VALUE WORLD

TECHNICAL PUBLICATION FOR

WILLIAM F. LENZER
SAVE EXECUTIVE VICE PRESIDENT
THE APPROACH

There will be four modes of presentation designed to maximize the learning experience:
- Papers - presentations on new and unique techniques and experiences to help you expand your knowledge base.
- Panels - groups of experts discussing topical subjects, interacting with you, the audience.
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NEW HORIZONS — THE 1980’S AND BEYOND

FOR THE VALUE PRACTITIONER
MANAGING VALUE MANAGEMENT
THE GOVERNMENT ENVIRONMENT

SPEAKERS

Please send a draft of your paper to Jim Vogl. The draft copy must be received no later than 15 January 1981. It will be returned to the author for final typing after editing.

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ABOUT THIS ISSUE

This issue of Value World features photographs of the 1980 SAVE International Conference held in Dallas, Texas. The photos show highlights of the opening day keynote luncheon plus some shots from the various communication sessions following the first day's activities. All of this is found on pages 12 and 13.

Our first article is extracted from the paper which SAVE President, John Bryant, presented at the conference. In our judgement, this was one of the best papers presented. Due to its length, we are only printing the first portion of the paper. More segments will follow in future issues. Jack Jonelis sent VW a copy of the Proceedings of the 1979 International Conference held by the Value Engineering and Management Society of South Africa. This was given to Jack by Larry Miles, who was a guest and speaker at the conference. We have printed three papers from these Proceedings. The author of one of the papers, Mr. H.K. van Heerden, attended the 1980 SAVE Conference and presented a paper.

The article "Contractor Finds VE Good Investment" is reprinted with permission of Building Design and Construction magazine. This is a good article for the construction people.

Boyd Cleaveland
Managing Editor

WILLIAM F. LENZER - BIOGRAPHICAL & PROFESSIONAL SKETCH

William F. (Bill) Lenzer was born in 1944 in Cincinnati, Ohio, is married and has four children. He has lived in Texas since 1949 and holds a Bachelor of Science Degree in Electrical Engineering from the University of Texas at Arlington (1969).

Bill's career in the mechanical and electrical engineering design area of construction began in 1963. For approximately six years, he worked full time in drafting and design for various "consulting engineering" firms, while attending a combination of part and full time university classes. He eventually progressed to "Project Manager", and was responsible for a number of large commercial and industrial projects. In 1972 he was the "engineer of record" on the First International Building in Dallas, Texas, the largest commercial facility that had been built west of the Mississippi River in the continental United States as of that date.

Bill's first exposure to VE and the Society of American Value Engineers occurred in 1974. In 1975 he founded "Value Engineering, Incorporated", a consulting and engineering firm which has since grown to employ 15 people. VEI specializes in providing consulting services, using VE methodology, for all aspects (and throughout the life cycle) of a client's facility and operation needs.

The company has conducted numerous VE studies for the U.S. Army Corps of Engineers, primarily in West Germany, as well as for the Departments of the Army and Navy in the United States. Additionally, Bill conducted two "Value-Energy-Management" seminars last year in Japan.

Bill is a Registered Professional Engineer in electrical and/or mechanical engineering in 24 of the 50 states in the USA, holds a certificate of engineering registration from the National Council of Engineering Examiners, and is a Certified Value Specialist. He is currently an active member of the American Society of Heating, Refrigeration and Air Conditioning Engineers; the Association of Energy Engineers; and, of course, the Society of American Value Engineers. He has served on the SAVE National Board of Directors as Regional Vice President (1978-80), was Chairman of the 1980 SAVE International Conference in Dallas, Texas and was elected to Executive Vice President of the Society in 1980.
Financial Concepts For Value Engineers

John Bryant
Harbridge House, Inc.
President, SAVE

Part I
THE FUNDAMENTALS OF ACCOUNTING

The practice of accounting has come into being as a means of enabling business managers to keep track of past events and providing them with useful information for making future decisions. The word accounting itself refers to a system used to record events that take place in the day-to-day operation of a business organization.

The evolution, over several hundred years, of present-day accounting practice has produced a number of generally accepted accounting principles. These principles are concerned with the standardization of both terminology and methods of recording the activities of a business. By standardizing terminology and recording methods, a common base has been provided on which accounting systems and reports can be interpreted throughout the business world. Through standardization the accounting reports of a company are made meaningful not only to its managers but also to its banker, its stockholders, its creditors, governmental tax agencies, and other persons or institutions who may be interested in financial reports. The need for accounting principles therefore becomes apparent. The generally accepted accounting principles, it might be said, provide a common "language" of business which is understood by a diverse group of individuals both within and without a given business organization.

Prior to discussing these fundamental accounting principles, it is important to point out that they are simply broad guides for recording and presenting data and do not prescribe how each event occurring in a business should be reported. Within this broad framework, then, an accountant has a certain amount of latitude in recording and presenting data.

Basic Accounting Principles

The following five principles form the basis for an understanding of accounting. It should be understood that there are a great many other generally accepted principles, but they are of more interest to the professional accountant than to the interpreter of accounting information.

Dollars, the Common Denominator

An accounting system records only those events which can be expressed in terms of dollars, for example, the purchase of a warehouse or of inventories. Sales of inventories for cash or on account can also be reported in terms of dollars and are therefore recorded in the accounting system. On the other hand, the morale or health of company personnel cannot be expressed in dollar terms; and the accounting system does not consider such factors. Nor can a company's accounting records show what competitors are doing or in what ways a competitor's products might be inferior or superior to the company's own product. Thus a company's accounting records do not reveal all of the facts, or even all of the important facts, about a business; they show only events which have taken place and which can be expressed in dollar terms.

The primary advantage of using dollars as the common denominator for accounting records is that dollars provide the only practical means by which the variety of facts about a business can be expressed quantitatively. Numbers can be added and subtracted to show the effect of any event on the company's financial position. For example, a company's net profit figure is a summation of the effect of numerous business events, including the sum total of sales, purchases, and the expense of operations.

A major disadvantage of using the dollar as the common denominator for accounting records is that its value, or purchasing power, changes over time. The amount of goods and services that can be purchased with one dollar is less today than it was five, two, or even one year ago. This decrease in the purchasing power of a dollar is called inflation. Similarly, an increase in the purchasing power of one dollar is called deflation. In this country, inflation has become a given and is therefore deserving of further comment here.

Any system of measure is only as reliable as the standard unit of measure, or common denominator. Consider the system used to measure and record a person's height, which is measured in inches. If the common denominator, the inch, fluctuated in length, reliable measurement would be difficult to make. For instance, a full-grown adult measured at two different times might be found either taller or shorter the second time. To avoid these possible distortions, units of length are standardized by the U. S. Bureau of Weights and Measures. Fluctuations in the length of one inch do not occur.

Attempts to stabilize the value of the dollar in this country, however, have been unsuccessful. These fluctuations, therefore, make it difficult to
accurately measure the financial condition of a company. For example, a company that has had no actual improvement in its financial condition might appear to look better because the unit of measure, the dollar, has inflated. Users of financial information must be aware of such distortion in the value of the dollar. Failure to recognize its effect on the accounting system can lead to serious misunderstandings, as discussed in later sections. For now, simply remember that inflation changes the value or purchasing power of money — distorting the common denominator of the accounting system.

The Business Entity

The second fundamental accounting principle to be borne in mind is that accounting is concerned with the business entity, as distinguished from the individuals who own or operate the business. The accounting records for a company should only reflect what is happening to the company; they should not reflect personal transactions entered into by the owner or operator of the business if such transactions do not relate to the business. For example, if the owner of a business buys a home for himself, this has no bearing on what is happening to the business, since the owner is an entity distinct from the business entity.

Value Equals Cost

The items of value which a company owns are commonly referred to as assets. According to the third fundamental accounting principle, a company's assets are entered in the records at their original cost to the company, indicating that the value of a company's assets is equal to their cost.

In point of fact, the reasonableness of the principle that value equals cost can be questioned. For example, a plot of land purchased for $20,000 in 1935 would have been recorded on the company's books at a value of the plot to $80,000. Following the principle that value equals cost, however, the land would remain on the books of the company at its original cost of $20,000. The principle that value equals cost can lead to an overvaluation as well as an undervaluation of assets. This happens most frequently when one assumes that the asset valuations shown on a company's financial statements indicate the price at which these assets could be sold. More frequently than not, assets command less than their stated value when put up for sale — especially under conditions of a forced sale.

Certainly, there are some assets that are properly shown at or close to their real value: Cash, for example, is shown at its real value. Investments in bonds are generally shown at close to their real value. Inventories can also be recorded at close to their real value. It is possible, however, with certain items, such as a previous year's model, that the real value (or value at which the item can be sold) is less than its original cost. The factor of time is the major cause for discrepancy between the asset valuations shown on accounting records and the real value of an asset. Generally, it may be stated that the longer an asset is held by a company the less relation there is likely to be between the "book value" of that asset (that is simply the value at which it appears on the books) and the actual market value. This fact is most easily observed with what are termed "fixed" assets — land, buildings, equipment, and so on.

With the exception of land, fixed assets have a limited useful life. Under the accounting process known as depreciation, the original cost of assets other than land is charged off as an expense in the accounting period in which the assets are used. The purpose of depreciation is not to approximate real or market value, but to distribute the cost of the assets equitably over their useful lives.

A question may be raised at this point as to why the principle of value equals cost is used at all. At this point it is enough to say that the use of this principle greatly simplifies the task of the accountant who would otherwise be continually revaluing his assets to reflect the almost daily changes in the real or current market values of the company's numerous assets. Moreover, who is to determine the real worth to a company of a warehouse or a value of any asset as opposed to its book value, but this is the exception rather than the rule.

The Dual-Aspect Principle

As mentioned above, a company's assets are items of value which it owns. On the other hand, there are claims held by various parties against these assets. These claims are called liabilities. There are two kinds of liabilities, those claimed by the creditors, and those claimed by the owners. The claims of the owners are called the net worth or owner's equity. Since all the assets have claims on them by either creditors or owners and since there can be no more claims on the assets than the value of the assets, it is obvious that:

\[ \text{Assets} = \text{Liabilities} \]

Having demonstrated that assets equal liabilities, it is possible to look at our fourth principle, the dual-aspect principle. Accounting systems are so established that each event is recorded from two standpoints. For example, if Mr. Jones establishes a business and invests $20,000 cash in it, the dual aspect of this event will show an asset of $20,000 cash and a net worth or equity of $20,000 which reflects Mr. Jones' claim against
the asset. This event can be shown as follows:

\[
\text{Cash Asset} -$20,000 = \text{Mr. Jones' Equity} -$20,000
\]

If Mr. Jones' company purchased $5,000 worth of inventory for cash, the dual aspect of this event would decrease the cash asset by $5,000 and create an inventory asset of $5,000. Mr. Jones' equity would remain at $20,000 since the event merely reflects a change from one asset (cash) into another asset (inventory). The accounting records of the company would show the following:

<table>
<thead>
<tr>
<th></th>
<th>Cash</th>
<th>Inventory</th>
<th>Total Assets</th>
<th>Total Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$15,000</td>
<td>5,000</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

As can be observed, the assets equal the liabilities.

If Mr. Jones's company borrowed $7,500 from the bank, the event, according to the dual-aspect principle, would indicate an increase in the cash asset of $7,500 and an increase in the liabilities (that is, amount owed to the bank) of $7,500. The accounting records would now show:

<table>
<thead>
<tr>
<th></th>
<th>Cash</th>
<th>Amount Owed to Bank</th>
<th>Inventory</th>
<th>Total Assets</th>
<th>Total Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$22,500</td>
<td>$7,500</td>
<td>5,000</td>
<td>$27,500</td>
<td>$27,500</td>
</tr>
</tbody>
</table>

Again the assets equal the liabilities.

It can be demonstrated that every event taking place in business effects two items when we follow the dual-aspect principle. If we transform one type of asset into another, we must reflect the change on each of the two assets. This was done above when inventory was purchased for cash. Similarly, when cash was borrowed from a bank, a dual effect was produced in that both assets and liabilities were increased by the amount of the loan.

The Accrual Principle

The fifth generally accepted accounting principle, that of accrual, is based on the fact that the net income of a business is not related to the flow of cash but rather to changes in the owners' equity resulting from operations of the business. It is an accepted accounting practice that the revenue of a business adds to the owners' equity and that expenses decrease the owners' equity. The difference between revenues and expenses is the company's net income. (As will be shown later, the above statements do not conflict with the dual-aspect principle.)

Going back to the accrual principle which states that the net income of a business is not related to the flow of cash, we can see that a bank loan which increases the company's cash is not a revenue item. A bank loan does not increase the owners' equity — rather it results in the establishment of a liability to the bank. Similarly, when inventory is purchased for cash, it is not an expense since cash is decreased and inventory is increased. (Inventory does, however, become an expense when it is sold as we will see later.)

On the other hand, some items are considered as revenue before the cash is received. For example, a sale made on credit is considered to be revenue to the company even though the customer does not complete payments on his account for perhaps several months. Also, certain items are considered as expenses even though the company does not pay for them for a period of time. This might happen where a company's salaries or wages are paid on a weekly basis, but the year-end accounting period falls in the middle of a week. In this instance, the salaries and wage expense for the first few days are shown as accrued expenses but are not paid until the end of the week.

Summary

Generally accepted accounting principles are a result of the need to standardize both terminology and the method of recording and presenting data. While there are a large number of generally accepted accounting principles in use today, there are five principles that are basic to an understanding of accounting:

1. The accounting system uses the dollar as the common denominator for recording business events.
2. The accounting system reflects the fact that the business is a separate entity distinct from the entities represented by the owners or operators of the business.
3. The accounting system values assets at their original cost.
4. The accounting system reflects the dual-aspect nature of each event that is recorded.
5. The accounting system indicates that net profit is not related to the flow of cash but rather to changes in the owners' equity resulting from operations of the business.

Having examined the five basic principles of accounting, we turn next to a discussion of the two financial statements most commonly used in business accounting, the balance sheet and the income statement.
SUCCESSFUL DESIGN-TO-COST THROUGH COST VISIBILITY

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Alfred I. Paley, CVS, Manager, Cost and Value Control, Loral Electronic Systems in Yonkers, New York. He received a B.E.E. degree from the Polytechnic Institute of Brooklyn and also attended Graduate School at the same Institute.

Mr. Paley joined Loral in 1967. He is responsible for personnel engaged in: Cost Control of ongoing development programs, combining project planning and scheduling, preparation of Estimates To Complete and measurement of progress toward goals; Design-To-Cost programs, establishing targets and monitoring progress; Proposal Costing, parametric estimating and cost history; Value Control and VE efforts.

From 1974-1976, Mr. Paley was Secretary of the Society Information Display, Mid-Atlantic Chapter; and since 1976 he has been a Board member of SAVE Metropolitan Chapter. He became a Certified Value Specialist in 1977.

In 1976, he developed and is teaching a course on VE, at Hofstra University, division of Continuing Education, and also lectures for the AMA on Value Engineering in Purchasing.

This paper discusses general Design-To-Cost methods used at Loral Electronics Systems in Research and Development projects; the use of cost visibility techniques to communicate the cost status of the project, indicate variances, provide early warning, opportunity for control, and the role of VA as a correction discipline.

It shows how VE was used as a management tool for communication of the Design-To-Cost status, and as a discipline to correct for variances.

GENERAL:

Design-To-Cost (DTC) as another requirement in Research and Development should be close to the heart of all Value Engineers. We are all familiar with Design-To: Performance/Specification, and Design-To: Schedule (sometimes referred to as, "Invent on Schedule"). We are also quite familiar with the affect on program, project and equipment costs if, as is usually the case, no one (or everyone) is responsible for Costs. The added discipline of Design-To-Cost provides for a mechanism to control costs "upstream", before-the-fact, rather than after-the-fact. With this advantage, control of costs becomes a realizable possibility.

In managing a DTC function, many detailed procedures have to be devised. This paper deals with an approach that was successfully implemented and details some of the solutions to the "How to do it?" kind of problems.

THE METHOD:

The method begins with the establishment of "target cost" goals at the start of the development phase. These target figures are then periodically compared with new estimates made on the equipment as it is further defined during the development phase. Any variances between the target figures and the new estimates are noted and reported so that corrective action can be taken.

DTC actually begins prior to the development cycle, as the equipment is defined in a Work Breakdown Structure (WBS) of sufficient detail to provide the visibility and identification of cost drivers. In general, the Unit Production Cost is used as the basis for control, and requires identification of such items as: quantity to be produced; rate of production; assumptions of tooling to be available; test philosophy and test equipment; and escalation factor (or calculation in constant year dollars). The resultant is then Design To Unit Production Cost, (DTUPC).

The Target costs and latest estimates should all be done in constant year dollars to maintain a semblance of sanity in the comparisons. The effects of Escalation/Inflation are calculated separately (and often result in arguments over whose crystal ball is clearer). The method in essence uses a piecewise linear approach to an essentially non-linear problem.

COST TRACKING FOR VISIBILITY:

The tracking of costs, to provide visibility and control, is done at two levels:

1) The Summary level, for reporting and general status indication.
2) The Prime Cost Level, providing cost visibility for control.

The Summary analysis is done at selling price and includes the cost of material, labor, overhead, G & A and profit. The Summary Level is generally too high for control, since it contains elements not under the control of the designers, engineers and other cost creators. The inclusion of these elements also affects the sensitivity of the variance analysis. The Summary Level is of course the “bottom line” and must be reported.

To achieve the level of visibility required for variance indication, the prices of items in the WBS is reduced to Prime costs (for Material,
Labor and ODC) and prime parameters (purchase price of Material, Labor hours for assembly and test, and the ODC price). To achieve the greatest sensitivity in the variance analysis, other "overhead" costs such as supervision, inspection, and sustaining engineering are removed from the lowest level of reporting (Labor hours for assembly and test), but are included in the overall cost, by adjustment of the labor rates to be used on the prime parameters.

**MANAGEMENT RESERVE:**

A management reserve of 10% is applied in calculation of the costs per WBS between the Summary and Prime (Target) cost level. This provides flexibility for Management Control in event of variance.

**CONTROL BY VISIBILITY AND EARLY WARNING:**

The objective of this procedure is to provide the cost creator the cost of the variable and parameter that he can best understand, and over which he can maintain control, i.e., for each element of the WBS, he is provided with information at the elemental level of cost, (cost of purchased parts and materials; assembly and test labor hours; and the ODC costs). This enhances the ability to understand the cost drivers and provide visibility for control. Comparison of the target "costs", to the reestimated "costs" becomes more meaningful in terms of the sensitivity, and thereby enhances early warning.

**DTC ORGANIZATION:**

To preserve early warning, the DTC team must be organized to be part of the Design Management group, which also includes Produceability Engineering, Reliability, Maintainability, Quality, Logistics, Purchasing, Methods, Manufacturing and Testing. This team is part of the Design Review process, and along with Design Review functions, assists in feedback of new estimates based on the presentation of designs by Development/Design Engineering. Figure 1 indicates a typical organization and work flow for DTC.
ENHANCING EARLY WARNING:

Maintaining the enhancement of control obtained in early warning requires special attention to quick-turn-around of estimates (and reestimates) as design progresses. As an example, at Loral, special procedures involving the use of data bank information in EDP were used to obtain material estimates. Ideally a turn around of 24 hours maximum is sought, from design presentation to cost estimating (actually, we achieved a few days turn-around). Labor estimates likewise are sought in timely fashion and the organization, previously described, provides the manpower and attention required to achieve fast-turn-around.

REPORTS USED:

Figure 2 is a typical Program Manager’s Summary report showing the Unit Cost Goal, Current Estimate and Variance. Figure 4 is a typical report of status of the DTC effort.
VARIANCE DETECTION & CORRECTION:

An objective of the process (comparison of target with new estimate) is to detect variances. In event of variances, the corrective action may be either:

1) simple substitution, correction and/or change in design,
2) trade off in other WBS items with favorable variances or,
3) use of VE techniques to identify cost drivers, function versus cost relationships, and alternate solutions to the specific problems.

ROLE OF VE:

VE is used as a management tool for communication of the DTC status, and as a discipline to correct for variances.

The responsibility for managing DTC is delegated to the Value Control group. This group develops the Unit Cost Goals, coordinates the estimates made monthly during engineering development, and coordinates activities between all departments in this effort. The DTC effort generally includes a special Design To Cost Design Review. In a recent program, this was conducted at the time when a variance had been noted which could not be reduced by the other means. A correction was required to maintain DTUPC goals. Typical of a VA/VE study, a task team composed of the design engineers, test engineers, production engineering, and Value Control studied the problem, identified cost drivers, suggested alternates and implemented the change to reduce the cost variance. In this instance, the problem was an increase in production test time. This was due to an inability to effectively use a piece of automated digital test equipment since partitioning of the design resulted in a mixture of analog and digital circuitry on the same printed circuit (PC) board.

Continued on Page 21
Society Of American Value Engineers
Dallas, Texas

Hi—Y'All!!
Bill Lenzer opens
the 1980 Conference

Ernie Bouey
SAVE Past President

Bill Lenzer, Ernie Bouey
Robert B. Dyer, Cooper Ind.

C.P. and Betty Smith
Carlos Fallon
1980 International Conference
May 13 - 16, 1980

Robert B. Dyer, V.P.
Planning and Analysis
Cooper Industries
Key Note Speaker

Our new Pres, John Bryant
with Art Mudge & Jim Dziewonski

Larry Miles

Jack Jonelis, John Bryant
& Discussion Group
In simplest form the management functions are set out as:

- **PLAN**
- **LEAD**
- **ORGANIZE**
- **CONTROL**

Seldom, if ever, do managers make a conscious effort to consider the implications of these functions in a practical sense. In fact, almost everyone in management goes about his or her daily task assuming that the existing organization structure automatically takes adequate care of the situation. The planners plan; the managers lead and motivate with the assistance of personnel and training departments; the managers organize and integrate operations; the control systems measure results and point out deficiencies which can then be attended to.

More often than not “management” divorces itself from the very techniques it professes to use — “We got to the top because we know how to do things”. “We know how to plan, lead, organize, and control! In fact, we know how to think! We know what is good for you others!”

However, the very success that has gotten an individual to the top of the tree is often his biggest barrier to further success and further achievement. This all adds up to a situation in which we are lulled into a state of complacency, unaware of the subtle changes taking place around us, and we wake up too late to ride the storm which breaks around us and our organizations.

This does not happen because of our incompetence, but because we have become victims of the normal logical habits of thinking. This is particularly true of our western culture. The records are saturated with examples of organizations that woke up too late to the real state of affairs, and collapsed.

Only 14% of the top 500 companies of 50 years ago in the United States are still around. In our own context there is a painful history of firms here today — gone tomorrow. Analysis will rationalize and establish the reasons why, but never is the process of thinking questioned.

There is enough evidence of military debacles and business failures and insolvencies around us that should jolt us out of the “It-can’t-happen-to-us” attitude. But then it is all too easy to blame someone else, the economy, the market, inflation, the government, or what have you.

In the military field we remember examples of abject failure — the fall of the Maginot Line, Singapore and the destruction of Pearl Harbour come to mind. The latter case has been well documented and analysed psychologically in the book “Victims of Group Thinking” by Irving L. Janis (Houghton Mifflin).

The top brass in Hawaii had access to excellent intelligence, received warning after warning of impending attack, but the interpretation of the information resulted in the almost inevitable debacle.

No one can gainsay that the commanders at Pearl Harbour were highly competent, dedicated and motivated men — what then went wrong? They became snared in the commonest pitfall inherent in our normal habit of thinking — i.e. once one has an acceptable logical answer to a problem it becomes almost impossible to look at that situation in any other way.

The same things happen in the business environment.

The Value Thinking disciplines (VA/VE/VM) give the lie to this, and their use will develop an awareness and approach that will reduce to a minimum the risk of taking wrong decisions. This is provided that an open-minded constructive attitude is adopted, and the VE Think Plan (VE Job Plan) is honestly adhered to.

In normal thinking, habit judgement and logic overpoweringly dominate the concept and idea phase of our thinking (Fig.1).

**FIGURE 1**

```
<table>
<thead>
<tr>
<th>Concept</th>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idea</td>
<td>Logic</td>
</tr>
</tbody>
</table>
```

It is usually a foregone conclusion that each idea will be evaluated as it emerges, and killed on the spot. It is almost inevitable that the first acceptable solution that gets through the filter of judgement and receives general acceptance from the meeting of a group will be adopted (Fig. 2).
Unfortunately this is achieved rather by reaction than by in-depth examination, generally using the information without challenging either its validity, its accuracy, or its meaning. Each argument for eliminating a particular solution leads to a slight change in the statement of the problem — but seldom will any change in the general concept or in the basic assumptions, be made. It is typical of two people at the same place and point in time viewing the same scene, but with diametrically opposed points of view (Fig. 3), and not being able to see anything other than his own.
It goes without saying that under such conditions the number of alternatives available to any executive and/or engineer will be severely limited. So much for the normal thinking habit of our culture.

The Value Think Plan adjusts this imbalance by expanding the concept phase into two major parts (Fig. 4).

**FIGURE 4**

Concept Processing
Analysis Ideas Logic

First, there is an analytical thinking phase in which the marshalling of information and the identification and analysis of functions takes place. Not only is the scope of the concept greatly expanded, but clear understanding of where our major efforts are to be concentrated is developed. This is achieved by using a technique, a type of matrix analysis called “Numerical Evaluation of Function” to establish the relative importance of the identified functions in achieving our objective/s. In fact this amounts to the practical application of Pareto’s 80/20 principle, even to the most complex problems or projects.

Second, creative thinking, brainstorming, is applied to the functions determined in the analytical phase that should be the focus of our concentrated attention. Here the quantity and not the quality of ideas generated is of vital importance. Equally, if not more important, is that judgement must be kept in check, and not used during this phase.

Only after these two preceding phases have been completed is judgement employed, and then not destructively, but constructively. The deepening of understanding and the broadening of concepts developed and generated in earlier stages have provided new insights, demolished untenable assumptions, and provided a broadly-based spectrum of possible alternatives. The tendency has been to free the minds from:

- Honest wrong opinion
- The shackles of past experience
- The beaten path
- Custom and tradition
- Habit
- Present methods
- Resistance to change
- Standard practice
- and many other inhibiting influences.

How does this fit in with our classic management functions?
I prefer to set them out as follows:

```
Plan
  Control
  Lead
  Organize
```

as an on-going and self-sustaining cycle

Before demonstrating the relationship of the Value Thinking approach to plan in the above context, let us look at what planning entails.

In his book “Principles of Management” (Publishers: Richard D. Irwin) by George R. Terry, he sets out the work of the manager in planning as:

1. Clarify, amplify, and determine objectives
2. Forecast
3. Establish conditions and assumptions under which work will be done
4. Select and state tasks to accomplish objectives
5. Establish a plan of accomplishment
6. Establish policies
7. Plan standards and methods of accomplishment
8. Anticipate possible future problems

Every one of these ingredients spells out in great big capital letters the need for “Information”. In fact the depth and breadth, the content and quality, the reliability and completeness of information, to a large extent, will determine the degree of risk in any decision. However, it is how that information is interpreted that will be crucial to the success or failure of the plan.

No one can deny that the above spectrum is beyond the ability of any one individual to handle comprehensively and adequately. The same can be said for any group of managers using our normal habits of thinking (Fig. 2) for arriving at their decisions. Why otherwise do we continue to have our Pearl Harbours and business failures? Do we have to accept these as “bad luck” events over which we have no control — a normal lesson of life? Why have we not learnt from them?

The answer for avoiding these pitfalls is relatively simple — though unnatural. It becomes common sense only when one under-
stands the workings — and one understands the workings, only after personal involvement in the process (and even then one finds some individuals who find it difficult, if not impossible, to grasp the true meaning and import. The answer is **Value Thinking Discipline**.

Let us look at only two of numerous practical examples that could be used to illustrate why this is so. Arthur E. Mudge, in his book “The Value Engineering Approach” (McGraw-Hill), states in the very first line “Value Engineering is a type of magic”. These two examples will demonstrate this magic, and why it is essential that organizations and individuals should involve themselves in the value disciplines and generate some of this “magic”.

**CASE 1**

It was the fourth day of a Value workshop studying a critical area of a large organization’s operations. The team was about halfway through the process of evaluating and developing some 700 ideas that had been generated on about a dozen main functions. Asked by the leader what had been happening in terms of the Value discipline during the past 10 minutes or so, the answer was given without hesitation, “We have crystallised the real problem”. About half an hour later their General Manager arrived and sat down next to the Production Planning and Control manager. His answer to his boss’s question on whether something worthwhile would emanate from the exercise was, “Thank Gawd you did not ask me that question yesterday, because then I didn’t know if I was coming or going! Yes, we’re getting the right answers”.

Subsequent events have proved this to be true.

**CASE 2**

A different organization, somewhere between 1500 hrs and 1515 hrs on the fourth day of a workshop examining a ± R8 000 000 capital expansion project which is being Value engineered. The group is evaluating and developing ideas. Idea number 530, an apparently stupid one, out of some 800 generated in the creative thinking phase, is almost eliminated by the leader. “Wait a minute, let’s talk about it,” says the Research and Services Manager. Basic input data is recalled; a hectic discussion ensues. Constructive evaluation follows and the key answers to the whole project crystallize with dramatic suddenness. The stupid idea had developed into a five-star recommendation — the result: avoidance of spending several million rand unnecessarily and the elimination of 60% to 80% of operational hassles, with accompanying improvement in profitability.

The state of confusion prior to the sudden crystallization of the thinking is inherent in dealing with any major problem or project using the Value Thinking approach.

In the Value Thinking workshop sense, the work of management in planning, as described by Terry previously, has been executed not by one individual, or a group working in virtual isolation, but by a broad cross-section of the brainpower within the organization. If need be additional expertise is imported from outside. The shackles of tunnel-vision have been cast aside. Clear guidelines have been developed for an action plan in which both involvement and commitment have been built in by the very nature of the Value Thinking discipline.

If one now links the Value Thinking process to the “plan” of the classic management functions, one finds that everything that happens in the former right up to the moment of truth, i.e. the crystallization of the thinking, has to do with **information**. Every facet of information is closely examined, turned upside-down and inside-out and translated into function language. These concepts are analysed for relative value, then expanded and multiplied by using applied brainstorming. In the processing phase each and every idea is again taken in turn to see if anything can be made of it — the answer most times is a kind of magic.

To express this as a model, in terms of Figure 4, information in the **plan** aspect of the management functions, runs to at least some point in the processing or logic phase when at last the pieces of the jigsaw puzzle start falling rapidly into place (Fig. 5).

Only then may we dare start serious planning! — When we have gathered, processed, and assessed the information by the Value Thinking process; developed in-depth understanding of the project and, in the process, established what further information must be acquired.

The Value Disciplines work — ask those organizations and people who use them as a way of life.
Contractor finds VE good investment

Reprinted from BUILDING DESIGN & CONSTRUCTION March, 1979 ©1979 CAHNERS PUBLISHING COMPANY

It might seem unlikely that a general contractor would use formal value analysis on his own building. But that's what Sven Flodstrom, president of a general contracting firm in Deerfield, Ill., did as builder/developer of a speculative office building.

Because he has watched the tribulations of other developers for many years, he knew the problems he would face.

Flodstrom had participated in value management training, but recognized his limitations in understanding the methods and also the ambiguity of his roles. He hired a certified value specialist, Jim Hudson of James W. Hudson & Associates, Arlington, Va.

Flodstrom believes he saved about $120,000 on his building because of value engineering—or a net saving of $113,000 after subtracting the $7,000 cost of value management. He bases this on his experience with construction costs on similar buildings in the area.

The 3-story building, to be completed this spring, has a gross area of 9,100 square meters. It will cost about $2.7 million.

The first step of the process was a scope review, attended by the design principals as well as the building's leasing agent and regulatory officials. At the conclusion of this review, a number of important issues were clarified, including the general outline of the building.

Originally an L-shaped building was proposed. One problem was that part of the site was in a flood plain, and the building would have to be located close to the road to stay away from this area. But in order to reduce the apparent mass of the building close to the road, the decision was made to abandon the proposed L shape and build 2 buildings, 1 partially behind the other. A center core with elevators, stairways and toilet facilities will connect the wings.

The floodway did not cut straight across the lot, but angled across the site. The 2-building, stepped design follows the angle of the floodway.

When the scope review was concluded, all members of the building team knew that water retention would have to be provided on the site and that the flood plain would encroach on the parking area.

It was also decided, as a result of the scope review, to build the entire project at 1 time. Earlier it was thought that about half of it would be completed, followed by the other half. The leasing agent confirmed that the office rental market was strong enough to absorb all the space at once.

"Scope is the all-important definition of the owner's dream," Hudson said. "At best, it is difficult to materialize the ephemeral, spiritual quality of this dream, and often only the architect is made privy to this essential information. Others on the design team get bits and pieces of this underlying foundation of the design program as filtered through the architect. Before the first line is drawn on paper, the project can suffer by varying interpretations assumed by each member of the design team."

After the scope review, another 1-day meeting covered all other criteria. Building set-back, water retention on the site, maximum building height and encroachment of the flood plain were some of the major factors which affected the design.

"It was obvious that the different professionals viewed these criteria differently in many instances," Hudson said. "Agreement among team members, owner and local officials is essential for optimum use of the site."

Following the scope and criteria reviews was a 5-day workshop. On the first day, a prime team of 4, with Hudson as team leader, met to determine basic functions of critical design elements. Workbooks reflecting these study areas were prepared for

9,100 square meters = about 98,000 square feet.
the next phase of the workshop.

**Teams study alternatives**

The creative phase of the workshop was held on the second day. One of the major questions was whether to use concrete or steel for the frame and floor. Separate teams were assigned to make each system work, with all necessary elements such as HVAC system, lighting and ceiling partitions.

A third team studied the exterior envelope, including wall, roof and windows.

The prime team met on the 3rd day to consider the alternatives proposed by the individual study teams. These were weeded out, refined, and costs verified where necessary. The better solutions were identified and prepared for further development the following day by the larger teams.

Unlike the usual workshop where all team members spend 40 hours, Hudson said the type of workshop conducted for the Flodstrom building recognized the important time for input by a larger group but did not tie up many persons for a long time.

"It is unrealistic to expect to keep a manufacturer's representative and other consultants for a week on 1 project," Hudson said. "Those who do spend 40 hours are paid for their time."

On the 5th day, basic decisions were made. One of these was to use a composite floor system with steel beams and metal deck topped with concrete. The savings of a composite system compared to a concrete structural system, taking into account all of the interfacing items, was projected at $40,000, according to Flodstrom. The savings was largely attributable to lower on-site labor costs.

For the building envelope, a Dryvit 4-ply exterior wall system was chosen over precast concrete for a projected savings of $65,000. The lightweight panels permitted a lighter steel structure, the system's steel studs could be used to apply drywall and the insulation was an integral part of the wall panels.

Flodstrom had wanted to put a basement under both buildings, but the leasing agent said he would have trouble leasing that much basement space. This was an important factor in putting a basement under only 1 building.

Flodstrom reserved one-third of the basement for a health club and instructed his leasing agent to ask prospective tenants if they are interested enough in the club to support it financially. He gambled that the answer would be yes and installed a 23-meter swimming pool for $8,000. If he gets enough support for the health club, he will invest another $80,000 to complete it.

**No magic**

Hudson said the value process should not be thought of as some kind of magic.

"It is pure logic coupled with a realistic evaluation of the motivations of people and organizations," he said.

For example, he said it is essential to recognize that each organization participating in the planning process has its own profit to consider.

"To conduct a value intervention at the wrong time means that some people and firms are going to get hurt financially, and that spells trouble that can defeat the very cost effectiveness the process is trying to achieve," he said.

Hudson warned owners to expect to bear the brunt of the cost of the consequences of value management.

"It is designed to give you the best investment in the facility you are having others design and build for you, so pay for it like you do any other service," he said.

Value management must be conducted by an outside consultant not connected with the original design effort, according to Hudson. The organization and leadership of a value effort cannot be compromised by dual loyalties, he said.

"Every professional must think 1st of his own profit to survive," Hudson said. "Value management frequently leads to decisions that negate much of the earlier design effort and require considerable redesign. A built-in conflict of interest exists, taxing the ethics of the professionals."

Flodstrom considers the value analysis to have been a good investment.

"Since I already had retained an architect experienced in this type of building and since my company has long experience both as general contractor and construction manager, it might seem superfluous to hire a value engineer," Flodstrom said. "However, it proved very beneficial."

Flodstrom emphasizes that value engineering gives the developer a much greater opportunity to inject his ideas before the planning has gone too far.

"Many questions arise during the value engineering stage about which the developer has very definite ideas," he said. "But when someone designs the building after only a short briefing from the developer, it is quite costly to incorporate these ideas later."

"In my opinion, the value engineering approach not only saves the developer time and money, but the architect can proceed with the working drawings sooner and prepare them faster since many questions which would arise when working drawings are prepared have already been answered during the workshop," Flodstrom said.

Flodstrom said he would not recommend the approach for projects of less than $500,000.

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23 meters = about 75 feet.
Value Management at Southern Cross Steel Co
by D.H.V. Carroll, Works Manager, Steel Division
Director, Southern Cross Steel, Middelburg

Various Anglo American gold mines as Pupil Engineer and Section Engineer.
Joined Southern Cross Steel in 1971 as Mill Engineer.
Promoted to Mill Manager 1972, then Works Manager Steel Division in 1977 and made an Executive Director in 1979.

INTRODUCTION
Our very first Value Management Session was some four years ago when we tackled a major expansion plan with the senior management teams involved. The outcome of this session was unfortunately — that our project was not viable — but the benefits of the value management techniques left a lasting impression on us all. Following a number of other sessions on a wide range of subjects, we have become firmly committed to the use of the VE techniques and all our capital expansions are now-a-days subject to a VE session before initiation. Our entire management staff from directors down to foremen have now all been through VE sessions and in fact we have, together with Keith, prepared a specific VE course for frontline supervision.

SCOPE OF PROBLEMS COVERED
The following are typical examples of the subject matter covered by our current VE sessions:
1. Develop a programme for ensuring the survival of the company in today's market
2. Optimise the cost effectiveness, layout and handling of the Rolling Mill to achieve X tons per month
3. Minimise the proposed Rx million expenditure while ensuring compatibility with the major expansion programmes
4. Investigate steelgrinding operations and recommend improvements
5. Discuss problems with autogrinders with special emphasis on design and operating features
6. Analyse and streamline the time office function to optimise the value both for the company and its employees
7. Analyse operations in the "Scrubber" and "Spot Conditioning" and make recommendations for improvements
8. The buying and stores function
9. How to retain our present skilled people.

These are mainly related to our Steel Division — similar sessions have been held in our Alloys Division.

Arising from these various sessions and others, we have achieved savings of many many thousands of rands. Some one-time savings and more important, a number of repeated annual savings. Another very interesting facet is that in tackling a major project with a fairly high-powered team, a number of smaller subjects arise for one day sessions with more junior teams.

COMPOSITION OF TEAMS
Initially we found it important that teams were kept to only two or three peer group levels. It was important that delegates would be at more or less the same level to ensure that they would feel free to participate. We have maintained a philosophy of multi-discipline teams from the very beginning and there is no doubt that this has been a major contributing factor to our success in the use of these techniques. The choice of the participants is extremely important. Obviously one needs to get the major expansion of our Rolling Mill facility, a typical group would be from the Rolling Mill: the Manager, Production Superintendents, Metallurgist, Engineer, Head of Production Planning, Inspection Superintendent, and one or two senior maintenance foremen. Outsiders: Meltshop Manager, Meltshop Superintendent, Meltshop Metallurgist, Administrative Manager, Assistant Training Accountant, Manager of the Laboratory, a Projects Engineer, Manager of Services and Development, Personnel Manager, Personnel DPO, Local Sales Manager, and Market Development Manager.

A typical team to look at specific handling problems in a section of the Rolling Mill, from the Rolling Mill: Mill Manager, Production Superintendent, Production Foremen, Engineer, Metallurgists, Production Operators, Line Inspectors, and Artisans. From outside: Meltshop Manager, Meltshop Superintendent, Production Planner, Director of Operations, Works Manager Steel, Project Engineer, Personnel DPO, and Steel Accountant.

In our initial sessions, we found it important to stick to delegates at a similar seniority level. However, with the full implementation of this technique we have found that this is no longer an important factor. The people who have been on the sessions have found that even with a wide
spread in seniority of people attending, there has always been full participation from even the most junior delegates. Our senior management have now all attended a number of the sessions and fully accept the discipline of no evaluation during the idea-generating phase. This has been fully appreciated by more junior people attending subsequent sessions and they have always participated fully. In fact they have come up with a number of the better ideas which have now been put into practice. This only goes to emphasize the wealth of brain-power available on the shop floor which goes largely untapped without this form of idea-generation.

VENUE
For major sessions, we have always used a venue remote from the work site. We, fortunately, have very suitable facilities at the Middelburg Country Club and have made use of these on a number of occasions. At times we have had the entire Steel Division operations management team away from the job for a full week. Many people may think that this is not advisable but it has hidden benefits which are proven in our experience. The next line of supervision, the people who would normally act when a Superintendent is, say, on leave, run the entire operation for the week. We have never had a major problem during one of these periods and in fact the opposite seems to occur — the core left on site strive that much harder to ensure that the operations run smoothly, i.e. a valuable training time and a time where mutual respect and trust is developed. Attendance at these courses is in most cases compulsory as we firmly believe that it is far better to go away for a week and study the overall operation, the causes of the fires, rather than having someone saying “I’m too busy fighting fires”.

TECHNIQUES USED
The majority of our large sessions have been lead personally by Keith van Heerden and we have stuck fairly rigorously to the formal system which he presents. Where all the participants have previously been through one of Keith’s sessions, we tend to cut back on the basic training and concentrate on the analytical thinking phase and the creative thinking phase. We believe that the maximum benefit is obtained by additional time on these phases, especially when two full mornings are devoted to creative thinking — when the delegates are still fresh. The judicial phase always takes far less time than one imagines possible.

BENEFITS ACHIEVED

Expected
Obviously the expected benefits are achieved. People learn the disciplined approach to problem solving, they learn that it is necessary to thoroughly gather the facts first, then generate ideas, crystallize these ideas and then evaluate the ideas. Functional analysis is now part of our daily lives. This fact has lead to greater efforts from all our employees even in our accident prevention programme. We are now in the fortunate position where everyone in our plant at Middelburg accepts that we are in the business to make stainless steel — not to have accidents.

Measurable
The following are typical of the savings which have come directly from Value Engineering Session ideas:

(a) Repeatable Annual
(i) 16.7% reduction in Meltshop electrical bill
(ii) 32% increase in output of steel over the last four years with only a 2% increase in manning

(b) One-Time Capital
38% reduction in a fairly major capital-intensive expansion which is a particularly significant one in that the original project team felt that this had already been trimmed to the minimum possible amount of capital.

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**Other benefits**

(a) **Communication**
   In most cases all of the people involved in a session would have to be informed of the subject matter at some stage in any case, with this approach, they not only are informed of the project but are also intimately involved in all the background information to the project. Further they help finalize the format that the project is to take so before any announcement is made, the people who have to make a success of the project know all about it and fully understand it.

(b) **Commitment**
   Having been involved in the formulation of the format of the project and having had the opportunity for their comments to be looked at in depth, an automatic commitment is created. The individual leaves the session with a basic commitment to the success of the venture.

(c) **Motivation**
   The added value of these considerations does not just end with the subject matter covered in the session. Generally speaking the overall attitude of all participants to the company, to their on-going jobs and to their relationships with other people in the company show great improvement. The general level of motivation is tremendously improved and the ongoing advantages of this cannot be measured. Instead of suffering the normal problem of everyone having a fairly large level of resistance to change, we have almost an opposite situation where people are continuously looking at ways of improving their jobs and their sections and pushing management for change and improvement.

(d) **Teamwork**
   This motivation is not purely an individual thing but a general phenomena which results in a tremendous improvement in team spirit. People who, a few years ago, were regularly at logger-heads will today sit down and analyse and solve their inter-departmental problems by themselves without their manager even knowing that they had a problem. The net result is a team of people committed to the on-going function of the company, committed to the new project, all pulling in the same direction and all pulling as hard as they can.

All these things cannot be measured exactly, the benefits of this approach to management can be seen in our Accident Prevention Programme where disabling injury frequency rate is considered a measure. One can see it in our NOSA Five Star rating which places us in a fairly unique position amongst steel-producing companies in this country. One can see it in our labor turnover figures which are far lower today than they were five odd years ago, and last but not least, our Financial Director doesn't seem to be able to wipe the smile off his face!

**CONCLUSION**
To summarize a few very important factors to bear in mind when initiating VE/VM in a company:

(i) It must be a top-down approach
(ii) Your top people must attend the first session and be committed to the concept
(iii) Recommended changes must be seen to happen
(iv) It is far more than "work study" or a "think tank" — it is a new, disciplined way of thinking.
As this was revealed, repartitioning of the circuitry and redesign of the PC board brought the estimated costs back into line, and reduced the variances.

APPLICATION IN LIFE CYCLE COST, RELIABILITY AND WEIGHT CONTROL:

The method described has been utilized for:
- Design-To-Life Cycle Cost (DTLCC)
- Design-To-Reliability (DTR)
- Design-To-Weight (DTW)
  
as well as DTUPC

Essentially the LCC or Rel or Wt controlling limits in the design must be identified — established as targets and/or goals at the WBS level and then reevaluated during design and development for comparison with the targets.

SUMMARY & CONCLUSION:

It should come as no surprise that the fundamental management process of Plan — Monitor — Control, functions well in a DTC problem. The visibility attained in the method described, provides the necessary sensitivity for early detection so that timely control can be made.

It has been shown in other cost control methods, that merely providing cost information to design engineers can make the resultant production cost come in, under target by greater than 10%. The experience in a recent program at Loral, development of a Military Avionic Radar Warning Receiver Processor, verified this “rule-of-Thumb”, and resulted in a 13.6% under target design.

Even in his wildest dreams, Larry Miles ("The Techniques of Value Analysis and Value Engineering", McGraw-Hill) could not have envisaged the impact his invention has had, and will yet make around the world, and in every shire and walk of life.
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