needed

To help analyse your present profit improvement program. Figure 1 shows four curves.

This hypothetical example shows how these relationships can be graphically displayed. We assume that you will select an established product; that sales targets on the product are being met; and that it has a future market potential.

The figures show four curves . . . Net sales billed, Profit (Income after Taxes), Documented Cost Improvement Ideas and Implemented Cost Improvement Ideas.

From these curves you can develop a ratio of the Implemented Cost Improvement Ideas to the Documented Cost Improvements.

You can also develop a ratio of the Implemented Cost Improvement Ideas to Profit.
The dollar magnitude has been left off intentionally. For this discussion the trend of the curves is important.
Looking at the curves in Figure 1, you see that sales forecasts are up only slightly, while a big profit increase is required. Cost improvement ideas are on the decrease, which means that the cost improvement area is the one to be worked on. Some strong action must be taken to revitalise and stimulate the employees to generate and submit more cost improvements. If present in-plant programs do not provide that stimulation, Value Engineering is your next step.

Value Engineering is Dynamic Tool for Increasing your Profits

The quickest way to get increased profits is through an effective Value Engineering program, versus increased sales.
Assuming company profit is 5% on net sales billed after taxes, you would have to take an order for $100,000 to gain $5,000 in the profit column.
A Value Engineering proposal for $10,000 savings (assuming a 50% corporate tax) will net $5,000 profit.
With the order you have taken to make the $5,000 profit from sales, it would be necessary to do engineering, order materials, load the shop and meet shipping schedules.
With the $5,000 profit acquired through the Value Engineering Program, it would be necessary to have management action and implement the proposals, but it is by far the quickest way to increase profits.
It follows that in companies where profit made is less than 5% on net sales billed, much larger orders must be taken to make the same $5,000 profit. A business could realistically be making only 1% on net sales billed and for that company, sales would have to be $500,000, to gain this same $5,000 after taxes.
A Value Engineering seminar is an effective vehicle to generate a large volume of Profit Improvement ideas quickly through employee training in new techniques.

Value Engineering – an Excellent Technique for Training your People

The participants in a Value Engineering seminar have a broader business approach:

It helps them to see project functions in relation to each other within the project.
It helps them to see inter-relation of one department to another in your company.
They are made aware of the importance of knowing costs – often for the first time.
They are better able to realise the importance of their own position and contribution, in terms of the total company profit.

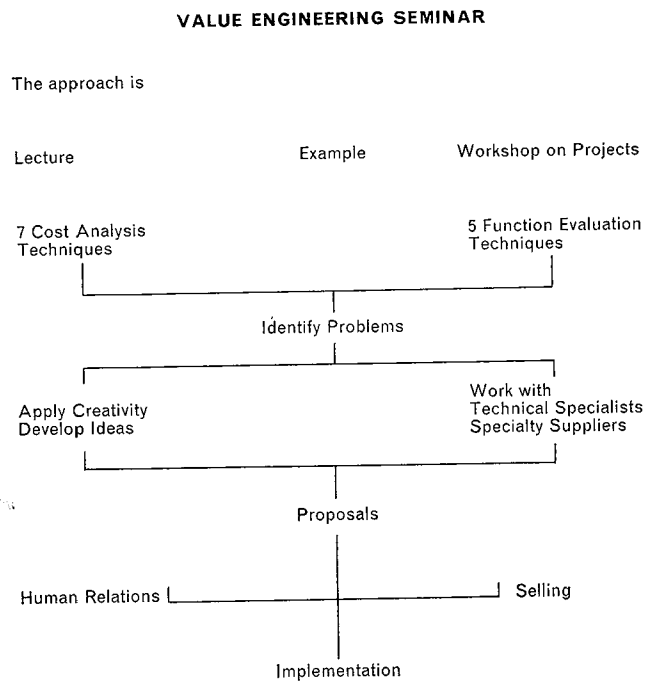
Value Engineering Seminar

You have a two-fold objective in the Value Engineering seminar. First, to learn a set of techniques to help you recognise, define and solve problems. Second, to demonstrate your understanding of the techniques by applying them to your projects and by writing Value Engineering proposals.
The seminar is organised into three-men teams to work on projects – projects from your company. The teams would be made up of an engineer responsible for the project, a person with manufacturing know-how on the project, and a person from accounting, purchasing, marketing, quality control or other discipline needed to support the particular project.
The approach in the seminar is outlined in Figure 2:

A lecture to describe a technique.
An example which shows how the technique has been applied.
A work shop where the participants apply the technique to their own project.

There are seven techniques of cost analysis to help you identify high cost areas and five techniques of function evaluation to help

Fig. 2



you identify unnecessary cost areas. These techniques help you identify problems (opportunities or challenges). The next step is to generate solutions to these problems. As you see in Figure 2, you can take two approaches and actually you should take both. No. 1 – you can generate your ideas by applying creative techniques and then develop these ideas. No. 2 – you can work with technical specialists and specialty suppliers to find the man who has the answer. Your objective is to write proposals to make improvements on the projects. Our experience is that these proposals can in general be of two types. First, from the cost analysis techniques will come changes to the present design – minor modifications. Second, from function evaluation, you will get new designs, new concepts, because you have asked 'How else can you provide the function?' In either case, we recognise that when you write proposals, when you want to make changes other people in the organisation must be told if your ideas are to be accepted and implemented. To emphasise the importance of this part of the program, we cover Human Relations and Selling in the seminar.
At the end of the seminar, the participants have learned new tools and skills, have applied and used them during the workshops and now bring forth, with great enthusiasm, proposals for potential dollar savings, new innovations and inventions, new materials, processes and applications, new suppliers, products and markets.
To maintain this spirit of enthusiasm, and for the company to gain full benefit, Management must now commit themselves, not only verbally, but by making it possible for these ideas to be applied. And as IBM puts it 'You have no commitment until you commit men and money'.

Benefits to You Through Value Engineering Training

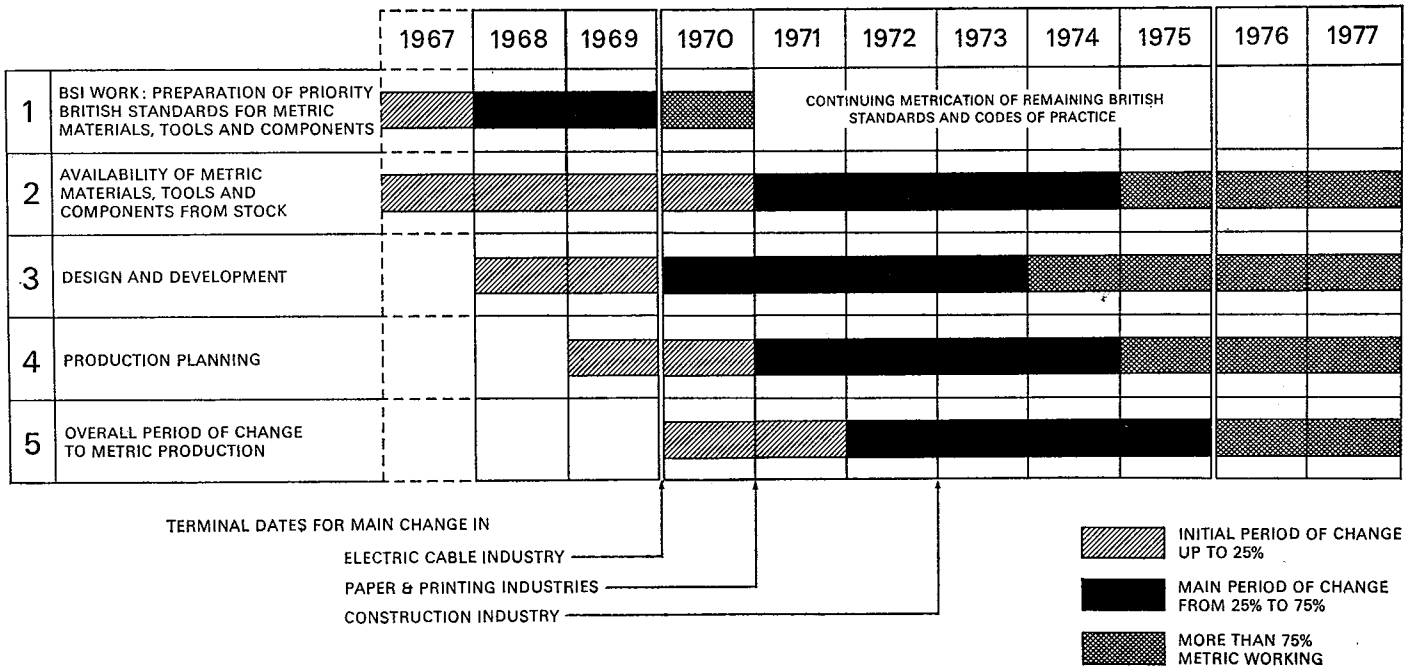
Your Value Engineering trained personnel can realistically look for the high dollar improvement when the situation arises that was identified in Figure 1, 'the big dollar gap'. They have techniques to help them and hence they will 'dig in' in a positive manner to reach the target that is needed.
The participants:

will have improved habits and attitudes
will be trained to think creatively and apply the techniques to future projects
will 'think function'.

Value Engineering is a dynamic, effective, profit-planning tool.

Metrication

THE ADOPTION OF THE METRIC SYSTEM IN ENGINEERING: BASIC PROGRAMME



The following is the text of a Statement made by the Minister of Technology, the Rt Hon. Anthony Wedgwood Benn, in the House of Commons on 26th July 1968:

'In May 1965 the Government announced their support for the adoption of the metric system of weights and measures in industry which had been proposed by the Federation of British Industry. They also accepted that the metric system would spread outwards from industry and become in time the primary system for the country as a whole. The Government consider that this will bring substantial advantages. More than three quarters of world trade is now conducted in metric units. All the Commonwealth countries except Canada have changed to the metric system or are about to do so and studies are in progress in the U.S.A. and Canada.

'In 1966 I appointed the Standing Joint Committee on Metrication, representing industrial management, the trade unions and the Government to encourage, assist and review the progressve adoption of the metric system by British industry. A report by that Committee makes three main recommendations. *First*, that manufacturing industry can only make the change efficiently and economically if the economy as a whole moves in the same direction on a broadly similar timescale, and in an orderly way. *Second*, that a Metrication Board should be established to guide, stimulate and co-ordinate the planning for the transition for the various sectors of the economy. *Third*, that any legal barriers to the use of the metric system for all purposes within the U.K. should be removed.

'The Government accept the recommendation that a Metrication Board should be set up as soon as possible. The Board will be advisory. The adoption of the metric system must be gradual, through democratic procedures based on the widest consultation. Membership of the Board will therefore reflect the interests of industry, the distributive trades, education (for which there are important implications) and particularly, the general public and consumers. Every sector of the economy need not move at the same pace. But there will be unnecessary confusion and expense, and great difficulties for industry, unless there is central machinery for co-ordinating the programmes of change for the various sectors.

'There can be no question of compensation; the costs of adopting metric weights and measures must lie where they fall.

'The Government agree that programmes for the different sectors of the economy can only be properly co-ordinated if there is some general guidance on the timing. They therefore accept the end of 1975 as the target date for all provisional programmes, with the qualification that if this date proves to be unreasonable for any particular sector, then programmes may aim at an earlier or later date.

'An initial task of the Metrication Board will be to submit to the Government an appreciation for each sector, including, so far as practicable, the costs and other considerations involved. In the light of this, programmes can be drawn for individual sectors. The Government will not be committed to endorse the programme for any sector of the economy before final proposals for that sector are submitted.

'The Government accept that legislation will be needed to remove obstacles to the adoption of metric units and to define the units to be used. Further consultation is, however, needed before the timing of legislation can be decided. Arrangements will be made to co-ordinate the interests of Government Departments so that they play their full part in the consideration of programmes and so that the public sector keeps in step as programmes develop.

'The educational system will need to keep pace with, and to some extent anticipate changes. The conversion will stimulate industrial and commercial modernisation and the rationalisation of production by variety reduction. We must also use it to help our export trade by harmonising our standards with those of our customers overseas.

'The adoption of the metric system in the United Kingdom will represent a major change affecting many aspects of the national life.'

The Checklist—An *Aide Memoire*

There are clearly many points to be checked in carrying out a V.E. exercise or in arranging a V.E. Workshop Seminar.

How can we be sure that we have missed nothing? A simple device to prevent things being overlooked is the Checklist.

There are some who believe that a Checklist is a substitute for thought – that anybody can do anything given the appropriate Checklist. This, of course, is not true. A Checklist is no more than an aid to memory – it is no better than the person who made it up. It consists merely of a list of things which is believed to be complete.

Like a housewife's shopping list it has the habit of requiring to be added to even at the last moment and in the act of shopping itself.

The great advantage of a Checklist, however, is that it is more comprehensive than conscious memory.

To prepare a Checklist we first of all write down all the points we can think of and later we add to it as we recall other points which should have been included. At any moment the Checklist represents the sum total of our recollections to date of all the points to be covered. This is its main advantage.

A secondary advantage from compiling a Checklist is that when all the points have been written down they can be arranged in some rational order and this may often facilitate doing the job for which the list has been prepared.

The Cost Reduction Program Checklist

There follows a Cost Reduction Program Checklist kindly supplied by Mr Frederick S. Sherwin, Value Engineering Coordinator at The Plessey Company Ltd.

It is divided into sections covering Administration, Motivation and Techniques. Other Checklists are set up function-by-function. As Mr Sherwin comments 'There are many more Checklist questions which could be added but any company which can answer "yes" to all these will have an excellent cost reduction program'. Using the Checklist periodically is one way of ensuring that a Company maintains its vigilance in the important matter of Cost Reduction.

V.E. Workshop Seminar Checklist

Also supplied by Mr Frederick S. Sherwin is the Checklist covering preparation for and follow up of a Value Engineering Workshop Seminar.

And the reader is also referred to Preparing and Conducting a V.E. Training Seminar *by R. L. Crouse (reviewed on page 248 of this journal) which is devoted to ensuring the success of seminars as far as their mechanics is concerned.*

COST REDUCTION PROGRAM CHECK LIST

It is recommended that Management and those who are directly responsible for the reduction of costs ask themselves the following thirty-six questions:

I. ADMINISTRATION

1. *Is every cost reduction chairman and coordinator well acquainted with the relevant company policy on this matter?* .....
2. *Does management at all levels direct cost reduction activities and hold monthly meetings to review results?* .....
3. *Does each business function participate actively and produce results in the program?* .....
4. *Are proper reporting procedures followed accurately and timely?* .....
5. *Does each manager and individual contributor know his responsibilities to the program?* .....
6. *Do all key employees who can contribute to the program have a copy of the Cost Reduction Program and has it been reviewed with them at staff meetings?* .....
7. *Have difficult goals been set and equitably allocated to all key techniques and each business function?* .....
8. *Does each key employee have a personal goal and does his supervisor measure his achievements in this area?* .....
9. *Is a proper balance maintained between cost reductions and cost avoidances?* .....
10. *Is there an attempt to insure that all cost reduction efforts are documented?* .....
11. *Are all cost centers the object of cost reduction effort?* .....
12. *Are cost reduction projects purposely and systematically selected, and targets and time tables set?* .....
13. *Are cost reductions properly validated?* .....
14. *Are periodic progress reports on cost reduction projects required at staff meetings?* .....
15. *Are all the sub programs given the appropriate attention and direction?* .....
16. *Are sufficient people and time allocated to administer an effective program in all areas?* .....
17. *Are suggestions answered promptly and is follow-up and implementation expedited?* .....

II. MOTIVATION

18. *Is each employee encouraged by management to contribute regularly to the program?* .....
19. *Is suitable recognition, rewards and compensation provided to each contributing employee?* .....
20. *Are posters, articles, news sheets and other promotional methods used to keep the program dynamics and provide continual individual motivation?* .....
21. *Does each employee understand his responsibilities to contribute regularly to the cost reduction program?* .....
22. *Is the cost reduction effectiveness of each business function and individual measured and are they informed of this measurement?* .....

III. TECHNIQUES

23. *Are all key decision makers trained in value analysis techniques?* .....
24. *Are all analytical techniques applied to appropriate cost centers?* .....
25. *Is creativity encouraged and does a creation atmosphere exist?* .....
26. *Are creative techniques broadly employed in problem solving?* .....
27. *Is teamwork prevalent in decision making and cost reduction project work?* .....
28. *Are cost targeting or product cost control concepts employed?* .....
29. *Are new materials, products, processes, sources, techniques etc. given wide publicity?* .....
30. *Are information seminars held?* .....
31. *Are special task forces conducted?* .....

32. *Are all cost centers the object of cost reduction efforts such as:*

procedures	.....
paperwork, publications	.....
scrap	.....
traffic	.....
filing systems	.....
shipping and packaging	.....
telephone	.....
lighting and services	.....
maintenance	.....
inventories	.....
warehousing	.....
capital equipment	.....
heating, air conditioning	.....
food services	.....
test and calibration	.....
inspection	.....
engineering drawings	.....

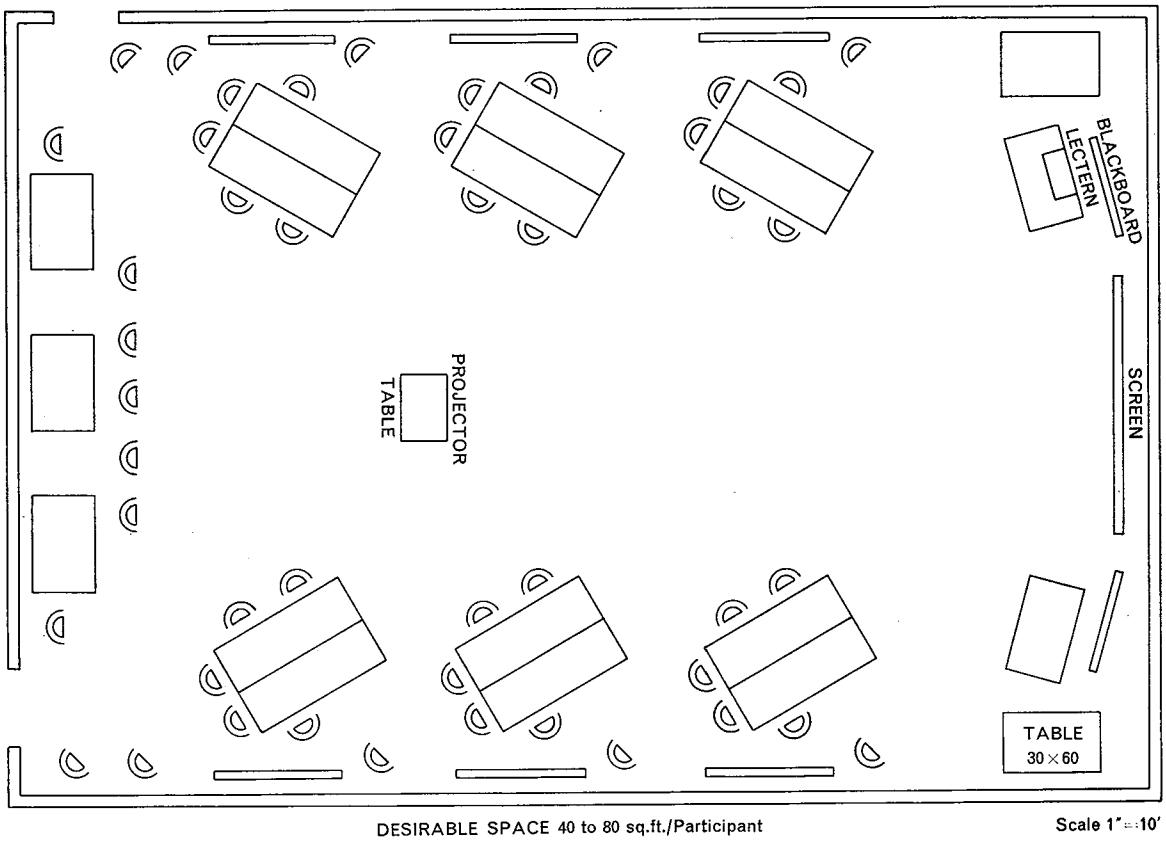
33. *Is every effort made to capitalise on the profit making aspects of Value Engineering and cost incentive contractual clauses?* .....

34. *Is cost information well organised and quickly available for analysis?* .....

35. *Is cost estimating done rapidly and efficiently?* .....

36. *Are work measurement and simplification techniques widely used?* .....

VALUE ENGINEERING SEMINAR
TYPICAL ROOM LAYOUT



DESIRABLE SPACE 40 to 80 sq.ft./Participant

Scale 1"=10'

V.E. WORKSHOP SEMINAR PREPARATION AND FOLLOW UP CHECKLIST

Those responsible for the preparations for a V.E. Workshop Seminar can indicate by a single slash (/) in the appropriate week column when an action is required to take place and then by crossing through such slash can indicate the action has been completed.

Action	*Weeks before Seminar*										*Weeks after Seminar*				*Responsibility*
	10	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*1*	*2*	*3*	*4*	
I. ADMINISTRATION															
A. Management Support															
1. Budget															
2. Manpower															
B. Management Letters															
1. To functional Management															
2. To Participants															
C. Training Material – Handouts															
1. Course Outline															
2. Workbooks															
3. Reference Manuals															
4. Worksheets – Paper															
5. Flip charts – (30 x 40) Markers															
6. Articles – Papers															
7. Participant List – by teams															
(Names, title, tel. no., Project)															
8. Project Information															
(Drawings, Costs, Methods, Specs, Hardware)															
9. Suppliers List – by day															
(Company, representative, Product, tel. no.)															
10. Consultants List															
(Name, specialty, location, tel. no.)															
D. Test Papers *(used during Course)*															
E. Coffee Arrangements															
F. Final Day Invitations															
G. Critique *or* **Comment Sheets**															
H. Liaison															
1. Training Dept.– Manpower Development															

Action	Weeks before Seminar										Weeks after Seminar				Responsibility
	10	9	8	7	6	5	4	3	2	1	1	2	3	4	
I. News – Release															
1. Photographs of Seminar															
II. PROGRAMME															
A. Outline – Times															
B. Lecturers															
C. Speakers															
1. Management															
2. Guest															
D. Consultants															
III. STAFF															
A. Selection															
B. Training															
1. Responsibilities															
2. Techniques															
C. Team Assignments															
D. Meetings															
IV. FACILITIES															
A. Room – Layout *(Light Control)*															
B. Equipment															
1. Tables															
2. Chairs															
3. Blackboards															
4. Visual Aid Equipment															
5. Lectern															
6. Display Tables															
7. Supplier Display Area and Tables															
C. Telephones															
D. Reference Books															
1. Directories															
2. Buyers' Guides															
3. Catalogues															
V. PARTICIPANTS															
A. Selection															
B. Information *(Background)*															

Action	Weeks before Seminar										Weeks after Seminar				Responsibility
	10	9	8	7	6	5	4	3	2	1	1	2	3	4	
C. Team Arrangement															
D. Inform about Seminar Programme															
VI. PROJECTS															
A. Selection															
B. Information															
1. Cost															
2. Sources															
3. Methods Sheets															
4. Specifications															
C. Hardware															
D. Assignment to Team															
VII. SUPPLIERS															
A. Selection of List															
B. Attendance Days															
C. Invitation															
D. Instructions															
E. Meet, Escort, Lunch															
VIII. FOLLOW-UP															
A. Appreciation Letters															
1. Suppliers															
2. Guest Speakers															
3. Consultants															
B. Project – Proposals															
C. Report															
D. Training Department															
E. Publicity															

MATTERS FOR DECISION IN CONNECTION WITH NEW PRODUCT DEVELOPMENT

In considering whether or not to embark upon the development of a new product reflection on questions such as those which follow will help to ensure that all relevant matters have been taken into account:

A. General Considerations for Favourable Development of new Product Lines

1. *Is executive experience broad enough to cope with new product lines?*
2. *Have sufficient funds been earmarked to finance:*
   - *(a) design*
   - *(b) the development of the new product?*
3. *Is the Board of Directors favourable to the introduction of this new product line?*
4. *Is this product a part of a well-defined development goal?*
5. *Is the company properly organised for product line development?*
6. *Does the company possess sufficient engineering design talent to attempt the development of this new product?*
7. *Would the present products be insensitive to the new product?*

B. Considerations in Selecting this New Product

1. *Does it make possible the utilisation of excess facilities?*
2. *Can the present company organisation absorb the additional work?*
3. *If new and specialised personnel are required, can you secure them when needed?*
4. *Has the company the financial strength to develop, manufacture and market the product?*
5. *Does a sufficiently large market exist to make the new product a probably financial success?*
6. *Is the market one presently being sold by the company?*
7. *Does it complement existing products?*
8. *Will it be essentially free of competing products at the time of its introduction?*
9. *Are expected profits sufficient to justify the expense of development and introduction?*
10. *Will you have patent protection?*
11. *Can your present service organisation absorb the product, or won't one be required?*
12. *Is it unlikely that competition will appear on the scene for the first two or three years after the product's introduction?*
13. *If competing products are already on the market, will your product have a significant price advantage?*
14. *If product will have no price advantage over competitors, can it be sold successfully because of other advantages at the same price with an adequate profit?*
15. *Will your company's name and reputation be of advantage in selling the product?*
16. *Will the life of the product and related profits justify the expenditure required to develop, manufacture, sell and service the product?*
17. *Is the history of similar products favourable?*
18. *Will the introduction of the product tend to cement relations with existing customers, rather than alienate them?*
19. *Will it be difficult for competition to establish itself because of technology, facility cost, market peculiarities, etc?*
20. *Will it require production facilities similar to those now operated by the company?*
21. *Does the engineering department generally have specific experience in the technical areas involved, even though sufficient numbers do not presently exist?*
22. *Will you have sufficient time to develop the product before its market value begins to decrease?*

C. Considerations relative to Manufacturing the new Product

1. *Will it utilise excess plant space?*
2. *Will it utilise excess manufacturing facility capacity?*
3. *Are the excess plant space and the manufacturing facilities located so that they can be advantageously used to produce the new products?*
4. *Is the necessary labour supply available in the plant area?*
5. *Is trained supervision available?*
6. *Do the plants have substantial experience in producing similar products?*
7. *Are no radically new techniques or facilities needed to produce the product?*
8. *Can a substantial number of the parts be manufactured more economically than purchased?*
9. *If the product is highly competitive, is the manufacturing organisation now successfully producing highly competitive products?*
10. *Does the necessary quality control organisation exist in the factory?*
11. *Does the factory have the right specialists now on their staff to successfully manufacture the product?*
12. *Has the factory produced a satisfactory and realistic estimate of the plant, facility, tools, etc., that will be needed?*
13. *Has the factory realistically estimated their start-up and labour cost for the various anticipated run rates – and have the factory estimates been used in analysing the potentialities of the product?*
14. *Will future foremen and supervisors be used to help manufacture the prototypes?*
15. *Does manufacturing generally agree that the design concepts are practical and do they see no major barriers to successful production?*
16. *Will the new product manufacturing activity exploit existing plant waste products?*
17. *Is the proposed manufacturing plant suitably located near raw material sources?*
18. *Is the plant suitably located near necessary subcontractors?*
19. *Will the introduction of the product lower the costs to produce existing products?*

D. Evaluating the Market Potential for the new Product

1. *Is the product saleable to present customers?*
2. *Does the existing sales distribution system serve the potential customers?*
3. *Is the existing sales and distribution system of adequate size and capacity to handle the introduction of the product (assuming that it presently reaches and serves the potential customers)?*
4. *Does the product supplement or complement the existing product lines?*
5. *Will the introduction of the new product likely have a desirable effect on sales of existing products? (An adverse effect is usually a major hindrance).*
6. *Will the sales of the new product tend to offset the seasonality of existing product sales? (A new company with no products starting up with a highly seasonal product has a major obstacle to overcome).*
7. *Is the expected life of the product of considerable length?*
8. *Does the product fill a well-established need?*
9. *Can it be sold at a price that assures a reasonable return on the required investment?*
10. *Will the expected profits recover the development and special tooling costs in a reasonable period of time? (Make sure this isn't longer than the anticipated life of the product).*
11. *Have the necessary advertising and sales promotion expenses been determined?*
12. *Will the anticipated returns from the sale of the product recover the advertising, sales promotion and sales expense as well as development, engineering and special tooling costs?*
13. *Will the market for the product be a stable one – not greatly affected by general economic trends, war, technological change, etc.?*
14. *Is it unlikely that substitute products will appear on the market?*
15. *Is it unlikely that some company will introduce the same or a substitute product at a price that will 'kill' your new product?*
16. *Does the company have a national or international reputation to the concerned classes of customers that will aid in selling the new product?*
17. *Is the product such that there will be no need for a field installation and/or repair organisation?*

18. *If a field installation and/or repair organisation is required, can one of the company's existing organisations doing this work absorb the load and will the problems be similar in skill requirements to those now being handled?*
19. *Can the sales of the product be built up to a satisfactory level in a reasonably short time?*
20. *Have the engineering department's statements regarding the advantages offered by the new product been actually checked with a sufficiently large sample of prospective customers?*
21. *Can the product be offered under the same terms as the customers are used to receiving from competitors and/or from suppliers of similar products?*
22. *Is the market history of similar products desirable?*
23. *Has a detailed and objective survey of competitors been completed to determine what actual and/or potential competition will likely be encountered, and did it disclose an answer favourable to the introduction of the product?*
24. *Will the new product not compete with, imitate, or injure present customers?*
25. *Will the product be introduced at the optimum time?*
26. *If one or more competitive products exist, will the new product be competitive in the following areas?*
    - *(a) Price*
    - *(b) Utility*
    - *(c) Quality*
    - *(d) Reliability*
    - *(e) Operating cost*
    - *(f) Size*
    - *(g) Appearance*
    - *(h) Service-free life*
    - *(i) Installation cost*
    - *(j) Safety, health, etc.*
27. *Has the product been designed to offer just the right number of special features, quality, etc., and not over- or underdesigned?*
28. *Have the proper and necessary customer use and service instructions been determined and will they be available when the product is introduced?*

Miscellany

Kipling's *If* Rewritten

Salome Dear, not in the Fridge (Allen and Unwin) containing a selection of the winning entries for the *New Statesman's* weekend competition. The competition has attracted wit, parody and satire. Rudyard Kipling's *If*, for instance, has been rewritten to conform with the spirit of our times:

If you can't trim your sails to suit the weather,
If you can't take your chance to pass the buck,
If you can't offer cardboard goods as leather
And then persuade the mugs to buy the muck;
If you can't work a profitable fiddle
Or cheat the Customs when you've been abroad,
If you can't wangle your returns, and diddle
The Income Tax, yet not be charged with fraud;
If you can't learn the craft of social climbing
And damn the eyes of those who're underneath;
If you can't kid your friend you're not two-timing,
Then, when it suits you, kick him in the teeth;
If you can't run a car on public money,
Or have your lunch each day at the Savoy,
You're going to find that life's not all that funny,
For, take my tip, you'll miss the bus, old boy.

H. A. C. Evans

Zero Error . . . Zero Defects

Is there room for a Z.D. Programme alongside a V.E. Programme? A reprint from *Design Electronics* (obtainable from Heywood-Temple Industrial Publications Ltd, 33 Bowling Green Lane, London, E.C.1) provides some comments on the Z.D. Programme. It covers:

The 'DO IT RIGHT FIRST TIME' approach
The Purpose of the Z.D. Programme
The Applications of such a Programme
Staff to run a Z.D. Programme
Organising a Z.D. Programme
Operating a Z.D. Programme

Using 'Defects' in a broad sense the following apply to the people listed below:

Production operators ..	Defective parts or items
Inspectors	Wrong components, etc., etc.
Typists	Inaccuracies
Draughtsmen	Incorrect tolerances
Salesmen	Wrong customer approach
Cost accountants	Errors in budgets
Senior management ..	Poor administrative practices

Thus it can be seen that a Z.D. can apply to almost anyone in a company.

Miscellany

Organised Cost Reduction

'The real problem of organising for cost reduction is to ensure that people at all levels are continuously reviewing their operations and accepting the reduction of cost as part of their responsibilities.'

This sentence appears in *Organised Cost Reduction Techniques for Modern Warehousing* by Brian N. McKibbin recently published in England by InComTec, 30 Fleet Street, London, E.C.4.

'Of course', the author continues, 'Cost Reduction is not an end in itself. The main reason for an effort to organise Cost Reduction is the need to keep pace with competition.'

A section of the book on the use of a contribution cost model describes a computerised method for the allocation of variable depot costs to inventory and deliveries, such that the contribution to the recovery of fixed depot costs made by sales to individual customers can be determined.

* * *

Banging Things Into Shape

New Technology (Issue Number 21) mentions the developments over the last ten years in metal forming by explosives.

In this method the workpiece is fixed in position between the forming die and the explosive charge, with a suitable shock-transmitting medium (such as water) between charge and workpiece. When the charge is fired, the explosive force is distributed over the workpiece, which shapes itself over the die.

Plant now installed at Radway Green can make components up to 6 ft across and 10 ft in diameter. Finishes of optical standard can be achieved. Typical products are pressure vessel sections and boiler ends.

Explosive forming's main advantage for small batch production as compared with pressing and spinning is that it does not involve heavy capital outlay for plant which may stand idle for much of the time. Only a die is needed – the punch being formed by the shock transmitting medium between the explosive charge and the workpiece.

The cost to make a component by explosive forming is £7 15s. 0d. with tooling representing only 35% of the cost. Only a female die of SG cast iron, fettled to give the desired surface finish, is required.

To make the same component by conventional pressing would cost £73, with tooling 96% of manufacturing costs.

* * *

Specialist v. Generalist

H. L. Gossage writing on 'The New World of Marshall McLuhan' in *McLuhan Hot and Cool* (Penguin) has this to say about specialism: 'The specialist is by nature environmental. He is committed to what McLuhan calls a fragmented function within a given process linkage. If his environment changes he will not necessarily become extra-environmental. It is more likely that he will carry his tendency to specialism with him the way a snail does his shell. A born specialist will tend to interpret all experience in the light of his own expertise. Illustrative story: One time a cloak and suit manufacturer went to Rome and while he was there managed to get an audience with His Holiness. Upon his return a friend asked him, "What did the Pope look like?" The tailor answered "A 41 Regular".

'If specialism epitomises the environmental stance, then generalism probably covers the extra-environmental. A generalist starts from the outside of a given environment; a specialist works on the inside. McLuhan has a special aversion to specialism; a sign in his office proclaims, "No specialist need apply". This does not mean that he is against professional expertise in the solution of problems, only against its built-in blinkers.

'Once you take a problem to a specialist you are wired in to a specialist's solution. However well executed it is, the odds are against its being a real answer.'

Factors Influencing the Real Acceptance of Ideas*

'The factors which influence real acceptance of ideas – *as contrasted with polite "agreement" designed to avoid doing anything* – can be listed as follows:

1. The listener likes the speaker.

2. The listener accepts already the speaker's authority in the field. The above are both concerned with the listener's attitude to the speaker as a person. Next come factors concerning the way he presents his ideas, his manner of speaking, and indeed of behaving.

3. The idea must be put in a way the listener likes; this of course varies, and the speaker's skill must help him know what it is.

4. It must raise no antagonism. There are plenty of words which conjure up past memories of ill-will and suspicion and can thus in a moment transform an atmosphere of sweet reasonableness into a storm of misunderstanding.

5. It must, instead, fit in, if possible, with some interest the listener already possesses.

6. Some people vary widely in the way they learn, other methods than speech may help.

This list has been criticised on the grounds that it is artificial, and perhaps hypocritical, to dress up an idea too much. But no degree of acting is being suggested; merely a presentation which appeals to the listener's likes, and this is as much a matter of simple courtesy as of any profound Macchiavellian subterfuge.

7. By the above methods the listener may himself be helped to participate in the formation of some new idea, itself being better than what was first proposed; and if so, it will be *his* idea, or better still *our* idea, and there will be a desire in both speaker and listener to act on it together. Even the most expert speaker will therefore be wise to curb his own enthusiasm, and leave something to be added by the listener.

8. The listener's receptivity varies from time to time, for many reasons which range from the weather to the state of his digestion. Monday mornings are notoriously unreceptive.

9. Finally – and it is noteworthy that it is finally – comes the value of the idea itself.'

* Extracted and summarised from *Human Relations in Modern Industry* by R. F. Tredgold (Methuen, London). See publisher's address inside back cover of this journal.

* * *

Some Up to Date Methods of Machining for Consideration

Mr P. Astle who is Group Value Analysis Engineer with Automotive Products Company Ltd of Leamington Spa, England, has kindly forwarded the following data sheet giving the approximate comparative figures for machining:

Type of Process	*Maximum Metal Removal Rate in³/min*	*Power Consumption HP/in³/min*	*Maximum Penetration Rates 0·001 in/min*	*Accuracy 0·0001 in.*	*Surface Finish Micro-inches C.L.A.*
Ultrasonic	0·01	50	100	2–10	10–25
Spark Erosion	0·3	40	500	2–50	10–200
Electron Beam	0·005	500	6,000	2–10	—
Laser	0·0005	60,000	40,000	5–50	—
Electrolytic Grinding	0·05	100	200	2–50	5–30
Electro-Chemical	2·00	300	500	2–50	5–50

Reprint No. 1:5:9

Basic Concepts – Management Appreciation – Communication

Factors Underlying Successful Value Engineering

by Brian F. Blundell, C.Eng., M.I.Mech.E.*

The author stresses that the correct approach to V.E. is fundamental and that full consideration must be given to the human reactions of all who are touched by the project. He emphasises how much the success of the project depends on the value engineer's objectivity and refers to the important role which the consultant can play in the establishment of V.E. The problems of lateral as well as vertical relationships are touched upon, and the art of listening is recommended to be cultivated by value engineers.

The brief – the terms of reference – should be clearly expressed in writing. Its time span and cost must bear a relationship to what it will produce in the way of savings. Such costs should be factually based and include all items.

Mr Blundell's notes of warning should be heeded by all who are concerned with the establishment of a Value Engineering capability in their company otherwise they may be running the risk of becoming numbered amongst the 50% of failed projects!

The success of Value Engineering as a means of giving customer satisfaction at least cost to a company's resources depends on certain general principles being followed right from square one. Modern industry is such that you cannot afford to fail although it is said that 50% of all V.E. projects do fail. Properly administered the systematic techniques used in Value Engineering *are* successful, and furthermore can be gainfully employed by all persons whose decisions have a bearing on product cost.

The Human Aspect

Value Engineering is like a game of chess insomuch that certain moves are laid down, different combinations of these are permitted, but the final result of the moves depends only on the man, that is, the decision-maker or manager of the game. Put another way the man to be successful must be involved from beginning to end. In terms of Value Engineering 'the man' is the top management not just the managers, and generally he will be the managing director or general manager responsible for the whole of a company's operations in order that decisions made by the Value Engineering team will have the necessary weight of authority for implementation. It is his responsibility via the value engineer to initiate a study of the selected product, part, system or service and to ensure that the necessary resources for the study are available. He will also direct the team in matters of administration, and will probably have been involved in the selection of the team itself so as to ensure a balanced representation of specialists and departments.

The top management must support the team throughout its task to achieve the best results and, above all, must provide incentive, real or psychological, in the formative and creative stages of the study. Real incentives include financial reward, equitable service contracts, and bonuses in kind such as company cars, extra holidays, whilst psychological incentives include friendly chats, giving praise where it is due, and what the services call 'mention in dispatches'.

Mr Brian Blundell as Chief Designer for the Rotofinish Group of Companies has had a wide and varied experience of the problems of design for economic production of both finishing and textile equipment. He is the author of a standard text on the former subject and has been actively engaged in applying V.E. techniques for a number of years. His address is: 3 High Street, Bovingdon, Hemel Hempstead, Herts., England.

The Value Engineer

The value engineer is the most important person in the team and he can be most effective if he is not emotionally involved with the subject of the study, that is, he should not have been its original designer or inventor.

In the larger company the value engineer is employed as such on a full-time basis, and is thus an accepted member of the company structure. In smaller concerns he is more likely (at least until V.E. becomes established as part of the company policy) to be an outside consultant. In this latter case it is important to recognise that until his work and intentions become known and proven he will generally be regarded with suspicion. A good consultant can quickly overcome such prejudice and suspicion that may exist, and he may generally achieve this more quickly by the technique of 'talking out'.

Talking out entails brief chats with the individuals who will have a role to perform in either the actual study or its implementation, and the consultant requires great diplomacy in selling himself and at the same time giving the appearance of interest in what the individual has to say.

Selling oneself is an important aspect of Value Engineering at various stages of a study, particularly when seeking information, looking for ideas, and presenting the case for a course of action. Equally, the art of listening is important requiring constant practise and more will be said about this later on.

The value engineer performs the functions of chairman and public relations officer to the team, and is responsible for directing team effort along the course set by the terms of reference of the study. He must understandably do this without appearing to place too much restraint upon the individuals concerned, having respect for their feelings and status thereby encouraging them to release their energy rather than absorb it on a protective strategy. On the P.R.O. front the value engineer keeps everybody informed of the objectives, progress and results of the study. In large companies this 'advertising' policy may include the showing of

films about V.E. to works staff and others who may be only indirectly involved, the issue of broadsheets, and lectures and discussions. The objects of these actions being to allay honest wrong beliefs about V.E., to foster cost consciousness, and to engender an enthusiasm for Value Engineering which is ultimately essential if the most benefit is to come from it.

In smaller companies similar objectives may be achieved through the closer personal contact which is possible.

The top management, value engineer and the individuals comprising the V.E. team are all responsible at different levels and at the various stages of the study for getting the best from people and throughout diplomacy is of paramount importance.

People Performing Better

In dealing with the team it is recognised that people cannot be redesigned to perform better but they can be trained and put to work together so that their biases balance out thereby achieving a greater amount of group objectivity.

If training is necessary then it should preferably be directed toward the company's particular needs, and be given by a specialist. The armed services are very good at this type of training, achieving high quality results in remarkably short times, and one wonders why industry tends to fall behind in methods of training.

A serious 'roadblock' to progress is the emnity which can exist between individuals working in small close groups due to the limited scope for personal advancement or promotion, and where this is suspected steps must be taken to separate the persons concerned where this is possible. But in any event it is essential to involve them all right from start to finish of the project.

Above all listen to their views, let them put forward their ideas, and avoid denigrating those ideas which are finally discarded. Remember that some element of risk is present in most decisions so make sure that the risks are minimised, and always credit the risk taker with the cost savings which accrue.

We have so far placed an emphasis on human relationships as one of the factors underlying the success of V.E. In fact, it is the most important factor. As an individual one must strive to breed confidence by practising what one preaches – attacking problems objectively without bias and preparing one's plan of action before one starts.

The Art of Listening

This is of paramount importance in communication whether in conversation, or at lectures or conferences, or – for that matter – on the telephone. Because communication (including listening) plays such a leading part in value projects a few words about the art of listening are felt justified.

To avoid the 'parlour game' situation wherein a message gets progressively more distorted as it passes from one to another, it is essential to make notes of the more pertinent points. Look at the brighter side of the conversation topic, and listen for the things which you can use for your own good. Sometimes a false sense of 'knowing what's coming' creeps in – beware – you may miss some of the main points. Again you may miss points if you hear something which you resent. In the latter instance, don't prejudge. It may just be that you didn't think of it first!

If the speaker fails to arouse you immediately don't condemn him before you have found out what he has to offer. Anyone can sit in silent judgement – the psychologists call it 'ego satisfaction'.

The content of the speech is important not the delivery which although sometimes an annoying distraction provides the opportunity for an exercise in self-discipline. Often a word can set you off on a mental tangent. If this happens write the word down, forget it and carry on listening or you may miss something more vital. Stimulation of this sort is potentially dangerous insomuch that personal feeling can interject and wreck the possibility of a harmonious solution to a problem. Personal emotional bias and non-objective thinking do not promote good answers. You may think you are immune from such feelings but just to make sure carry out a personal check occasionally.

Listen for Ideas

In your V.E. team meetings and in other places listen-in for ideas. Don't worry if you miss some of the facts, enough will be retained to support the context of the conversation. As a listener you are in the unique position of analysing proposals in the light of your own experience due to the fact that speech can only transmit about 150–200 words per minute compared with a thinking speed of 500 words per minute. Use this extra time for analysis but don't mentally depart too far from the central theme. You must also resist distractions. The worst offender here is the telephone. If it takes precedence over your other listening then retire gracefully and acknowledge your defeat. Don't try to both listen to others and speak on the telephone to someone else. Don't let V.E. team meetings be interrupted in this way.

Finally, don't evade the difficult by closing your mind to the speaker when he talks about things with which you are unfamiliar.

The Brief is Most Important

There is a tendency once a project has been decided upon to hand it over to the V.E. team in the vain hope that they will operate according 'to the book' and follow through on a definite pattern and come up with a solution which will cut costs. Whilst operating under this arrangement they will probably produce some improvement in cost it does not follow that what they produce is the best they could do.

In such circumstances the fault is due fairly and squarely to the Management. The role of management in terms of psychology has already been uppermost in this article, but of equal importance is the role which management must play with regard to the terms of reference and the method of executing the V.E. project. The aims to which the solution to a V.E. problem should be directed should be clearly set out.

The terms of reference should be written down, otherwise the previously mentioned 'parlour game' situation will rapidly develop amongst the members of the V.E. team. The terms must clearly and unambiguously state the objective of the project, the limitations imposed by company policy, and the other outside influences which may have a bearing on the direction in which the team moves. The resources available for the V.E. exercise and for manufacture of the recommended solution should be set out by Management and made known to all those who are involved in the V.E. exercise. Otherwise the project does not have a basis in fact.

Value Engineering for the sake of doing it is no good to anyone. Value Engineering is primarily a useful tool only when it is the best tool for the job.

The Objective Must be Real

It is not sufficient to assume that because one company value engineers its products another company should do so. In short 'prestige Value Engineering' is out. In every valid case of Value Engineering the objective is to find the cheapest way of performing a function. So the function required must be highlighted and, if known, should appear in the terms of reference. Two general types of objective are readily identified, namely, the improvement of a particular part, product, sub-assembly or service; and the creation of a new product to replace an existing one. In the first case the objective is to reduce the cost of the product as it stands by elimination and redesign, whilst on the other hand we have the freedom to replace the product by an entirely different one.

It may be argued that these two alternative objectives are really one, but the distinction is drawn here to illustrate the need for close definition of the objective and hence the scope of the V.E. exercise.

It follows that the need for stating the company's policy and market potential will depend on the type of objective. For instance, it is doubtful whether the manufacturer of clay bricks would retain his faith in a V.E. team who found that concrete performed the function much better and at lower cost unless he also supplies concrete bricks.

Selection of the product to be studied is, of course, very important, and care is needed in order to select the right one. In many cases a product having the highest or a high cost/value ratio is chosen taking into account the probable production batch size and frequency of production which generally (though not always) is geared to the sales of that product and the expected increase in demand, if any.

Several techniques are available to the V.E. team to assist in the determination of the cost/value ratio including linear programming, learning curves and synthetic costs. Historical data, where it exists in reliable form, is always useful, and again sometimes a product is chosen on the basis of its complexity. The more complex the better the opportunity for savings.

Assessing the Value of a Proposed V.E. Programme

A useful criterion to assess the value of a proposed Value Engineering programme is to stipulate the savings expected and from this an estimate of the allowable time span and scope of the study may be made. Typically the criteria take the following form:

(*a*) The gross saving in product cost must be more than 'x'% of the existing product cost ('x' usually being between 5 and 25 depending on the circumstances).

(*b*) The gross savings must be at least 'y' times the cost of the V.E. study ('y' being about 10, again dependent on circumstances).

It is suggested that the calculation of budgets which is what these calculations amount to should always involve the accountant since it is easy to overlook hidden costs such as transport and accommodation, administration overheads, etc.

Remember that whilst most competently managed companies endeavour to obtain the best product at lowest cost, it is those companies which coordinate their efforts which get the best return on their investment. To illustrate the criteria stated above. Suppose the estimated production cost of a forecast sale is £100,000. Then at 5% cost reduction £5,000 must be saved, and if this figure represents a 10:1 ratio of cost saving to value study costs then only £500 is available for expenditure on the study. If the cost of running the V.E. study is £4 per manhour then the total manhours available for this particular study is 125 or about 3 man-weeks.

It can be seen that even if we anticipate larger savings (say 25%) the costs of the V.E. project must be tightly controlled. In the smaller companies it is necessary to aim at savings in areas which sometimes are not regarded as so important in larger companies.

The Design Aspect

Substantial savings can be made by adopting a policy of simplification, standardisation and 'modularisation' leading eventually to simplified drawings and schedules.

A striking example of the effect the number of piece parts in a product can have upon trouble-free production is given in an article entitled 'Almost Good Enough is Dangerous' in *Metalworking Production* (20/4/66) referring to the reliability of an off-the-highway dumper. The dumper weighed 45 tons and contained 10,739 piece parts and 1,633 assembly operations. Using the formula x^n to determine the percentage of perfect complete machines P which will be produced when x is the reliability of each part and assembly, and 'n' is the number of 'goof opportunities', it was shown in this article that if 9,999 parts in every 10,000 are correct the number of perfect machines is only 29%. When 9,998 parts in 10,000 are correct the number of perfect machines drops to 8%.

Drawing-wise it will be appreciated that every dimensions has a tolerance and therefore a chance of being wrong. Therefore keep dimensions to a minimum and encourage draughtsmen to develop an attitude to minimise dimensions. For example, the deletion of the dimensions of a chamfer should lead to the elimination of the chamfer, not a free license to the workshop to produce what they think is necessary. In other words the draughtsman should be encouraged to value analyse his drawing.

* * *

The factors underlying successful Value Engineering which have been mentioned will, it is hoped, trigger off the thoughts of those engaged in or responsible for Value Engineering to ensure the V.E. effort is not being hindered.

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Miscellany

Takings Soundings

Attitude surveys, or opinion polls as they are more generally known, are the vogue in Britain. Traditionally, the politicians and their parties have been the subjects but in recent years there has been a massive increase in more broadly based surveys, ranging from the state of the country's hospitals to road speed restrictions. Any activity, it seems, is fair game for the opinion sounders.

'Why should I waste a lot of time and money asking my employees what they think is wrong with the company when I already know what's wrong? If they have any complaints they can always put them to their foreman or manager. I don't believe in raking up trouble.'

There has been an upsurge of interest in industry. B.O.A.C., Shell and more recently Vacu-Blast have all carried out highly successful surveys in the past year, and Wates the builders is planning to do an attitude survey of its entire 4,000-strong labour force next year. Pilot studies for the exercise have already been completed at a plant depot, a big site and the service department.

Problem areas. Attitude surveys take two main forms: specific and general. The specific surveys deal with problem areas, such as departments which have a particularly high labour turnover, but they can also cover such matters as pensions or wage structures.

Sterling Winthrop, the pharmaceutical group, for example, last year carried out a selected attitude survey in the marketing department of one of its subsidiaries, Philips Scott and Turner. The 40 staff members were asked their views on the department and how its operations could be improved.

But the most famous example of a specific survey was the one made by Shell earlier this year on pensions and retirement. Covering some 30,000 employees, it took a year to complete and cost 7,500 guineas. Some people doubt if it was worth the time and trouble, but it brought to light facts about pensions and work attitudes that shocked many people in the company and in industry generally.

* * *

Looking Critically

Reviewing *The Medium is the Massage* by Marshall McLuhan, Arthur M. Schlesinger, Jr answers the question 'What is McLuhanism?':

'It is (according to his reviewer) a chaotic combination of bland assertion, astute guesswork, fake analogy, dazzling insight, hopeless nonsense, shockmanship, wisecracks, and oracular mystification, all mingling cockily and indiscriminately in an endless and random monologue. It also (he says in his judgement) contains a deeply serious argument.'

'The essence of this compelling argument is that society has always been "shaped more by the nature of the media by which men communicate than by the content of the communication".' McLuhan's method is to look critically at an advertisement in the same way as a critic might look at a painting, a movie, a play or a book. Or the way you might look at a fellow you know in an attempt to understand what kind of person he is.

Try this yourself. Look at an advertisement. Is it honest? What kind of appeal does it make? Does it have overtones or undertones that stimulate notions that the product can't possibly fulfill? Is it designed to lead you on to understanding, or to block off understanding by some lie? Does it have an economic interest? Does it suggest some people are better than others?

You might try an advertisement analysis at your dinner table.

Industrial Mental Health

The columns of *The Times* (4/3/68) carried a significant review article on *To Work is Human* by Mr Brian Inglis. Published by The Macmillan Publishing Company, 866 3rd Avenue, New York, this book presents the findings of a pilot survey of industrial mental health in the United States. It arose out of an exploratory meeting held between industrialists, psychiatrists and other interested parties. It takes the form of a collection of papers on various aspects of the subject, contributed by experts (though that is not a term which can confidently be used, in connection with mental health, let alone industrial mental health).

On the evidence of this book, and other sources, it seems that it may soon be possible to predict, with reasonable accuracy, which employees are neurosis-prone, or coronary-prone, or ulcer-prone. It may be in the firm's social interest, and it will probably be in their financial interest, to initiate preventive measures.

To this day, however, management has never quite succeeded in coping with human breakdown. Where the link with the work is direct – say, when a disorder arises through some chemical being employed – most firms are aware of their responsibilities. But where it is indirect, and uncertain (as it may be at all levels) there is no consistent policy. And this is particularly true in the field of mental illness.

The problem of mental illness in industry cannot be left to solve itself. Already, the cost in terms of lost man-hours, and sour labour relations, is serious. Yet surprisingly little research is being done.

* * *

Young People at Work*

'Can you remember your first day at work? If so, would you be willing to admit that the first day in the factory terrified you? If it did not you were probably exceptional; or perhaps you are fooling yourself. From school to work is a big step, bigger than most of us, in retrospect, are willing to admit, but still a very real one for all those school-leavers who move, as the Ministry of Labour's jargon has it, into "gainful employment", every year.

'Leslie Paul has described the move as comparable to emigration for an adult; migration to a new country. And so it undoubtedly is; a change which demands new habits, a new situation of working for a boss (or apparently many bosses), a demotion perhaps into insignificance compared with the importance which you may have had at school.

'Many young people are quite unprepared for what they find. Having to do simple repetitive jobs without a break may be bad enough. Learning to cope with another sort of discipline may be unsettling. Feeling that they have, perhaps, got the wrong job can be disastrous.

'All this makes it strange that a great many youngsters make the shift from school to work without any preparation from adults. Parents still, on the whole, choose the first jobs for their children and it must be conceded that very few of them can know exactly what they are about. In theory, schools should offer careers advice and an increasing number have careers masters who try to fill what little spare time they have, after coping with an over-full timetable, with information about a world of work which is almost as unfamiliar to them as it is to their pupils. Their efforts are praiseworthy, but not very expert. As recently as January 1967, Anthony Crosland, at that time Minister of Education, said in a BBC television interview: "Careers advice in schools was scandalously neglected up to two or three years ago, and it is neglected even now," '

* Extract from a book of this title by E. McFadyen (Pergamon 1968, 2/6).

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Construction Industry – Applications

An Application of Value Analysis to Building

by Nigel Pearson, B.Sc., A.I.O.B.*

This article arrives at a time when the impact that Value Engineering is having on the American Construction Industry is attracting the attention of architects, planners, civil engineers and constructors in many other countries. Mr Pearson has presented those areas of building in which the principles of Value Analysis may, with profit, be applied.
Although there are great opportunities for V.A. to be applied to design and to building components, the author stresses its application to the service aspects – on the site processes. Value problems arise in connection with the allocation of resources and, as V.A. is basically resource management, its questioning techniques can be applied.
Comparative method value is advocated at the commencement of the works programming and it is suggested that after the commencement of the contract the responsibility for cost-saving should pass to the site staff who should be trained in V.A.

Opportunities for V.A. in the Building Field

The first word of the above title is deliberately chosen. The remarkable achievements of Value Analysis in various industries have been principally concerned with the design of consumer products, though the British Productivity Council's definition refers to the study of 'any product, material *or service*' (my italics). Thus, when the application of Value Analysis techniques to building is considered, it is perhaps to be expected that attention tends to be focussed on design and specification processes and the manufacture of building materials and components.

Certainly there are great opportunities for Value Analysis in these fields. But I feel it is important to recognise that the principal function of the contractor is still to offer the service of erecting the client's building on the site specified for it. The following suggestions are therefore deliberately confined to consideration of the effect Value Analysis could have on site processes. Its potential in the fields of design and manufacture is much clearer and less likely to be overlooked, and in these fields it may also be easier to apply. However, the potential savings to be gained from its application to site procedures should be at least as great as in cases where the subject of analysis is design, specification or manufacturing process. This is said without personal experience of applying Value Analysis to building, though with ample evidence of the benefits accruing to the contractor from the questioning techniques of an allied subject, Work Study. Therefore it should be understood that in the following I am attempting to formulate ways in which Value Analysis might aid companies and sites, rather than describing the results of its application to them.

Site Applications of V.A.

Site applications of Value Analysis divide conveniently into two categories. Firstly, the techniques could be applied to the problems of general site organisation within a company (e.g. staffing, organisation structure, communications, etc.). Secondly, value problems arising in connection with a specific contract could be studied. This would involve the consideration of labour strength, plant and material requirements and working methods. In each case it would then be necessary to identify the functional divisions existing within the whole. This could best be done by initially considering resources, since Value Analysis is basically resource management in such a case as this. The relative importance of the various divisions would also require identification.

For example, in the field of general site organisation the functional divisions of Administration, Supervision, Measurement and Valuation, Technical Services, etc., could readily be identified. A Value Analysis questioning technique (What is the function? Why is it needed? What alternatives are there?) could then be applied to each, with the aim of satisfying the requirements for least cost. Staffing, documentation and standards would be taken into account in each case. Job descriptions and responsibility charts would arise naturally from such a process. In the second category such divisions as Labour, Plant (various categories), Stores, etc., could be similarly analysed.

In order to apply the techniques in this way, the Value Engineer would need to work closely with other departments at all stages at which decisions affecting sites might be made. Thus he would participate in general management meetings, in tender planning (where the *optimum* speed of erection, or the *cost* of a specified speed, might concern him greatly), and in pre-contract planning (here site staffing and the selection of own subcontractors and suppliers could be influenced by Value Analysis techniques). At the commencement of works programming the value engineer would concentrate on such items as comparative method value and the provision of programme performance specifications for subcontractors and suppliers. In these ways a number of Value Analysis teams would, in effect, be created. The value engineer might also be expected to find useful opportunities for collaboration with other 'management technology' departments, such as Work Study, Organisation and Methods or Quality Control, where such existed within the organisation. One useful by-product of this would be the feedback and recording of cost-reducing ideas.

After Commencement of the Site Work

It is suggested that, after commencement of a contract, the responsibility for cost-cutting should pass to site staff, who should all be trained in Value Analysis techniques. Regular internal site meetings could be held to discuss ideas for cost reduction and

* ***Mr Pearson is Work Study Officer at Mitchell Construction Co. Ltd., Peterborough, England. His address is 2 Talbot Avenue, Orton Longueville, Peterborough, England.***

cost avoidance. The implementation of ideas would be aided by the transfer of responsibility for producing these from value engineer to site.

It was noted above that the value engineer would apply analysis to the selection of sub contractors and suppliers, and the company's Purchasing Department would play a vital part in this process by supplying cost/performance data on these. This service would, in turn, be supplied to sites after commencement of the contract, to assist in ordering procedures. The general application of Value Analysis techniques within a contractor's Purchasing Department is clearly also of great importance.

Some might argue that in many building organisations questioning techniques are already being applied in most of the management and planning departments mentioned above. However, the value engineer would bring to these departments his own special contribution – the application of value-consciousness to every element in the plan. Because of his training he would be more likely than anyone else to realise that site operations *cost too much*, and to go on to ask whether the prescribed results could be obtained more cheaply. By example he would tend to encourage this type of thinking in management and site staff, probably with startling results in terms of savings.

Needless to say, the quality of the finished works would always be the paramount consideration in all the procedures outlined above. This would be defined by a combination of the standards imposed by the designer and those which the company's policy and reputation dictated.

Requires the Support and Interest of Management

The support and interest of top management would need to be enlisted to give a reasonable chance of success to a Value Analysis programme such as that outlined above.

It seems likely that the activities of a value engineer on these lines would result in impressive reductions in cost of labour, plant and materials, and in site overhead expenses. In addition, the basic form of a company's site organisation could well change radically as a result of the application of definition/function/alternative questioning techniques and the consequent release from habit constraints.

Breaking the Memory Code is the Next Step

'We have cracked the genetic code. The next great step is to crack the memory code', says Professor Georges Ungar of Baylor University, Houston, one of the world's greatest experts on memory and the working of the brain.

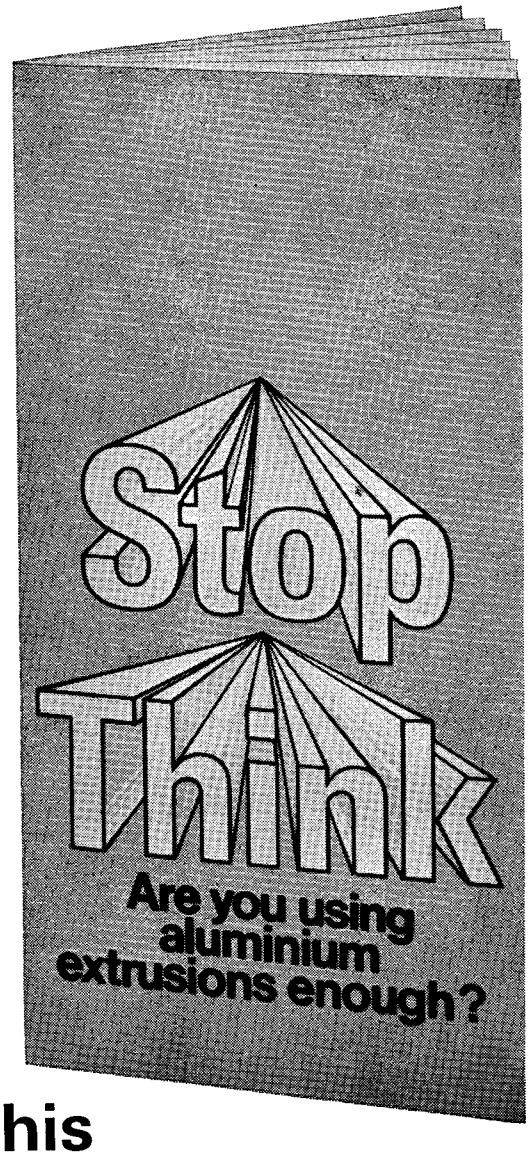
'Memory and learning are registered chemically on molecules. When you learn things, information containing chemicals form in the brain', he says.

He has instilled unnatural skills into rats – to prefer light places to dark, to ignore hammer clangs on metal or air puffs on the face. From extracts of their trained brains he has isolated the molecules on which each specific skill was recorded, injected them into other rats – and found the recipients had acquired the same specific skill.

'These memory molecules are probably peptides', Dr Ungar went on, submitting my own peptides to some little strain. 'I have isolated peptides containing eight of the 20 amino acids which are "letters" in the memory code. Their sequence in a chain of peptides forms a "word". Just as our 26-letter alphabet can form an infinite number of words, so these amino acids can produce some 10,000 million words of memory or learning.

'If we break the memory code we shall be able to produce the coded molecules by chemical synthesis. We might then be able to inject simple learning [like five O Levels?] and skills into human beings. In a more remote future we might transmit more complex skills like learning a foreign language or changing basic attitudes such as racial prejudice.'

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Developing and Organising an Effective Value Engineering Programme—Part 1: The Fundamentals of V.E.

by B. G. Matossian, B.Sc., D.R.T.C.*

The author identifies the need for Value Engineering (or Value Analysis) as a new approach to cost effectiveness emphasizing that the objectives are as old as industry itself, but demonstrates that the scientifically planned approach, the criteria employed and the procedures applied are new. Because Value Engineering/Value Analysis (V.E./V.A.) is the application of systematised thought and organised team action, he stresses that it calls for company-wide education and the use of developed skills. He then, in subsequent parts, shows that this concept has to be introduced – as a discipline – in defined stages: motivation, training and organisation. In analysing some of the methods and procedures employed he shows how this concept has been successfully applied in industry and government organisation, and especially how it has promoted a more purposeful discipline in the conduct of business.

INTRODUCTION

The Scope of Current Treatments of the Subject

During the past two years the concept of Value Engineering or Value Analysis has won widespread acceptance in this country. It is no longer the virtual monopoly of a few advanced managements. Articles on the subject have flooded the management, trade and technical publications and have even invaded the general Press. In spite of this genuine interest, discussion has tended to be restricted to certain aspects and to have neglected the broader implications. This paper is intended to supplement this discussion from a more comprehensively philosophical standpoint, suggesting an approach and a methodology that will put the detailed considerations into context.

Much of the recent published discussion has been about hardware. Exponents of V.E. have started with a manufactured product, analysed it, attached a cost label to each material used and each component and shown how by substituting less costly materials and by modifications in design, cost could be reduced while quality and function remained unimpaired. This handling of the subject has made a profound impression on managements in all sectors of industry.

To neglect this aspect would be foolish. In the United Kingdom at present the manufacturing industries spend some £12,000 million on wages and salaries, processes, overheads and – a relatively small proportion of this sum – on profits. Another £12,000 million is spent on materials. Some 50 per cent of the turnover of British industry goes into bought-out materials and components; a fact that surprises even well-informed businessmen when the statistics are presented in this form.

* ***The author, after two years in Britain as an electronic design engineer, spent eleven years in Canada and the United States with RCA, Barker and Williamson Inc., and General Mills Inc. Returning to Britain in 1963 he founded B. G. Matossian and Associates, 144 St. Vincent Street, Glasgow C.2, Scotland. This paper was presented by the author to a meeting of The Institute of Marine Engineers on 26th March 1968.***

Limitations of Accepted Management Techniques

Currently available management techniques are mainly concerned with operations management – the first half only. With all the techniques included under the umbrella term, 'operations research', those, such as MTM-2, which have to do with personal output and incentive payments, the statistical and accounting methods of control such as standard costing, and including more generalised approaches such as management by objective, there are altogether about eighty management techniques now in use. From careful analysis, 95 per cent of these deal with manufacturing processes, overheads, controls, incentives, organisation and administration: which account for only half of turnover. The remainder, which include V.E., place greater emphasis on the productivity and efficiency of materials and components – the other half of turnover.

Considering that the other half is so effectively catered for, it is in the area of materials that the biggest economies are to be made. Since most of our raw materials are imported from abroad, the difference these economies could make to our perennial balance of payments problem is immediately evident. Apart from that, no company engaged in manufacture can afford to ignore them. In many instances they may make the difference between profit and loss or even, between survival and extinction. That is why it would be a mistake to depreciate the approach from the side of hardware.

A More Comprehensive View Needed

What has disturbed the author is that this approach appears now to have exhausted its potentialities. As so often occurs in human affairs, just when we think we have discovered a solution to a problem, the solution itself raises new problems. Many companies are finding that this moment has arrived in relation to V.E. Industry has recognised the untapped potential of V.E. and what it has to offer. V.E. has passed the grass roots stage but has not yet grown to full maturity. The need at present is for a more comprehensive view.

One of the problems that has arisen is that the market is now saturated with V.E. specialists. This, too, repeats a typical human situation. When a solution is discovered to a baffling problem it attracts the attention of able men who at once set about mastering the technique. They then wish to practise it.

Others, less able, who have not given it the required attention, seek to exploit the situation. How are the responsible people to distinguish the good from the not quite as good? How are they to know which of the many proposals made to them is the right one for their particular situation? Before they can make their decision they must first be able to answer the question: 'What is the best way of initiating, developing and installing this technique?'

A Principle for Dealing with Change

In this instance, the question is particularly difficult to answer because there is not, and cannot be, any universally applicable formula. Attempts have been made to examine the approaches of successful value engineers and draw from them a set of rules that would be valid in every situation. This attempt has failed. There is no such set of rules. If such a set of rules were laid down by some hypothetical V.E. authority it would become obsolete almost before it was promulgated. Precisely one of the most characteristic features of V.E. is that it deals with change. Because we are no longer in a static situation, any methodology that settles down into a rigid system pronounces its own sentence of death. It cannot survive the next move forward and nowadays movement does not proceed by fits and starts: it is continuous.

The fallacy of trying to reduce V.E. to a formula becomes evident as soon as we ask why this technique should have been devised and become acceptable at this particular time. There is always a reason why a new invention is made at one moment rather than at another. It is called into existence by the needs of the time. The Industrial Revolution began with the steam engine. After that, industry went across a plateau of steady development for a century and a half before the use of the internal combustion engine became a commercial proposition. We then had a revolution in overland transport which, hard on its heels, was followed by the development of air transport. Then came the electronics revolution and the jet age. The intervals between these dramatic changes have become shorter and shorter. Technological change is a cumulatively accelerating process, but each phase of this progress has required an adjustment of the structure of industry to suit itself. Since the Second World War, not only has the pace of technological change been terrific, but the changes required in the structure of industry to cope with it have been so rapid that few individuals can keep pace with it. Is that not one of the principal reasons why the average age of senior management has dropped by ten years since 1939? Only the newly qualified can hope to keep abreast of the times. Industrial leaders have been struggling – rather desperately – to catch up with this situation. Hence the multiplicity of management techniques.

Moreover, competition has become more severe. Whereas formerly manufacturers in the Western world had customers waiting at their door, now what were once regarded as primitive countries are making their way.

V.E. is one means of enabling managements to keep abreast – or ahead – of this situation. It is an advantage and not a drawback that it rests upon a system of basic principles and not a set of rigid rules. It is flexible and can deal with change as it comes. The objectives of V.E. are as old as industry itself but what is new are the method of approach, the techniques applied and the criteria employed.

The *method of approach* consists of a number of organised procedures and activities which are fundamental to the success of creating and implementing value improvements. These cover:

1. the development of capabilities to recognise and overcome obstacles to progress and resistance to change;
2. the utilisation of creative problem-solving techniques;
3. the promotion of effective departmental team work;
4. the application of trained thinking to overcome mental blocks to simple solutions;
5. the improvement of value attitudes and habits;
6. the utilisation of special techniques to identify unnecessary costs;
7. the increased application of value principles to daily decisions;
8. the improvement of communication for better dissemination of ideas.

The *techniques* include a number of basic principles which must be consciously and skilfully applied at all times. The most important ones are:

(*a*) adopt a positive attitude;

(*b*) apply creative thinking at all times;

(*c*) establish teamwork and good human relations;

(*d*) avoid the temptation to generalise;

(*e*) identify and define the real problem;

(*f*) do not prejudge – get all the facts;

(*g*) establish the objective and prepare a V.E. job plan;

(*h*) use information from best sources;

(*i*) establish meaningful costs;

(*j*) determine and evaluate each function required or performed;

(*k*) separate the relevant from the irrelevant and the useful from the useless;

(*l*) encourage and test new ideas;

(*m*) recognise and overcome 'road-blocks';

(*n*) do not be influenced by past custom and habit;

(*o*) use and pay for suppliers' know-how and skills whenever possible;

(*p*) establish the cost of all important tolerances;

(*q*) use experts to extend specialised knowledge whenever possible;

(*r*) use standards and standard parts whenever possible;

(*s*) use proprietary functional products and processes whenever possible;

(*t*) spend the firm's money as your own.

The key *criteria* are 'function' and 'value'. A process of analysis is used to identify or determine essential functions. A value content is then established by considering the lowest cost of performing that function reliably – its functional worth.

FUNDAMENTALS OF VALUE ENGINEERING

The Concept of Function and Value

V.E. can be described in simple terms as an organised and creative way of identifying and challenging the unnecessary to reduce economic waste. Whereas most cost reduction schemes concentrate on methods of production and products as they stand, V.E. is a more fundamental approach; it takes nothing for granted and starts by challenging everything about the product, including the basic design concept and the existence of the item itself, but subject only to the restrictions that the required function or performance must not be changed and the value must not be sacrificed. Therefore in V.E. work everything is questioned and evaluated at first in terms of 'What it does', and not in terms of 'How it's done' or 'How it's made'. This evaluation is considered from the standpoint of value, in a sense that transcends price.

Value is difficult to define because the concept of value is that of a variable, and there is no absolute unit of value. The value of a product or service depends upon the time, needs, subjective tastes and circumstances. Value is a relative measurement of how well an item fulfills its function with due consideration to performance

and cost, that is, the relationship between function and cost. However, value can be categorised which makes it easier to define and analyse. V.E. is concerned with three basic types of value:

Use Value – which is objective in nature – is determined by the functional properties and characteristics of an item which provides a 'use' or 'service';

Esteem Value – which is subjective in nature – is based on features and characteristics which encourage ownership;

Cost Value – is a monetary expression. It is the sum of material, labour and overhead costs required to produce an item.

What, for example, is the value of a small motor car to the person who buys it? There is no easy way of measuring this. To a travelling salesman it is the basis of his career and livelihood and it is indispensible. To a man in a sedentary occupation, such as a solicitor's clerk, it may be merely a means of obtaining an occasional weekend's pleasure. The first problem for the manufacturer is to provide a vehicle which will carry either of them safely and reliably from one place to another.

To use the V.E. method of analysis, the function of the car is to 'transport people' – its 'use value'. The manufacturer knows that if he is to satisfy his shareholders he must produce a car that will fulfil this prime function reliably at minimum cost. The price depends upon the fluctuations of the market. The value, for which there is no unit of measurement, is the service it provides for the customer. The basic functional properties of the car must coincide with that value. Once that requirement is fulfilled other marketable values have to be considered. Whether, in addition to 'transporting people', the car has to reflect the status of a sales manager or offer the luxury demanded by a company chairman's fashionable wife, are subsidiary or 'esteem' values. This is why, in the automobile industry, Value Engineering is equally concerned with esteem values.

The prime considerations of V.E., therefore, are function and value to the customer. The value concept is first used to determine precisely the use and esteem functions – marketable functions – required by the customer; the V.E. analysis establishes an appropriate monetary worth for each essential function, and the techniques cause an organised and creative approach to be used to provide each function at its appropriate cost. It is a first principle of V.E. that necessary performance, function and quality must not suffer as a result of its application. By virtue of the basic V.E. concept, the line between use value and esteem value is drawn right at the start – by the definition of the customer's requirements. Any parts, components, features, etc., which do not provide quality, use, appearance or customer features are identified as unnecessary costs and challenged. This is one of the several ways in which V.E. differs from the traditional cost reduction exercise. Also, considering that standards of value differ with people, time, use and place, Value Engineering of a product or service should be carried out periodically during the life cycle of a successful product.

By adopting this approach L. Miles, in the late 1940s found, in an examination of 230 products, that it was possible to reduce costs by an average of 25 per cent if the function was performed in a slightly different way. It is worth noting at this point that the various customer associations that attempt to set standards could easily defeat their own purposes by specifying materials and designs too closely. They could fossilize products in their existing state. On the other hand, if they studied products more from the standpoint of function and value to customer they could make a splendid contribution to progress. They should be wary of laying down standards once-for-all and should make a policy of periodical review.

Value Engineering as a Continuous Process

Yet we may adopt this approach and still, when it comes to the practicalities, be left with a technique that differs little from ordinary cost reduction. A case could be cited in which a company, suddenly faced with competition from a more efficient and cheaper product, set aside several of its staff to study their own product to find out how it could be made to beat its rival. Although these men worked wonders, they could not discharge their commission. Finally, someone from outside the firm with an open mind had to be brought in, not to improve upon the rival product, but to do battle with the false, traditional approach of the company itself.

By the time he had completed his task, a product with a long history, on the verge of obsolescence, was able again to compete with any possible rival in quality, effectiveness and price. Yet even this achievement was not what it ought to have been. When the adviser went away the company fell back into a state of stagnation. Nothing more was done. After a few years the product would once more be obsolescent and the whole process would have to be repeated. The adviser did a fine piece of technical work. Had he, in addition, left the company's staff in a condition of awareness and open-mindedness they themselves would have kept the product permanently in the forefront. When a company's staff is well attuned to change there need be no violent upheavals. Development will proceed continuously as they adjust to constantly occurring changes in the situation. If it is true that change is now endemic to industry, and all the signs point to that, industry must cultivate a mentality and create an apparatus that can assimilate change and make the adaptations it requires without being thrown off balance. The purpose of V.E. should be to do both. It is pre-eminently an instrument for dealing with change.

This is where we touch upon basic philosophies. V.E. programmes should, like plants in a garden, not only be self-sustaining, but should also grow of their own volition. No programme that has a termination date – or that does, in fact, terminate – can in the fullest sense claim to be V.E. For V.E. does not give rise to a predestinately ordained life cycle but to a continuous process of growth.

Cost-consciousness at the Design Stage

Here it would be as well to distinguish between Value Engineering and Value Analysis. For convenience the terms are used synonymously in this paper.

Strictly speaking, V.A. takes an established product and subjects it to analysis, proposing such alterations in the materials and modifications in the design as will enable it to fulfil its function, as well as, or better than it did before, at less cost. Value Engineering begins at the design stage of a product and ensures that designs, materials and processes of manufacture are such as will most economically fulfil the function proposed for the product.

It may appear strange that a special technique should be necessary at this early stage; part of the designer's responsibility is to avoid extravagance and he should know the relative value of different materials. Prevalent attitudes have not encouraged this cost-consciousness on the part of designers. The tendency has been for heads of other departments – especially commercial departments – to discourage designers from questioning costs by insisting that the responsibility of the designer was to concentrate on designing the best possible product economically. In fact, cost information has been intentionally withheld from design and drawing office personnel. It stands to reason that economic judgement is only as good as economic information available. Under the circumstances the designer has essentially been forced to make design decisions, without meaningful cost information, based purely on past experience and performance criteria only. As a result, the designer specified within reasonable limits what was most satisfying to him; not necessarily what was most economical. Also, one must bear in mind that at this time of rapid technological change, past experience can be very misleading and can easily confine a designer to the past. If these attitudes are beginning to alter now, perhaps V.E. may fairly claim a share in having brought about the change. For in the forefront of V.E. today is the consideration of the method or techniques that can be used to maximise cost-avoidance early in

the products design and development cycle – the stage when cost-effectiveness can be most readily and economically influenced. V.E. has established a discipline for a more realistic method of optimising the relationship between performance, reliability, appearance and cost.

Overcoming Departmentalism

There is a still deeper reason why special techniques are, and always will be, required at this stage. Confined for most of the time within the four walls of his room, it is hardly possible for the designer to acquaint himself with all the variety of materials now becoming available, their properties and cost. In the building industry, for instance, it was estimated that, during the year 1965, an average of 30 new materials became available every month. Not only is it a full-time job for a specialist merely to keep in touch with this proliferation of materials, he himself will need a purpose built office system and a computer programme if he is to be able, without protracted research, to match materials with design requirements. In metallurgy, plastics, man made fibres and numerous other sectors, a similar story could be told. It would be absurd to expect the designer to acquaint himself with the whole range of this multiplicity of alternatives.

This will in the future have to be a team enterprise in which all the relevant departments of a firm participate. In the past, when the question for the designer was that of making the most of the few materials available or even of searching for any material that would do the job at all, it was reasonable to expect the designer to work in splendid isolation while procurement was left to others. When we add to the problem of selection among a large variety of materials that of specifying standard components that are to be bought out, the obsolescence of this system is clear. The question then becomes: 'How can this co-operation be cultivated?'

The various departments of a big company tend to become little empires cut off from each other by well defended frontiers. Each is jealous of its independence and its prerogatives. Each has interests which conflict with the interests of other departments. In some companies departments are encouraged and expected to put their own interests first and to fight for them. Also, men's first loyalties are apt to be to their own discipline rather than to the organisation for which they happen to be working. In research, for instance, people's loyalties may well be to science rather than to the particular company they serve. They may feel themselves to have little in common with employees in other departments. The first step in the new direction must be the dissolution of these frustrating barriers. The team is the best device yet discovered for harnessing human enterprise and teamwork there must be. It leads to faster and better organised action and is an effective way of disseminating and generating ideas.

Suppliers and Customers in a Value Engineering Team

If instead of the designer handing the buyer a set of drawings on the basis of which he places orders for materials and components with favoured suppliers, the buyer was fully in the designer's confidence as to the purpose, in the overall plan, of each particular material or part, he could then bring to bear a wide knowledge gained from his familiarity with the whole range of suppliers – which the designer does not have. Also considering that the buyer in an average firm is responsible for spending approximately half the turn-over in bought-out materials, does it not stand to reason that he should be encouraged and expected to constructively criticise and challenge specifications and drawings in an organised and systematic way? The V.E. discipline makes it essential that the buyer plays an important rôle in the team, and that his well-informed knowledge and initiative should be effectively used for a direct contribution to better value at the design stage. It is only logical that a purchasing department, instead of being considered just as an administrative service by many traditional companies, should be given the responsibility of bridging the gap between know-how inside the firm and outside.

The principle can be carried further. There is no reason why the suppliers should not be drawn into the team on value improvement projects. Let them also be fully aware of the intended function of what they have been asked to quote on or supply. Recognising that they have specialised knowledge and know-how to contribute to the common objective, they, too, should be given the opportunity of questioning specifications, drawings and routinely processed orders in a systematic way. As the supplier is not influenced by a prevailing company tradition or outdated habit, it is surprising how, if given the encouragement, he can come up with some unexpected simple questions which often lead to embarrassingly simple and cheaper solutions. This also creates an awareness and helps to draw people out of the misleading confinement of conventional solutions to problems. Not only will the suppliers be complimented by being asked to join the V.E. team and feel a correspondingly warmer loyalty to their customer, but they will also experience the added satisfaction of knowing that they are operating more efficiently and creatively. Industrialists are unfortunately not always sufficiently sensitive to human factors such as these. They are not without importance.

What of the firm's own customers? What it expects of its own suppliers it can also do for those it supplies. The consumer industries have their own market research methods of finding out how best to adapt their products to the needs of customers. It is being recognised more and more clearly that the marketing men must be in close liaison with design and production. Companies supplying industry are in a somewhat different position. Particularly in the various branches of engineering, more of their products are custom-built. There are far more one-offs and small batches. Specifications frequently come without any further explanation. Sometimes these specifications are so detailed as to allow little scope for initiative. If a relationship of confidence has been established which takes for granted that there shall be discussions, the firm can direct upon the order all its experience and perhaps make fundamental suggestions for the improvement of the specifications. Knowledge is one of the most precious of all commodities and is just as easily wasted. Why, at any point, should the knowledge of experienced and qualified men be thrown away?

The Importance of People

That is one among many reasons why an enlightened V.E. policy concentrates primarily on people and their relationships rather than on hardware. If the right atmosphere, and the right attitudes and habits of mind are created among the staff of a company, they themselves will look after the hardware. As would be expected, there are pitfalls. In cultivating a habit of mind that almost involuntarily assimilates and adjusts to change, the V.E. specialists may find that certain people become so fascinated by the process that they demand change merely for the sake of change. There is no point in change unless it is for the better. This is to be guarded against.

In his endeavours to cultivate the new mentality the V.E. specialist will meet many deeply entrenched resistances. High costs are a stubborn enemy whose defences look at first sight to be impregnable. The attack must be planned and concerted between all arms. One of the first moves of the value engineer should be to identify those of the staff who are likely to be his allies and those who will stand on the other side. He will hope to win over the latter but this may take time. Among his earliest allies will be those who are directly responsible for outstanding costs. Embarrassed by these too clearly visible indications of their expensiveness they will be happy at the thought of being able to present a more favourable balance sheet. Those whose costs are less easily identifiable are often less well disposed because their expensiveness cannot be brought home to them. Traditionalism and conservatism will produce with genuine conviction every imaginable excuse for resistance to change. There is no need to enumerate them all, but these indicate the lines of thought: we have tried that before; we have always done the job in this way and it is what our customers prefer; it will cause too much disruption. Also, there are people so habituated by

years of experience to traditional ways that, even if they wished to co-operate, they are incapable of assimilating new ideas. These may use their experience as an argument against the 'upstart' value engineer with his 'new fangled nonsense', forgetful that their experience has not been a process of learning but a regular repetition of worn-out routines. The value engineer must, in the early stages at any rate, be possessed of infinite patience. It is useless to try to impose V.E. upon such people. If he tries, he may find that, while they will pay lip-service to his ideas in order to satisfy their superiors, they will practise an unconscious sabotage, and by unco-operative spirit undermine his plans and his efforts. To forestall this he must employ all the arts of leadership.

How to Win Converts in the Company

First he will form a nucleus of staunch supporters whose interests are in progress. Then, by the power of personal inspiration, by the offer of status, prestige and advancement, by persuasion and by the force of fact and demonstration, he will provide motives for co-operation. 'Motive' is the magic word. If he can show that it is in their interests to co-operate, he will win converts rapidly. In the course of this difficult enterprise in human relations he will be re-orientating their minds, influencing their way of thinking, educating them and training them, but the prime emphasis will be on winning them.

One of his advantages is that it is a basic principle of V.E. never to kill an idea. Every thought that is expressed has to receive careful and detailed consideration. Since even the most traditionalist of men enjoy having their thoughts seriously discussed, the value engineer possesses an effective instrument in his insistence that the ideas of all should be thoroughly investigated. Even the leaders of resistance will find themselves becoming members of the team almost without knowing it. Everybody has discontents but too often they are negative. The value engineer will set out to turn the 'chip-on-the-shoulder' type of discontent into a constructive discontent. Progress usually starts from a discontent with things as they are. Upon this the value engineer can build. Then he will be able to draw on untapped resources of imagination and creativeness such as no machine, computer or system can provide. V.E. depends for its success on a liberation of the mind so that it can think without preconceptions. When they are disabused of illusions, traditions and prejudices and have learned to question even the most deeply ingrained convictions and habits, people display a remarkable originality and creativity.

Basic Education in Value Engineering

The working out of the V.E. problem should involve as many people as possible. All of them must be educated in the principle of V.E. and trained in its implementation. First, they must learn how to identify the salient problem. Is it a quality or a cost problem? When they have satisfied themselves on this point they must know how to operate stage by stage in an organised problem solving process, proceeding systematically so that no relevant details are overlooked. They must learn how to apply the scientific method of precise observation and to test their judgement by definite criteria – not working by hunch and guesses. To be able to put a monetary value on every suggestion is a necessary discipline. To carry the financial criterion from the point of sale right back to the earliest design stage is one of the major demands of V.E. If results are to any purpose it should be possible to evaluate and measure them in financial terms. It is not to the purpose to use a less expensive material if doing so will involve a more costly process of manufacture that will cancel the gain.

The V.E. programme must provide for filling gaps in the information that is such a vital element in the equipment of the men who make decisions. If several alternative approaches to a problem are practicable but no data are available to tell them which is the most economical, they have no means of research and so are driven back on guesswork and hunches. V.E. should develop comparison data that are easily accessible, readily used and kept well up-to-date.

As the programme advances, its results will show not only in immediate cost reductions but also in improved cost-effectiveness throughout the organisation. Day-to-day decision-making will be more precise. People's performance in their daily work will improve and their interest in the company's activities will be enhanced. The opportunity of a more creative participation will bring latent talents into the open. Employees will no longer feel that they are merely doing a job that they are instructed and paid to do but will feel an active concern for the company. Design will cease to be the responsibility of only the designer and be shared by the whole organisation.

THE TERNARY SYSTEM – COUNTING IN THREES

Computer logic circuits based on the ternary system of arithmetic have been devised by two engineers at the Haifa Faculty of Engineering in Israel. The ternary system works on 3 as a base, as distinct from the everyday decimal system of counting, based on 10, and the binary system, based on 2, which is the standard system in computers.

Mr Israel Halpern and Mr Michael Yoeli say the ternary system offers advantages in both speed and simplicity over the conventional binary system. They have devised logic circuits that perform the basic arithmetical operations in ternary numbers and which could be of practical use in certain kinds of computers.

Binary System Disadvantages

The binary system uses only two digits, 0 and 1, so that the numbers one to five are represented as 1, 10, 11, 100 and 101. The advantage of the system for computers is that the two digits can be represented by electrical devices which are either 'on' or 'off'. The disadvantages are, first, that the system needs more digits to represent a number than does the decimal system and, second, that, as with the decimal system, the sign of a number, whether plus or minus, is not implicit in the statement of it and must be represented separately.

The ternary system exploited by Halpern and Yoeli uses the digits 0, +1 and −1 (represented as $\underline{1}$), which enables the sign of a number to be incorporated in its representation. In ternary, the decimal numbers one to five become 1, $1\underline{1}$, 10, 11 and $1\underline{11}$. The beauty of this system is that to change the sign of a number it is only necessary to replace the $\underline{1}$s with 1s. Thus +5 is $1\underline{11}$ and −5 is $\underline{1}11$. Addition and subtraction can be carried out without regard to sign, which means that arithmetical operations are simpler than in the binary system.

Ternary System Advantages

Another advantage is that fewer ternary digits are needed to represent a decimal number, with the result that ternary addition takes about two-thirds the time of binary addition, and ternary multiplication less than half the time of the binary operation.

In spite of these advantages, ternary multiplication has not hitherto been used in commercial computers because the necessary electrical devices are not available on a commercial scale. The only ternary machine so far built is the Russian computer Setun, devised by N. P. Brusenzov of Moscow State University. Halpern and Yoeli have devised ternary logic circuits based on conventional diodes and transistors, and they believe there may be an application for the system in special-purpose computers. Ternary logic is particularly suitable for computers that process both negative and positive numbers. Digital control systems, where error signals may be of either sign, and pulse code modulation system, in which a signal with fluctuating value has to be represented in digital form, are two examples of computing systems where ternary logic with its in-built signs could offer significant advantages over the existing binary system.

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These are the articles which appear in Vol. 1 No. 1 of the new journal entitled

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The Journal of the Society for Long Range Planning a new quarterly publication from Pergamon

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The Value Engineer's Bookshelf

'The arts of reading are a pyramid whose pinnacle rests on the stages below'
—I. A. Richards

Can you read six books a day? When did you last read a book on Value Engineering or one dealing with a related subject? In 1967 over forty new titles of books of interest to value engineers appeared each week. *Plan to catch up now by reading these reviews and sending for those books for which you have practical use.*
One star (*) against the review indicates that – although important – the information deals with a subject on the fringe of a value engineer's interests; two stars (**) that the book is very useful; and three stars (***) that it is particularly significant for value engineers.
The number in parenthesis ( ) refers to the publisher's name and address given on the inside of the back cover.

Materials – Design

*The Mechanical Behaviour of Engineering Materials

Biggs, W. D.
Pergamon Press, 1965 146 pages 25/– (102)

Useful to value engineers, this book clearly explains the relation of properties and structures of the more commonly used metals and alloys, and concludes with a chapter on the problems met with in selecting these materials.
The selection of materials inevitably results in some form of compromise between those properties which are desired and those which are merely tolerated. The efficient engineer is guided in his choice of materials by design for performing a function and – just as importantly – by considerations of producibility such as the ability of the material to be machined, shaped, joined and hardened. The designer has to make some sort of comparative assessment of the relative cost and functional advantages from the use of alternative materials, and the author outlines the properties associated with function and those associated with fabrication. In this latter connection the value engineer would do well to note what is said about corrosion and the joining of two-phase alloys.

F.C.T.

Design – New Products – Checklists

*How to Launch a New Product

Leduc, R.
Crosby Lockwood & Son Ltd., 1966 130 pages 25/– (148)

The author – Director of a French advertising agency – deals clearly with the integration of all the services which have to be marshalled for the conception, testing and promotion of new products. The book will assist those involved in marketing new products to assemble the marketing and advertising tools required to make the operation a success. It will be of interest to value engineers seeking a concise account of the development of a new product right from its conception. The importance for its success of *the value of the product* (its function/cost relationship) is pointed out by the author.
As Henry Ford said 'Sales begin on the drawing board'. He – as we know – was very conscious of the rule of the consumer.
A product's life cycle shows five phases – the launch phase, the growth phase, the maturity phase, the saturation phase and the decline phase.
Twenty-two points which need to be considered when evaluating an idea for a new product are listed, and there is an Appendix setting out the facts which need to be studied before launching a new product. From this study the Market Brief (performance, cost, characteristics, range, etc.) is made up. Design (which should go along hand in hand with V.E.) then begins. Here the 'Guidelines' for assessing the suitability of a new product will be a useful check for the value engineer who is listing the features he requires to incorporate (or maintain) in the product which he is analysing.
The section on the method of fixing the product's price – estimating its utility, the elasticity of demand, the *total* cost of the product, and the competition – will be found to contain much useful information.
Reference is made throughout the book to the report on *Management Research Development* compiled by Messrs. Booz, Allen and Hamilton, Management Consultants.

E.V.W.

Materials – Design – New materials

**Selection of Materials and Design

Wolff, P., Kennedy, A.; Inglis, N., Broom, T. and Arrol, W.
Iliffe, 1967 80 pages 25/– (149)

The five papers in this book were presented at a course held jointly by the Institution of Metallurgists and the Institution of Mechanical Engineers in October 1966.

The first paper by Mr Wolff of Nuclear Design and Construction Ltd. discusses the designer's problems in making decisions on materials and the support he requires from the materials specialist. His warning of the high danger of failure to achieve 'the engineering objective' at each organisational interface and acknowledgement of time, manpower and informational limitations indicates a close knowledge of the difficulties that are encountered in everyday engineering practice.
The two papers, 'Fundamental Scientific Aspects' and 'Selection of Materials', are complementary. Mr Kennedy deals with the limits within which those designing the materials must work and Mr Inglis discusses the effects the properties of materials have on the method of 'working' them. The engineer's difficulties in fabrication and inspection are analysed and the problems arising from over-specification are discussed.
The last two papers by Messrs Broom and Arrol – 'Future Trends in the Development of Materials' and 'Future Trends in the Selection of Materials and Design' – will be of interest to value engineers. As one of these authors reminds us 'it is almost a natural law that "better means more expensive".' Hence increased material costs can only be recouped by sizeable improvements in efficiency or other performance parameters.
Reference to 'the daunting prospect of the vast increase of information' and the assistance which the designer might obtain from the computer tapes of the American Society of Metals and other organisations highlights the problem of making readily available what is already known.
Useful reference lists are appended to two of the papers.

H.K.

Critical Path Programming

*A Programmed Introduction to Critical Path Methods

Cambridge Consultants (Training) Ltd.
Pergamon, 1967 70 pages 10/– (102)

Beginning with the contents of the book put forward in the form of a quiz the text then poses questions, the correct answers to which appear on succeeding pages. The book relies on the question numbers for sequence as the pages are not numbered and it illustrates the Critical Path Programming technique with actions involved in the building of a house.
It progressively builds up the complexity of the network system thus giving more and more practice to the reader.
Finally, there is a Glossary of the terms used, and the reader is referred back to the quiz at the beginning of the book.
Correct use of this book should result in the reader acquiring a working knowledge of this planning technique in the minimum of time.

H.W.

Capital Expenditure – Re-equipment Policy – Discounted Cash Flow

*A Simple Introduction to Capital Expenditure Decisions

Garbutt, D.
Pitman, 1967 134 pages 18/– (119)

Value engineers who are seeking a relatively low-priced handy guide and set of tables for calculating discounted cash flow will find it in Mr Garbutt's book. The author, who lectures at Cranfield College of Aeronautics, rounds off his discussion of the subject with an outline of suitable procedures for the authorisation and control of capital expenditure.
Distinguishing between the purely *economic* and the *business* evaluation (which takes account of *all* the factors) the evaluation of a proposed investment on a going concern and a new project is outlined. A table giving the return on investment in various manufacturing industries on a going concern basis is followed by a list of criticisms of this type of accounting data.
The author discusses the Cost-Reduction type of investment project such as is associated with Value Analysis. Appraisal of such a project involves the comparison of the net cash investment with the net cash returns which that investment will produce. The comparative cost and pay-back methods of evaluation are described. The payout-plot method (a graphical presentation of the cumulative cash returns on a project expressed as a percentage of the original capital investment) enables the riskiness of projects of different sizes to be compared.
The important concept of Time-Value of money and the Principle of Equivalence are well handled by the author who also provides a useful check on the numerous tax considerations which need to be taken into account.
Book values, as he points out, are irrelevant to decisions about the future.

W.L.K.

Human Relations – Checklist – New Products

*How to Get the Better of Business

Webster, E.
John Murray, 1967 160 pages 21/– (123)

Like the author of 'How to Run a Bassoon Factory' Mr Webster obviously understands that systems are made to work or fail by people. He shows how to cope with the information explosion and to keep up with the pace of business today.
This book is both humorous, penetrating and sound in its advice. The author too exposes a great amount of humbug – 'You're finished at forty', and 'The less they (the workers) know the less they will worry'.
Top management could read with profit what is said about 'Killing the Willing' and the lessons could be applied particularly to the 'management' of creative people such as value engineers. In companies – as well as countries – 'the many' owe much to 'the few'. Mr Webster's advice on delegation is also well worth following. On the subject of Data for Decision Making he reminds managers of what Marion Harper (Head of Interpublic) said that to manage a business well is 'to manage its future and to manage the future is to manage information'.
Setting out the qualifications which he would require of an industrial intelligence officer, Mr Webster says that in business ignorance (so far from being bliss) is commercial suicide.
He asks us to cut out confusion in the courses and conferences. People do not ask *what action should result* from a course – what should the man do (or do better) when he returns to the company? Value engineers will find on the Checklist for Promoting a Product a helpful indication of all the features which it requires.

L.F.

Human Relations

*Left Luggage—From Marx to Wilson

Parkinson, C. Northcote
John Murray, 1967 203 pages 25/– (123)

The author of Parkinson's Law (which word has passed into everyday business usage) needs no introduction to most of us who have come to look forward to a succession of very readable books from him.

In *Left Luggage* he takes a look at British socialism starting with a survey of the development of the Labour Movement. He shows the persistent influence of Marx and the steady erosion of democracy, Labour's continued blind faith in the Welfare State and nationalisation, and its present uncertainties and hesitations. The British in the twentieth century, he says, have lost their sense of mission. He makes out at least as good an argument against a classless society as for one – illustrating it with a biography of Sir Stafford Cripps.

The author excuses 'Marx's apparent stupidity' – as he calls it – by the time in which he lived, but where Marx was merely ignorant in supposing that peasants could run factories for themselves he contends his followers have not the same excuse.

Attlee, Angell, Bevan, Beveridge, Cole, Dalton, Engel, Michael Foot, Gaitskell, George (Henry and Lloyd), Hammond, Kier Hardie, Jenkins, Joad, Laski, Lenin, Morris, Thomas More, Rowntree, Ruskin, Shaw, Tawney, the Webbs, and Wells all get mention in the book. Touching on Christian Socialism, the Communist Manifesto, the Cooperative Movement, Fabianism, the Left Book Club, the L.S.E., Whitley Councils and the W.E.A., the author makes 'the going easy' for those who would equip themselves (or refresh their memories) on the background of the ordinary working man in Britain. A knowledge of such things should make for a better understanding of the problems of the man on the shop floor.

T.H.I.

Production – Decision-making – Procurement

*Business Cycles and Manufacturers' Short-Term Production Decisions

Moriguchi, C.
North-Holland Publishing Co., 1967 152 pages 64/– (144)

The subject of short-term forecasting is of interest to all who are concerned with production planning and especially if the author – as in this case – is prepared to test his hypotheses. He has done this on figures for stock-sales ratios in the cement, paper and timber industries, and indicated other demand-dominated industries (such as gas ranges and domestic refrigerators) which could be similarly treated. His hypotheses apply to all industries in which the month is a basic unit of time and production is for stock and not to order.

As we know manufacturers hold inventories in order to lessen overall procurement costs, smooth out production, anticipate price rises, and overcome the problems of lead time. Therefore, the ability to correlate successfully business expectations with inventory is a most useful management 'tool', and one which if mastered could contribute towards maximum profitability.

A.F.

Forecasting – Finance – Checklist

*Planning your Business

Prepared by Irish Management Institute and Advisory Service of Irish National Productivity Committee
Stationery Office, Dublin, 1966 84 pages 20/– (150)

The National Industrial Economic Council's Occasional Paper No. 1, which was prepared by the Irish Management Institute and the Advisory Service of the Irish National Productivity Committee, presents the manager with an extremely useful step-by-step guide for planning the development of his business.

Beginning with a questionnaire, designed to uncover the degree of planning in which a manager already engages, the booklet goes on to discuss why there should be planning and what is involved in making a plan. It clearly illustrates the danger of the product/profit gap, and stresses the need for managers to understand the relevance which the National Plan has for his business.

Twenty-seven exhibits set out clearly how a business plan may be formulated. The procedure for updating this planning, and the planning documents give a very practical lead which is reinforced with full details of a hypothetical planning exercise.

When, at the present time, Corporate Planning, L.R.P., economic models, and Input-Output analyses of the Leontoff type are the fashion, it is most refreshing to come across a book of such modest length which is full of such commonsense advice.

It has been said that 'Where there's a plan there's a profit' and this book provides sufficient information to enable every business no matter its size to have a plan.

C.J.D.

Information Retrieval – Patents – Standardisation

*Technical Information Sources—A Guide to Patents Standards

Houghton, B.
Clive Bingley, 1967 101 pages 20/– (151)

After describing the British and other Patent systems the author draws attention to the uses which can be made of Patent Specifications. 'Ideas', he says, 'disclosed in patent specifications relating to one field can stimulate developments in completely different fields'.

Post coordinate or uniterm indexing and other retrieval methods are described.

Attention is drawn to the types of standards – covering dimensions, performance or quality, testing, terminology and codes of practice – and their uses explained. Here the value engineer and the standards officer will find much to interest them.

An outline of the system for handling technical reports will also indicate the directions in which further and up-to-date information may be sought.

South Wales Switchgear, through applying 'variety reduction' methods increased its productivity through standardisation by 50 per cent over a period of three years.

A.C.

Value Standards – Cost-estimating – Checklist

**Manufacturing, Planning and Estimating Handbook

Wilson, F. (ed.)
McGraw-Hill, 1963 840 pages 180/– (101)

Prepared under the direction of the Technical Publications Committee of the American Society of Tool and Manufacturing Engineers the 135 contributors to this book crystalise their experience in methods for analysing the methods of manufacturing a product and for estimating its manufacturing costs.

'Engineering', the book says, 'is a spectrum of interlocking activities requiring men of diverse talents, training and interests. The four basic concepts that must be dealt with in manufacturing are ideas, things, money and people'.

A questionnaire covering the analysis of manufacturing provides a number of points of direct interest to value engineers.

Steps in making cost estimates contain many useful value standards, and a list of areas in which a standards programme might be set up is given. A corrosion guide for fasteners, fatigue

allowances, learning curve applications and the line-balancing method for optimising production are included in the book.
It is interesting to note the use of the questions – Does its use contribute to value? Is its cost proportionate to its usefulness? Does it need all its features? Is there anything better for the intended use? and so on – without any reference at that point to Value Analysis. The important cost-saving technique Value Analysis is dealt with in eleven lines!

C.E.

Creativity

**Thinking and Reasoning

Wason, P. and Johnson-Laird, P. (eds.)
Penguin, 1968 431 pages 8/6 (135)

How do we think? What happens when we solve a problem? In spite of this book which presents the opinions of over forty experimental psychologists on these and similar questions we still face the challenge of how to trap the inventive process.
The book – as the editors record – is concerned with *directed* thinking, the kind of thinking which occurs when someone tries to solve a problem. Although many facets about thinking have been discovered there is no single theory into which they can be integrated. The chief difficulty in studying thinking is that it is a private activity. All that can be observed is the *results* of thinking, not the processes which led up to them.
Reference is made to both the Behaviourism and Wurzburg Schools of research into thinking, and to the deductive and inductive methods of reasoning. People's ability to make valid deductive inferences and their performance in inductive tasks is studied. 'A Study in Thinking' (the work of Bruner, Goodnow and Austin in 1956) is followed up with more information on cognitive growth and methods used in measuring it.
More important than how people solve problems is the ability to find (or delineate) what the problem is in the first place. For once problems have been formulated then computers are increasingly being able to solve them.
With all the work which has been done on the study of creative people we still know very little about the processes underlying the creative act.

D.C.

Producibility

*An Introduction to Workshop Processes

Gwyther, J. L. and Page, R. V.
Penguin, 1968 243 pages 15/– (135)

*Workshop Processes and Materials for Mechanical Engineering Technicians: 2

Rankin, J. A.
Penguin, 1968 288 pages 17/– (135)

These two books and *Workshop Processes and Materials for Mechanical Engineering Technicians: 1* would provide a useful source of explanations of basic engineering processes for those undertaking Value Analysis work without an engineering background.
The simple treatment of such mysteries to the uninitiated as fits and tolerances, tensile strength, hardness scales, and the forming and cutting of metal makes them easy to understand.
An Appendix devoted to machine fastenings – nuts, frictional locking devices, positive locking devices, keys, splines and cottered joints – with its illustrations places the alternatives before the value analyst who is looking for the lowest-cost jointing solution. With the forthcoming changeover to metrics the information on S.I. (Système Internationale) Units is very helpful. Information is given on the common alloys and plastics.

H.G.

Training

*Human Resources for Industrial Development

International Labour Office, 1967 238 pages 17/– (120)

This book first discusses the skill requirements for industrialisation and then goes on to highlight the training problems which this involves both in the industrially forward and in the industrially developing countries.
From this broad base the book proceeds to consider other policy issues such as social participation in industrial development, employment and wage aspects.
Since human resources planning for their optimum use is part of the value engineer's daily consideration it is not unexpected that he will be faced with the same (even if only at the level of the firm) problems and constraints.
What is said about on-the-job training is very relevant, and the necessity for short, medium and long-range planning to provide a framework within which to estimate the extent and depth of the skill needs is also pointed out.
From a sociological viewpoint the analysis of aim of industrial development (the increase of output and income, not the provision of jobs) it is realised is not a matter of indifference. Whether a path of development leaving many people without work, or providing many new jobs quickly is chosen is dependent upon how a country faces up to its responsibilities. Not to use the latest technologies at all would be wasteful as it might be wrong to use them indiscriminately.
The four main groups of technologies are – (1) Technical know-how with little capital element, (2) the tool element separated from the labour element, (3) machines which replace non-existent human skills, and (4) all modern technologies. These should be introduced gradually and not at the cost of jobs or wages.

F.L.P.

Quality – Reliability

*A Penguin Survey of Business and Industry 1967/68

Robertson, A. (ed.)
Penguin, 1968 157 pages 8/6 (135)

Covering *British* industry this survey states that 'At the root of Britain's economic troubles lies some kind of inefficiency and . . . a great deal of thought has gone into trying to determine precisely what it consists of'. Mr Robertson, in his introductory remarks then goes on to say, 'A favourite scapegoat is management, another is the trade unions . . .'
'The management of the immediate tomorrow' versus defensive type management; the value of size as regards the balance of payments; and the advantages of recognising the adequacy of wage rates are but a few of the topics included in the survey upon which today's modern managers should be informed.
The application of the law of 'the trivial many and the vital few' (Pareto's law, named after its postulator) is illustrated in an excellent chapter devoted to answering the question 'Are British Executives Underpaid?' The extensive quotation from Steindl's

Random Processes in Economics is very worthwhile reading for those who seek a clear explanation of 'the 80/20 rule'.
V.A./V.E. receives brief mention along with Q & R. 'More and more companies have set up *formal* Value Analysis and Value Engineering *teams* to examine with critical eye their traditional manufacturing approach.' How true it is – as one writer puts it – the 'built to last' mentality instead of 'built for the job' still tends to prevail in many British industries today!
The reader's persistence is rewarded with interesting information in the last chapter in which Lisl Klein, Social Scientist at ESSO, covers occupational psychology, Ergonomics, Human Relations Training and Organisational Theory. G.F.B.

Electrics – Purchasing – Design

*Design Engineering Handbook—Electric Motors

Weaver, G. G. (ed.)
Products Journals, 1968 160 pages 40/– (126)

This is yet another great time saver for the value and design engineer from these publishers.
Other titles equally useful include *Adhesives*, *Electric Controls*, *Value Engineering*, *Metrigrams*, *Metals*, *Fluidics*, *Plastics*, *Electrical Connectors*, *Sealants*, *Fluid Power*, *Creativity*, *Product Finishing*, and *Printed Circuits*.
Reference to *Electric Motors* will save hours in looking for the right component and locating the best-value supplier.
After dealing with the main British standards for Electric Motors, Enclosures, Mountings and Control Equipment, the fifteen specialist contributors offer their experience of the different types of motors – including 3-phase, A.C., synchronous, single-phase, D.C., Servomotors, Stepper motors and miniature motors.
A graph shows that there has been an 80% reduction in the weight of equivalent h.p. motors from 1904 until the present day.
Value engineers will find the checklists in the chapter on the 'Choice of Electric Motors' and the advice of interest. Points to cover in ordering a motor also indicates the type of considerations which need to be taken into account.
The book contains the addresses of 150 suppliers of electric motors. A.B.

Design

*Design Engineering Guide—Stress Analysis

Product Journals, 1968 34 pages 7/6 (126)

Experimental stress analysis is finding increased interest amongst the designers and value engineers assisting as it does in the production of more economic designs.
Its application often results in weight reduction (materials conservation), and easier producibility.
In experimental stress analysis use is made of photoelasticity, photoelastic refective technique, brittle lacquers and strain gauges.
Such methods are described and profusely illustrated in this *Guide* which concludes with a 20-point summary to assist those who have to select the best method to use for particular problems and with a list of the suppliers of stress analysis equipment.
Some readers may be interested to learn that there is a British Society for Strain Measurement (founded in 1964) and which has both 'Company' and individual membership classes. Details may be obtained from the Secretary, 281 Heaton Road, Newcastle-upon-Tyne. G.Y.

Producibility – Design

*Manufacturing and Machine Tool Operations

Pollack, H. W.
Prentice-Hall, 1968 593 pages 126/– (117)

This book – which shows the limitations of production of tool-room operations – will give to those value analysts who are unfamiliar with manufacturing processes a good coverage of the field from the most simple to tape-controlled machines.
It is written by a man with a good deal of practical experience. This shows up in the selection and presentation of the material in the book.
After discussing the general purposes and fundamental principles of machine tools, their limitations as well as capabilities are clearly pointed out.
It is not enough (as the author says) merely to design a machine – it must be capable of being both built and operated.
Features lists which are scattered throughout the book would be useful to those concerned with optimising value. After dealing with casting techniques, cutting methods are covered, and the book ends with two interesting chapters on Numerical Control and Quality and Dimensional Control.
For those wishing to gain a quick general appreciation of N.C. the chapter on this subject deals with:
the economics of N.C.
N.C. systems and commands
Codes and Tape Preparation
N.C. Machines.
The mention of H.E.R.F. (High Energy Rate Forming) and E.C.M. (Electrochemical Machining) indicate the up-to-dateness of this useful textbook. G.G.T.

Human Relations

***Human Relations in Modern Industry

Tredgold, R. F.
Methuen, 1968 192 pages 14/– (141)

This most useful book, in the University Paperbacks series, has been written by the Physician to the Department of Psychological Medicine at the University College Hospital. It outlines how problems of satisfaction at work, individual and group behaviour under stress, leadership, training, leisure, absenteeism and so on may be approached and overcome or mitigated.
The book 'developed out of talks' which were given over twenty years ago at Roffey Park (which began as a Rehabilitation Training Centre and later developed in other directions) will be of great use to anyone engaged in the daily practice of management. It is a marvellous source book and the author refers to the views and work of such well-known people as Sir George Schuster, Elton Mayo (of Hawthorne Experiment fame), Russell Fraser and Konrad Lorenz' two books *King Solomon's Ring* and *Man Meets Dog* which (he says) should be part of every manager's library.
Describing such things as the effect of human relations on productivity, the workings of the human mind, the effect of fear of the unknown, the significance of neurosis in production and the uses of emotional outlets, Dr Tredgold says 'It is, of course, possible (though rather disturbing) to hold two opposing emotions towards the same person at the same time . . .' Ambivalence is the term which he gives to what is popularly referred to as a love-hate relationship which is experienced at some time during their lives by all people.
For a book which puts forward practical ways for solving industrial relations problems and for handling human problems this one would be hard to surpass. Dr Tredgold adds to a breadth of reading a wealth of experience in the study of the subject which he has so obviously made his own. F.T.

Management Techniques – Training

*The Genesis of Modern Management

Pollard, S.
Penguin, 1968 391 pages 8/6 (135)

This study of the Industrial Revolution in Britain shows how at that time capitalists saw the need for managers and it describes the problems which confronted these *first generation* managers. The book highlights those factors which have brought about present-day practices in British management and provides those who are interested in origins much useful bibliographical reference material – about 70 pages of it.

During the Industrial Revolution the management problems were the same in all types of industry – labour recruitment, training, production control and accounting. In the early part of the Industrial Revolution the typical entrepreneur was his own manager and formal management development (training) up until 1850 was 'so rare' according to the author 'as to be negligible'.

The annual salaries for 'top' managers, 'typical' managers and bookkeepers progressed over the 140 years from 1690 to 1830 as follows:

	1690–1750	1750–1790	1790–1830
	£	£	£
Top managers	350	650	1250
Typical managers	45	75	175
Bookkeepers	22	50	75

It is interesting to read that 'schooling might cost from £12 to £20 a year including boarding'. Charges in 1788 (the year in which Australia was first settled) for teaching writing and accounts was 10/- a quarter.

Work rules, which came into being about this time, dealt mainly with disciplinary matters, and the earliest writings of advice on management were 'as banal as the worst of the books on similar topics still are today' says the author.

The names Boulton, Robert Owen, Newcomen, George Stephenson, Watt and Wedgwood; and the places Dowlais, Merthyr Tydfil and New Lanark and the terms *Costing*, *Depreciation*, *Piecework* and *Sub Contract* indicate the extent of the field covered in the book.

The author comments that among the great number of accounting textbooks published in Europe between the seventeenth and early nineteenth century there was an absence of works on cost accounting. In 1796 Edward Farmer, submitting an accounting textbook, said 'Here is a set of books framed to assist the merchant or manufacturer with various ways to prove not only the correctness of its debits and credits but *the real profit of the concern*'.

Professor Pollard, who occupies the Chair of Economic History in the University of Sheffield, has provided students of business and management history with a most useful book.

G.H.J.

Work Study

**Achievement Through Work Study

Webb, S.
Pergamon, 1968 73 pages 15/- (102)

Mr Webb, the author, is Operator Training Officer at Pressed Steel Fisher Ltd. He is engaged in the administration of Work Study Training and obviously has made a careful selection of material in his book for the audience for which it has been written. It is an easy-to-read book on this important contributory technique to increasing productivity.

The subject matter of Work Study is presented with illustrations and test questions.

Beginning with Method Study, the author indicates the types of items which offer scope for such study – poor material usage, bad plant layout, manufacturing bottlenecks, poor quality output and fatiguing work. He then shows how processes may be visually represented on Flow Process and Multiple Activity Charts. The Critical Examination Sheet supplied to readers is a most useful way of checking to see all relevant points have received consideration.

In the section on Work Measurement which then follows there is a very clear explanation of the important concept of Rating.

A section on Synthetics (the name given to a Work Measurement technique which builds up the time for a job by aggregating the element times obtained previously by time-studying similar work *or movements, etc.*) is followed by consideration of Analytical Estimating and Activity Sampling. Analytical Estimating is a Work Measurement technique whereby times are established from knowledge and practical experience. Activity Sampling, instead of making a continuous observation, makes random, intermittent observations.

The book contains two other useful features: footnote answers to the progress tests, and a family-tree index [a method quite new to the reviewer and *very functional* (!)].

It is a book which may be placed in the hands of anyone requiring a brief clear introduction to the subject.

J. O'H.

Direct Labour – Work Measurement – Time Study – Value Standards

*Work Measurement: Some Research Studies

Dudley, N. A.
Macmillan, 1968 135 pages 42/- (142)

Those who are interested in methods for improving the accuracy of measuring work will find that these reported researches will provide them with much food for thought.

Readers should realise that this book *is not an instruction manual* for work measurement; it assumes that work study techniques are already well-known to its readers.

Professor Dudley, who occupies the Chair of Production Engineering at the University of Birmingham, points out that 'not until the (work measurement) practitioners are regarded as the custodians of the time standards, and are removed from the area of bickering about wages rates, is it likely that any substantial improvement in standards of practice will be achieved.'

Details are given in the book of the National Time Study Rating Survey, of field studies on compensating relaxation allowances, of work sampling and of motion time studies. Information is also given on pacing worker performance.

Chapter I has an outline of the development of work measurement from the time of F. W. Taylor (1856–1915) up to the present. At the end of the book there are 133 references to further reading, and a Glossary of the main terms.

A.S.M.

Cybernetics

*An Introduction to Cybernetics

Ashby, W. R.
Methuen, 1968 295 pages 18/- (141)

Cybernetics has been defined as 'the science of control and communication in the animal and the machine' – in a word, as the art of *steersmanship*.

Many people have been prevented from taking up the study of cybernetics by an impression that it must be preceded by a study

of electronics and advanced mathematics. This impression – the author tells readers – is false. If the subject is built up step by step there is no reason why a complete understanding of its basic principles cannot be gained without a knowledge of mathematics or electronics.

The book – which sets out to help the reader who is not highly equipped electronically or mathematically – does so admirably, and before many chapters have been read an understanding of the fundamentals of cybernetics can be had.

The book begins with an explanation of what is meant by 'stability' and 'feedback' which must be understood initially, and then it goes on to outline those principles which must be followed when the system is so large and complex that it can only be treated statistically. Next, what is meant by 'information' and how this is coded is explained. This leads on to Shannon's Theory.

It is a book *for those who want to work* in order to get a clear understanding of the subject.

Cybernetics offers a single vocabulary and a single set of concepts for representing systems, and it also offers a method of investigating systems scientifically. It offers the hope of providing effective methods for the study and control of systems that are extremely complex.

The book makes plain such terms as Black Box, Markov Chain, Entropy of Communication Theory, Information Theory and Pay-off Matrix which are fast becoming a part of the general business and management vocabulary. Cybernetics has its own foundations – its truths are not conditional on their being derived from some other branch of science. Since Norbert Wiener first set down its fundamental truths the science of cybernetics has undergone marked expansion, and Mr Ashby has made an excellent job of interpreting these truths so that all who conscientiously follow through on his book will end up with a balanced appreciation of the subject.

G.H.G.

Training

**Industrial Training Handbook

Barber, J. W. (ed.)
Iliffe, 1968 412 pages 74/6 (149)

This is a balanced informative work by some thirty specialist contributors, and it will be of considerable help to training officers and also those who are charged with the responsibility at Board level of determining training policy.

The five-part book which deals with:

The Training Framework
Preparatory Considerations to Training
Specific Types of Training
Training Methods, and
Training Organisations

is modestly said by its editor to be 'an introduction' made up mainly of contributions from those attending industrial training courses at Portsmouth College of Technology.

Chapters which deal with 'The Industrial Training Act', 'The Training Function in the Working Organisation', 'Effective Recruitment and Selection', and 'Job Analysis' have particular interest for the Manager.

Training aids covered include the Film Loop, Programmed Learning, 3-dimensional Chalkboards, Flip Charts, Felt and Magnetic Boards, Photographs, Overhead Projectors, Epidiascopes, Cine Films and Closed Circuit Television (C.C.TV). The Project Method, the Case History Method, Lecturing, Seminars and Discussion Groups are all described; and training for specific functions outlined. Management and Supervisory development, in-plant training and T.W.I. (Training Within Industry), Re-Training for whatever purpose, Apprentice and Operator Training, and the Simulator are explained. B.A.C.I.E., B.I.M., City and Guilds, the Industrial Schools, I.P.M. and the Institute of Supervisory Management are amongst the initials and names which will be familiar to those engaged in personnel and supervisory management. The scope of these bodies is fully covered thus providing in handy reference form a great deal of valuable information.

Although such subjects as Work Study, Operations Research, Decision Theory and Queueing Theory are mentioned in the book the reference to Cost/Benefit Analysis is the nearest the book approaches to Value Analysis. However, value engineers (concerned as they are with value for money) will find the list of training cost centres helpful to them in costing out their own training facilities.

K.F.

Design – Creativity

*Framework of Technical Innovation

Parsons, S. A.
Macmillan, 1968 196 pages 42/– (142)

After reviewing Britain's technical progress the author, who is Principal of the Liverpool College of Technology, discusses the communication of ideas, the functions of Research Councils, the direction of money toward innovation, the design process, the educational and manpower problems and the need for consumer guidance.

Discussing the 'Factor of Ignorance' Mr Parsons says: 'A mechanical engineering designer usually has to make some assumptions when he is considering the actual working conditions of the product he is designing. For example, it is not possible to simulate all the conditions that a product will encounter in service on a test bed.

The book takes these matters above mentioned into account in considering Britain's attempt to solve her balance of payments problem and concludes with a useful study of the problems encountered in the development of magnet steel.

K.N.P.

Direct Labour – Wages – Productivity – Training – Transport – Trade Unions

*After Donovan?

Marsh, A.

*Industrial Democracy

Goodman, G.

*Measuring Productivity

Wilson, G.

*Shop Steward Training

Coker, E. E.
Pergamon, 1968 24 pages each 2/6 each (102)

To complete this quartet of books *After Donovan*? assesses the Report of the Royal Commission on Trade Unions and Employers' Associations. Mr Marsh, its author, says 'We have been making up our industrial relations *as we go along*.' Many would agree with him. The vital question is the one which he asks: 'What happens now?' After Donovan, what? The views of the twelve apostles of Donovanism are being challenged on all sides – the Unions saying that they are taking away their freedom of action, some employers saying they do not go far enough, and students of industrial relations asking did the wise men have sufficient vision? As this Report will be the subject of debate for some time to come this booklet is well worth purchasing.

Industrial Democracy ties in with the previous book and points the need to re-examine the role of people at work, to search for effective ways in which the old them-us relationship may be rendered obsolete. It goes into the question of whether more worker participation in management is practicable, and outlines recent developments outside Britain. More worker involvement should be our immediate objective for when this has been accomplished we shall be on the way to solving many other problems which, at the moment, seem so intractable.

Measuring Productivity by Geoffrey Wilson is a report of a case study in measuring productivity in the British Rail Road Services Department. The key to the success was the provision of targets against which those responsible for the particular function could measure their achievement. 'Achievement' seems a much more emotive word than 'performance' or 'productivity' or that soulless phrase 'Production Per Man-Hour' (P.P.M.H.).

Mr Coker in *Shop Steward Training* points out that there are about one-fifth of a million shop stewards in British industry and their training poses a great problem not only as regards their numbers but also as to the length, method and content of their teaching. The F.B.I. and T.U.C. in 1963 jointly agreed what the shop stewards should be taught:

Structure, working and policies of the steward's union,
Union rules and procedures,
Workshop negotiations,
Relations between unions,
Systems of wage payment,
Work study,
Job evaluation, and
Social and economic subjects related to industrial affairs.

The author sets out the various teaching methods giving their advantages and disadvantages from a steward's (trainees) point of view. He supplies a list of educational guidelines for those training shop stewards, and the book concludes with three very useful appendices – the Thurrock Technical College's First Principles of Industrial Relations 10-week, 4-hour release course; Syllabus for a 24-week, full-day course conducted by the Oxford University Delegacy for Extra Mural Studies, called 'Industrial Relations and Communications'; and Some Useful Addresses.

B.D.W.

Purchasing – Survey

*Buyers' Views on Salesmen

Tack Research Ltd., 1968 72 pages (152)

How do Purchase and Value Analysts regard the people who come to sell to them? What gives rise to the opinions which they form of these people? How far is the opinion formed created by the salesman?

These are the questions which the Research Division of the well-known Tack Sales Training Organisation set out to probe covering such matters as the salesman's product knowledge, his sales presentation, the buyer's accessibility, the salesman's appearance and his personal habits.

Seventeen tabulations include details of the sample of 1,040 buyers who responded to the questionnaire, manner of persuasion used by the salesmen, the reasons which the buyers' had for granting the salesmen their interviews, buyers' hours of work, and the type of salesmen's failings.

As in all such endeavours the sample and the questionnaire are of fundamental importance. The responses were satisfactory and the method of questioning which had been pilot-tested provided an adequate unbiassed coverage of the subject.

Purchasing officers and other buyers can testify to the absolute need for the salesmen to know his product. In 65% of the cases they did. Imaginative sales presentations were made by 54% of salesmen. In only 24% of cases was the interview granted the salesman from real interest and/or need.

The questionnaire paid a lot of attention to the buyers' views of salesmen's appearance including fingernails, shoes, linen, hair-style/length, etc. and sought opinions upon the type of handshake which the salesmen had. Clammy, Limp, Masonic, Crushing and Pumping were some of the adjectives used to describe these. Smoking habits too were commented upon.

The most disliked failing of the salesman was recorded as flattery although this may have been a loaded question, and the telling of dirty stories was placed last as a failing which could be a comment on morality as well.

How, I wonder, would Britain's export salesmen rate on this type of questionnaire which, of course, would include other relevant questions?

The survey concludes with this opinion:

'On the whole, the salesmen I see are good chaps with a desire to please and be helpful. Most of them have their personal short-comings . . . so have I.'

Whilst this may be an admirable comment on British salesmen it would be most interesting now to have a survey in reverse:

How do salesmen see buyers – Purchasing Officers, Value Analysts, Purchase Analysts, etc.?

Are they fair and reasonable in their requirements and their standards?

Do buyers behave as well as they expect salesmen to?

J.E.

Human Relations

**Industrial Society: Social Sciences in Management

Pym, D. (ed.)
Penguin, 1968 463 pages 10/- (135)

Can the industrial psychologist and social scientist help to solve industry's problems which include:

the best use of human resources
the ergonomic problems in production
organisational and individual behaviour
the development and marketing of new products?

Twenty-one contributors have provided answers to this question in this book edited by Mr Denis Pym of the Department of Occupational Psychology at Birbeck College. The book contains a very comprehensive bibliography.

The Americans as the editor points out call the social scientist the 'Change Agent'. The social scientist represents a threat to the *status quo* – even by merely describing what is going on! People who find his presence threatening search out reasons why the project must be limited or postponed: 'I'm a bit worried how the Unions will react'. 'I don't think my managers can spare the time'. 'Couldn't we put it off until later.'

The work of the N.I.I.P. and the Tavistock Institute is familiar, as are Elton Mayo's Hawthorne Experiment at the Chicago Plant of the Western Electric Company and Elliott Jaques' Glacier Metal Project, to many who are interested in human relations in industry. These institutions and projects are described in this book and mention is made of McLuhan's work on media analysis. McLuhan holds that the consequences of automation will be to unite production, consumption and learning!

Discussing the new role for the social scientist W. H. Whyte in *The Organisation Man* asks if social science is not just a sanctioned form of manipulation. The book highlights some recent thinking and research on this type of question, and faces up to the oft-heard comment on social science that 'it's all just commonsense'. It is the limits of commensense which interests social scientists. The absence of progress in industrial relations is shown by the way many managers rely entirely on such things as productivity agreement and executive training just as their predecessors relied on aptitude testing, wage incentives, and scientific management.

Management (like politics) is the art of the possible and *because it is an art* there is in its practise ample room for the industrially trained sociologist.

W.D.B.

Materials Management – Supply – Purchasing

**New Ideas in Materials Management

Van De Mark, R. L.
Industrial and Commercial Techniques Ltd., 1968 216 pages 55/– (154)

Supplementing the books *Inventory Control Techniques*, *Production Control Techniques*, and *Wholesale Inventory Control* (all published in America by Van De Mark Inc.) this most original book presents twenty-nine 'New Ideas' on the management of materials.

The author points out the difference in Unit Cost as used by the accountants and as understood by the inventory department. The latter – for its E.O.Q. calculations – needs the costs at the time the Unit goes into stock and when it leaves the stockroom. The 'K' factor (or inventory cost factor) and easy ways of calculating usage (Poissons Distribution Order Point and V.D.M. Order Point) are described by the author who advocates, in place of a single control system, a hybrid system for the control of inventory. This hybrid system consists of perpetual records for the 'A' and 'B' items and the use of physical counts, etc. for the 'C' items. 'A' items include only 15% of the items but 70% of the material *usage*, 'B' items 20% of the items and 20% of the usage, and 'C' items 65% of the items and *only* 10% of the usage.

The time-element in recording, too, is emphasised. Pre-posting versus post-posting. Which is better and why? These and other relevant considerations are reviewed.

The book also deals with the important line-of-balance concept. A line-of-balance chart simply being an inverted time cycle chart which enables us to cope with the task of identifying the problem. The work of the Rush Orde Committee, and the 3-part A.V.O. (Avoid Verbal Orders) system are also explained. And the author's final word to the reader – 'Now put what you've learned to work. Otherwise we've both wasted our time!' – is a very sound piece of advice.

V.F.S.

Warehousing – Plant Layout – Checklist

**Organised Cost Reduction Techniques for Modern Warehousing

McKibbin, B. N.
Industrial and Commercial Techniques Ltd., 1968 141 pages 55/– (154)

Mr McKibbin, who is a Distribution Consultant and Director of Planned Warehousing Ltd., obviously brings a lot of practical experience together in this 'key to effective distribution' as the book is sub-titled.

It would be a pity if those who were interested in manufacturing plant layout, because of the book's title – were to overlook it as most of the information it contains has equal relevance to the location, construction and equipping of production plant. Some of the various cost indices have been applied by the reviewer to established operations and they have been found to be remarkably close to reality. This is always an encouraging sign as to the practical worth of a book.

Beginning with a description of Organised Cost Reduction in which the fundamental importance of measurement is stressed the writer goes on to discuss the types of measurement and provides guidance as to the directions which a survey should take. For the uninitiated there is a section summarising the techniques of work measurement including time study, synthesis and activity sampling. After going into the reasons for setting up a planned distribution network, the strategy of site location and the types of building construction, there is a most useful 5-page checklist covering the points requiring consideration. Factors which affect the cost of construction – shape, size, span, height, heating, roofing, cladding, doorways, flooring and lighting – are first detailed as to requirements and approximate cost; then a Cost Control on Building Development section provides a typical cost analysis for the construction of a factory and storage unit.

The author then goes into a detailed account of handling equipment needs, its selection and purchase, and the training of operators for it. Again operating cost tables are very helpfully provided.

The book concludes with a Distribution Cost Project and a worked example of Journey Planning. The book should form part of every plant layout and material handling man's library, and value engineers (interested as they are in comparative as well as absolute costs) would also find it a mine of useful data.

B.D.W.

Design – Ergonomics

**Industrial Design for Engineers

Mayall, W. H.
Iliffe, 1967 142 pages 32/6 (149)

Explaining the industrial designer's work in regard to engineering products the author discusses these elements of design:

how the industrial designer's work is integrated with that of the engineering designer;

how the ergonomic principles of man/machine relationships are applied in design;

how the basic aesthetic concept of unity, order, form, colour and variety are incorporated in design.

The book provides the engineer with an appreciation of the industrial designer's function and shows how *design as a whole* must be considered if the desired end-product is to be obtained. Since Henry Dreyfuss began 'designing for people' and Thomas Treadgold spoke of the work of the engineer being 'for the use and convenience of Man' it has become increasingly clear that successful products must satisfy people in the ergonomic sense as well as meeting their other needs (aesthetic and functional). The book clearly sets out the ergonomic requirements which a product has to meet and it points to the limitations met with in using anthropometric data.

The chapters on the psychology of seeing and on colour help the reader to understand how things are seen and the advantages of using colour properly on engineering equipment.

Lastly, industrial design in practice is described right through from the specification of design requirements to the final presentation of a proposed design. This is followed by a bibliography.

D.L.C.

Information Retrieval

*Library and Information Services for Management

Bakewell, K. G. B. (ed.)
Clive Bingley Ltd., 1968 130 pages 25/– (151)

This is a report of a short 3-day course for information workers held at the Liverpool School of Librarianship and covers such matters as:

the information requirements for management, and

the problems of communicating this information.

Its dust cover indicates other books from the same publisher dealing with further aspects of library science and some of these would be most helpful to anyone charged with the responsibility of setting up a management information service.

The working method of ANBAR, including the classification system which it uses, is described and the value of business archives explained. One way in which computers are being used

to produce indexes is outlined. This is the K.W.I.C. (or Keyword-in-context) system, and the problems involved in its application are mentioned.
It is interesting to note that the Dewey Decimal and Universal Decimal (U.D.C.) classifications, the Library of Congress classification, the Selective Dissemination of Information (S.D.I.) index, and the Harvard Business School's classification were evaluated and the Library of Congress scheme was most favoured for the classification of management literature.
The last of the ten authors, Mr Sewell, deals with the problems of breaking through 'The Language Barrier' in information dissemination. This barrier includes knowledge of the availability of information (current awareness systems) as well as translating information from foreign languages.
A final check through the index of the book indicates that the activities of ASLIB, the BIM, BISRA, BSI, LADSIRLAC and PERA are also touched upon in the text.
The book will be useful to value engineers who wish to ensure that they have exhausted the main avenues of information whch are open to them in the solution of their problems.

E.G.B.

Work Study – Materials Handling – Plant Layout

*I.M.S. Clinic Proceedings 1967

Hillenbrand, R. (ed.)
Industrial Management Society, 1968 176 pages $10.00 (155)

These proceedings of the 31st Annual Industrial Engineering and Management Clinic, held in November 1967 in Chicago, contains transcripts of talks by some thirty leaders of industry, labor and education.
Such topics as work measurement, methods, cost control, materials handling, plant layout, automation, labor arbitration, programmed instruction, wage incentives and human relations were covered by the speakers.
Profusely illustrated, full of good sound practical advice, containing much forward-thinking on management problems – what more can be said about this book except maybe that – for value engineers – it contains a paper by Arthur Mudge giving advice on 'Establishing a Value Engineering Program'.
Arthur Mudge claiming that 'a dissatisfied employee is your greatest asset' goes on to show that a successful Value Engineering program relies to a great extent on the constructive discontent of the individual. He illustrates the steps in setting up V.E. in a company and points out the difficulties to be overcome before it can become successful. H.K.

Research and Development

*Science and Technology in Europe

Moonman, E. (ed.)
Penguin, 1968 175 pages 6/– (135)

The work of ten authors, this Penguin Special includes views upon:

Scientific and technological collaboration
The Role of the University in R & D
Development of Research
American Scientific Interests in Europe

and lists some 300 books for further reading.
Its contributors – Sir Anthony Myer, Professors Benson and Davies, and Messrs Leicester, Salomon, Windbury and Sapper – help Mr Moonman and his wife to achieve quite a task of answering the question: What is the future of European science and technology?
The editor leads off with a survey of the extent of S. & T. collaboration in Europe referring to CERN, ELDO, ESRO and EURATOM and providing the reader with some useful background statistics against which to set some of the views expressed by his colleagues.
The time-lag between the conception and execution of an idea is referred to by Mr Leicester (Chairman of the Committee of Directors of the Management Research Association) who provides some figures of the income and direction of expenditure of Industrial Research Associations. He also contrasts what is happening in the various European countries.
Finally, the editor and Sir Anthony Myer sum up the implications of a coordinated Science and Technology Policy.
It is a very worthwhile book for the Managements of all industries and, I should think, mandatory reading for those who are in technologically-based companies. H.F.L.

Creativity

**Invention and the Evolution of Ideas

Schon, D. A.
Tavistock Publications Ltd., 1968 208 pages 21/– (140)

Originally published as *Displacement of Concepts* (its unifying principle) this stimulating book takes its illustrations from the development of new products and inventions.
Its author, Mr Schon, is an industrial consultant who works in the field of which he is writing.
The displacement of concepts – the functioning of older theories as projective models for new situations – is an essential process in the evolution of new ideas. There is novelty in the functioning of new ideas. They are, according to Mr Schon, neither illusions nor law-like recombinations of old ideas. New ideas do not spring from nothing or from mysterious external sources – they come from old ones.
We have, says the author, yet to see the directions of displacement which will be taken by the welfare state, automation and other innovations of our time. As the reviewer sees it the main innovative problem is that of bringing the familiar theory as a projective model to a new situation, and this is the basis upon which the displacement of concepts rests. The book is commended to the attention of serious enquirers into the reasons for creative behaviour. J.W.S.

Communication

*Effective Communication

Learning Systems Ltd.
Pergamon, 1968 86 pages 10/– (102)

This book is one in the series of Pergamon Programmed Texts for Industry and Commerce. Other titles include *Workshop Mathematics*, *Discounted Cash Flow* and *Critical Path Methods.*
The aim of the book is to provide management with a simple practical method of applying the principles of clear and efficient communication to their own work.
Efficient communication requires (1) correct and necessary information, (2) concise explanation, (3) knowledge of a person's background, intelligence and expectations, and (4) feedback. To ensure these points are covered there is a Communications Check Card as a helpful reminder.
The text (in two parts – sending and receiving communications) brings out the salient points to adopt with the aid of illustrations; it is self-testing; and is itself written in the form of good communication.
It covers telephone, face to face, messenger, letter, memo and telex forms of communication.
It is a useful book to put in the hands of people who are seeking to improve their powers of communication. I.B.

Reprint No. 1:5:13

Selected Abstracts of Recent Literature on Value Analysis/ Engineering

Miss C. Maby — Abstracter

'To manage a business well is to manage its future and to manage the future is to manage information'—*Marion Harper.*

These Abstracts are based on a survey of periodicals and books, supplemented by a selection of abstracts which have already appeared in other Abstract Journals. Permission to reproduce the latter is gratefully acknowledged.

The addresses of the publishers of the periodicals containing the abstracted articles may be obtained by noting the number appearing in the round brackets and referring to the addresses on the inside of the back cover.

Abstracts [55] to [62]

[55]

Basic concepts – Management Appreciation

Engwell, C.

V.A. Engineer Talks About Problems of Introducing Techniques
Engineering News 16 March 68 (39)

This presents the views of the man-on-the-job on the problems which are met with in introducing Value Engineering into a company.

First he deals with the difficulty of accurately assessing achieved against the forecasted savings, and it is suggested that 'one might expect something like 60 per cent of original estimated savings to begin with'.

Team members are best drawn from the functional areas which can most benefit the particular project being examined. The higher the level from which they can be drawn the better.

Keeping people aware of what is happening is also important, and this encourages their cooperation.

Information development is also important. There is a lot of duplication of information. Keeping a good information bank going takes a lot of time and effort.

[56]

Applications – Management Appreciation

Leslie, H.

V.A. is Really Worthwhile Money-Saving Technique Only If Correct Approach can be Employed
Engineering News 16 March 68 (39)

'You have to penetrate under the skin' as one writer puts it. Under whose skin? 'Top management first or we shall not get very far, and then all the way down the line of management.'

'Value Analysis is nothing but a philosophy of constructive discontent' according to Mr Leslie. Techniques used within this philosophy enable an individual to identify areas of unnecessary cost.

The article then lists the reasons which allow unnecessary cost to get into a product or service, and goes on to explain how these may be overcome or removed.

These are the requirements of successful V.A.:

1. Top management must be behind the effort giving it a high degree of priority.
2. People in the teams must be capable of making implementation decisions.
3. Middle management people must be 'educated' in the technique or they will put up obstacles which are very difficult to surmount.
4. The only meaningful measure of V.A. success is the amount of savings it achieves against its cost.

[57]

Materials

Stamford, M. S.

Value Engineering Favours Brass
Copper, Sept. 1968 pp. 12–14 (36)

Sutcliffe, Speakman & Co. Ltd, Leigh, Lancashire, England, have produced components as hot brass stampings for a lower cost than the steel parts they have replaced.

A hydraulic brake-line component originally machined from rolled steel section is now produced by a hot brass stamping with the following advantages:

1. Considerable overall weight reduction,
2. Speedier drilling, and tapping,
3. Protection against corrosion, and
4. Elimination of external machining.

Cost is by no means the only criterion to be taken into account when selecting the most suitable material of construction. Easier fabrication and machinability are often more pertinent.

[58]

Basic concepts – Management Appreciation

Gage, W. L.

Value Analysis Steps Out
Metalworking Production, 28 February 1968 pp. 56–7 (38)

'For Value Analysis, 1967 can be rated the year in which the technique really established its influence' is how this article leads off, pointing for confirmation to the increasing membership of the Value Engineering Association, the publication of several important books on the subject, and the successful holding of a number of conferences throughout Europe.
Miles' concept was an organised approach to identify unnecessary cost and remove it without impairing quality, and the author refers to the different lines on which this theme has been developed.
The article contains illustrations of the application of Value Analysis by the British Aircraft Corporation and Vickers Ltd at their Barrow Works. It also refers to Government Procurement policy and the adoption of the Value Engineering clause in such contracts.

[59]

Basic concepts

Raven, A. D.

Effective Value Analysis Needs Strong Management
Metalworking Production, 10 April 1968 pp. 49–51 (38)

There is no great problem in using V.A. to identify ways in which savings may be made. The hard part is getting the suggestions implemented.
Mr Raven, Chief Value Engineer of Jaguar Cars Ltd, cautions against going in for short cuts and quotes from the experience of Perkins Engines Ltd where he was formerly Group Value Engineer. He illustrated how (and where) V.E. fits into that company's Organisation Chart.
'It must be realised by top management,' he says, 'that V.A. like any other tool, requires firm backing and involves some risk.'

[60]

Applications – Management Appreciation – Packaging

Saywell, P. W. L.

Value Engineering – Some Examples of Remarkable Savings Achieved
Factory Management, Oct. 1968 pp. 6–10 (37)

Mr Saywell is Senior Lecturer, Education and Training Section, Production Engineering Research Association (PERA) and this article is the substance of the paper which he delivered to the PERA Symposium on Value Engineering held in July 1968.
Value Engineering is now generally recognised as one of the really successful management tools to be introduced in the past twenty years.
Illustrating the remarkable savings being achieved through the application of V.E., Mr Saywell points in turn to limit switch simplification (78% cost saving and £8,606 expected savings in a year), reduction in the number of components of an air pipe hood and a radiator support bracket, a paint brush redesign, and a lavatory cleaner package cost improvement.
Packaging he shows is a fruitful field in which to apply V.E. efforts and he finishes with the useful V.E. maxim NEVER TAKE ANYTHING FOR GRANTED.
This is a paper in which Managements who are considering introducing V.E. could possibly find applications which would be closely paralleled in their own situation.

[61]

Applications

McKinnon, R.

Progress in Value Engineering
The Times, 4/11/68 (22)

Of all the management techniques available today the star performer surely is V.E.! 'There are now almost as many management techniques as there are plans for Piccadilly Circus' says the writer. And he goes on '. . . it is doubtful whether any other branch of management science (including even the faithful old retainer, work study) can claim more than a fraction of what Value Engineering has already achieved'.
Dealing with the reason for Mr Harry Erlicher's conception of V.E. (the advantages of many of the substituted materials) Mr McKinnon describes the modern differences between 'Value Analysis', 'Value Engineering', and 'Value Assurance'.
The achievement of the Rolls-Royce Company are mentioned – the RB211 has 30 per cent fewer parts than a conventional engine and at the same time incorporates six major improvements. These are:
1. Improved thrust-growth capability,
2. Reduced fuel consumption and weight,
3. Fewer parts leading to lower cost,
4. Lower noise levels at take-off and approach,
5. Ease of repair and maintenance, and
6. Reduced smoke levels.

[62]

Value standards

Whelam, R. G. L.

Costing Plastics
Design Engineering, Nov. 1968 pp. 21–30 (18)

The costing of plastics is more often than not a technical rather than an accounting function. The cost for any plastics materials should be divided into – raw material cost, conversion cost, installation cost and maintenance cost.
The sum of these four items can be described as 'the ultimate cost'. A Value Analysis exercise should take account of this *true cost*.
The article contains some useful tables (which the value engineer will need to keep up to date) including:
1. Volumetric cost (pence per cubic inch of materials),
2. Trend in Raw Materials Prices (1954 taken as 100),
3. Production equipment capacities, and operating and capital costs.

The costing procedures (Capacity Costing and Marginal Costing) are illustrated and contrasted and the article concludes with these findings:
1. The consideration of plastics as a material requires four interrelated factors to be taken into account.
2. The continuing down trend in plastics price levels is making them competitive with traditional materials used in many products.
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HOW TO GET RESULTS FROM PEOPLE

YOU MUST TREAT PEOPLE AS INDIVIDUALS

A. Let people know how they are getting on.
   Decide WHAT YOU EXPECT of each person.
   Point out WAYS TO IMPROVE.

B. Give credit when it is due.
   Look for EXTRA PERFORMANCE.
   Tell the person right away.

C. Tell people *in advance* about changes, that will affect them.
   Tell them WHY.
   Get them to ACCEPT the change.

D. Make the best use of each person's ability.
   Look for ability not now being used.
   Never stand in a person's way.

HOW TO HANDLE A PROBLEM

Determine your objective in tackling the problem

Step 1. GET THE FACTS
   Review the record
   What rules and customs apply
   Talk with persons concerned
   Get opinions and feelings

Be sure you have the whole story and the right objective

Step 2. WEIGH AND DECIDE
   Fit the facts together
   Consider their bearing on each other
   What possible actions are there?
   Check practices and policies
   Consider effect on the individual and the group

Don't jump to conclusions

Step 3. TAKE ACTION
   Are you going to take the action yourself?
   Do you need help in taking action?
   Should you inform someone of your action?
   Watch the timing of your action

Don't pass the buck

Step 4. CHECK RESULTS
   How soon will you follow up?
   How often will you need to check?
   Watch for changes in attitudes and relationships

Did your action achieve your objective?

HOW TO SHOW PEOPLE A NEW JOB

GET YOURSELF READY TO SHOW THE JOB PROPERLY

A. Go through the job yourself beforehand
   Divide it into STAGES.
   Select the KEY POINTS.

B. Get everything ready and conveniently arranged
   LAY OUT materials and equipment.
   Have AIDS to showing available.

Step 1. PREPARE
   Put a person at ease
   Say what the job is
   Check existing knowledge
   Create the interest to know
   See person in correct position

Step 2. PRESENT
   Tell – Show – TELL AND SHOW – One Stage at a time
   Stress KEY POINTS
   Be CLEAR, COMPLETE, PATIENT
   Give ESSENTIALS

Step 3. TRY
   Have person do the job
   Correct mistakes *as they are made*
   Check understanding of KEY POINTS as job is done again

Step 4. PUT TO WORK
   Tell person responsibilities
   Tell person who will help
   Encourage Questions
   Check – as necessary

You will recognise that these reminders are from the T.W.I. (Training Within Industry) Cards originally compiled by Messrs. Dooley & Dietz way back in 1941. Then, in America, because of the war, there was need to give people the basic supervisory skills as quickly as possible.

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