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Tools of Value Engineering (I)

——Standard——

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価値工学におけるツールに関する研究　(I)

——標準について——

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The standard becomes our decision of what we should be doing. Now we need to know what we are doing. Finding out what we are doing requires in every instance a device which scans or senses the deeds we are performing, and couverts this sensing in to communicable language. We will call this device the "Sensor", and it becomes, logically, the subject of our study.

1. Introduction

Without a standard there is no logical basis for making a desison or taking action.

The standard was invented billions of years ago, and exist in profusion in all biological organisms. Biological control and action are based on responses to those stimute which are a depature from standard.

The human race reinvented the concept of standards. Primitive man had to judge whethcr fruit,s fish, vegetables, or meat were it to eat. He had to evolve standard for communication for trade, for defence. He was prolific in evolving standards (rituals taboos) for stabilizing his curlure.

The human invented standards, kowledge of performance is not enough ; he must have a basis for comparison before he can decide or act.

The concept of a standard is not limited to numbered quantities——budged profit, scheduled deliveres. Neither is it limited to "things." The concept of standards extends to business practice as well——routines, methods, procedures. Dalcher, L. M., has summed up the purposes served by these "administrative" standards :

(1) to coordinate the work of several departments all working on the same problem.
(2) to promote consistency in handling repeated functions.
(3) to convert solved ploblems in to routine procedure which make the solution a matter of record.
(4) to provide a guide for all who face these problems for the future.

2. Static Societies

If anyone doubts he effectiveness of a control system in preventing change, let him study the old societies to see how for centuries on end they remaind static.

In 1568, a Spanish expedition under Alvaro de Mendana discovered what we call today the Solomon Islands. The treasuer of the expedition, one Gomez Catoira, wrote a detailed account of the native customs and language as part of his report the Council of the Indies.

The report must have been stimulating, becouse additional expeditions, one after another, set sail for the Solomons, without finding them. The map makers kept shifting the Solomons to the shrinking unexplored places on the map. Finally they gave up——the discovery must have been a take.

But it wasn't. In 1768, Bougainvillcrediscovered the Solomons. A century later, a restudy was made of the native customs and language. The lack of contrast was amazing. In every respect, custom, language, right down to the "pettiest detail in their dress," the mode ot life was like that which Gomez Gatoira recorded so meticulously three hundred years before.

How did such societies remain so static for so long ? By a clear system of standard, rigidly enforced. The community evolved standards for what one should do (retuals) and for what one should not do (taboos). People leaned these things from infancy——it had never been different. The forces of belief and superstition, as well as the overwhelming presence of the community, saw to it that there was strict com-

pliance with the standards.

3. The dialect of standards.

Standard are all over, though they masquerade under a variety of aliases.

In the market, the standard for "How much should I sell?" is called a "quota."

In the laboratory, the standard for "How much should it measure?" is called a "specification."

In the office, the standard for "How much should I spend?" is called a "budget."

On the shop floor. the standard for "When should I deliver?" is called a "schedule."

And so on——target, piece rate, goal, aim, intent. The dialect varies, but the meaning it the same.

4. Standards should be

By now there has been extensive experience in use of standard as a tool for managing. Out of this experience has come a recognized set of tests or criteria for good standards. Standards shoud be.

Attainable : Ordinary or "normal" men, applying themselves with reasonable effort should be able to meet the standard .

Economic : The cost of setting and administering. standards should be low in relation to the activity covered by the standards.

Applicable : They should fit the conditions under which they are to be used. If these conditions vary, the standards should contain built-in flexibility to most these variables.

Consistent : They should help to unify communication and operations throughout all functions of the company. They should also be consistent in time, so that pranning for tommorrow is done in the light of knowledge gained to date.

All-inclusive : They should cover all interrelated activities. Failing this, standards will be met at the expense of those activities for which standards have not been set.

Understandable : They should be expenssed in simple, clear, terms, which admit of no misinterpretation or vagueness. The instructions for use should be specific and complete.

Stable : They should have a long enough life to provide predictability and to amortize the effort of preparing them.

Maintainable : They should be so designed that elements can be added, changed, and brought up to date without redoing the entire structure.

Legitimate : They should be officially approved.

Equitable : The standards should be accepted, as a fair basis for comparision, by the people who have the job of meeting the standards.

5. History as a Standard

By a wide margin, the most usual standard is historical. We compare Aprill a year ago, there is much merit, and much deficiency, in historical standards.

The merit lies in their appeal to practical men. A man who is told "You did it once ; Why can't you do it again?" has no real answer. The historical standard meet many of the criteria of a good standard. It is attainable, since it has already been attained. It is applicable, since it has already been applied. It is stable, since it asks for no change. It is "equitable" in the eyes of the man who is asked to meet it.

With all this, the historical standard can be tatally defective. The risk is that a poor performance may be perpetuated. Our sales may be as good as last year and the year before, but the industry is growing 15 percent year after year. Our peremt scrap may be 10 percent this year against 10 percent last year. But we could economically get to 2 percent if we really went for it. So our preoccupation with history may blind us to our opportunities.

A form of improvement standard based on improving on history was used suceessfully by the manufacturing company. At the time of annual planning he would stady the month-by-month performance charts of his plants and shops for costs, productivity yields, etc. He would identify the three best consecutive months. Then he would put it to his managers as follows : "Here is a level you actually held for a quarter of a year. How about making that your ahead?" This proposition was difficult to debate. Where the manager could point to special conditions prevailing during the 3-month period, the talk soon led to an agreement to see to it that those special conditions beeame regular.

The scheme was quite effective. Not only were the improvement standards generally accepted ; the entire approach tended to sharpen the analysis to discover why several months in a row could be better than history.

6. The Engineered Standard

The engineerd standard is directed at what performance should be rather than at the historical has been. The measure of what performance "should be" is obviously valuable. It does away with the gnawing suspiction that histry is blinding us to the real possibilities.

Engineered standards are widespread in the shops, mainly in material usage, quality, process yields, and labor man-hours. Generally they are based on close study of actual operations, plus analysis of the data to separate out the irregular and avoidble. The resulting standards are a composit of actual performance, seasoned with engineering judgment.

There are stirrings among the engineers to break out of the traditional labor and material standards into broader fields. The techniques of socalled

"Operation Research" (and its numerouses) are being used to create models for discovering the optimum levels of inventory, proft, prices, etc. However, as yet, we have not found reliable ways to set engineered standards for some of the most critical performances to the list——what should be our share of market, whom should we promot to be general manager, what should we promote to be general manager, what should be our level of morale.

The engineered standard also limitations. One is the economics of setting standards. There must be enough repetition, or similarity, to provide for economic amortizaion of the engineering effort.

The main limitation of the engineered standard lies in its failure to meet the criteria that standard shall be attainable, applicable, and equitable.

The main limitation of the engineered standard lies in its failure to meet the criteria that standard shall be attainable, applicable, and equitable. Obviously, the engineer feels that these criteria have been met. But the line man who is faced with meeting the standards often says not. Lurking behind these stated objections may be the real objection of the line man ——he has not participated in or consented to, the standard.

A well-worn battleground has been that of "precision" of engineerd slandards.

A time-study engineer observes a shop operation with a stop watch. He is well skilled in techniques of recording what was the actual time taken. He is also skilled in identifying the abnormal events which requive sepate anarate analysis. But sooner or later he is faced with converting how long the operation did take into how long it should take ; this conversion is at the very heart of the distinction between historical standard and engineered standards. How does he make this conversion ? He makes it by using an estimate based on "engineering judgment."meandg he says " I think ……"

It does not follow that the conversion of "did take" to "should take" would be identical if several engineers made the estimate for conversion independently, or even if the same engineer did it more than once. The engineers know the error of estimate is there, and they have conducted some experiments to measure how big it is. But they have avoided publicicizing such studies.

A good rule to keep in mind is that the accuracy of such estimates depends on the number of observers, not observations. not on the number of observations The bias is in the observers. By broadening the number of observers, the chance of extreme bias is reduced.

The engineer feels pretty strongly about the importance of expertness in setting standards. He can get so wrapped up in his techniques, laws, and principles that he accepts them as axiomatic. A classic examples is the conviction of Frederick W. Taylor, "the father of scientific management" that the determination of work standards and wages be left to the expert ;

We will come back to this problem under the headings of Participation in Setting Standards and Consent in Setting Standards.

Companies with a well-developed set of engineered standards have an impressive list of uses for them.

7. The Plan as a Standard

Many standards——budgets, schedules, quotas——are rusult of a mixture of considerations. The budget is good example.

A well-ordered budgeting procedure starts with defining the objectives for the year ahead-objectives in deeds, not money. These objectives may be things like : bring products A, B, and C to market : drop products Y and Z from the line ; hold present share of market on the original equipment business ; increase share of market in the replacement business from 10 to 11 percent ; consolidate the two Eastern plants ; open new sales branches on the Gulf and West coasts.

To do these deeds requires facilitiies, personnel, time money. These need are worked out by a study which combines use of history, engineereds standards, market data, and that mysterious ingredient, business judgment.

Companies which are faced with repetiti introduction of new products or model changes evolve a plan for giving easy birth to the new family members. Timetables and roles are laid out of sales forcasting product depelopment, market testing, approaval of samples, tooling, material ordering, fabrication, build up of inventories, sales promotion, packaging, selling.

The plan also operates microcosm. Many employees do their work without the benefit of a supervisor on the scene——the salesman, the installer on the customer's premises, the plant maintenance man, the trucker. These men must be Supervised by plan rather then by personal supervislm.

These plans take familiar forms——the itinerary for the trucker, the call list for the salesman, the daily schedule for the maintenance man. Where the plan is not worked out in advance, provision is made for call-in so that job-by-job supervision can be given.

The control by plan extends the methods used "Standard practice" is the key phase. As improved practice is evolved, wether by engineers, the supervisors or the employees, the improvement is woven into standard practice, the manuals, the procedures. So the better way becomes the regular way.

8. Subjective Standards

In a sense, these are simply the lack of objective standards. The boss say "Your cost are too high." which coms as surprise to the underling. He thought his cost were pretty good.

Expeience has shown that these subjective evalua-

tions are mainly a curse. Human beings yield to pressures of the moment, so that what was good in rush times. becoms no good in hard times. Our concepts of prices, quality, and service change remarkably depending on whether goods are scarce or plentiful.

Nowhere is the problem of subjective standard more a curse than in evaluation of human performance. Much of the impetus for seniority, work rules, etc., stems from the opportunity for arbitrariness which the subjective standard gave the supervisor. To this day the personnel people and the behavioral scientists are hard at work refining the performance-rating systems to make them more and more objective.

9. Standard for a Function

With all the talk of the importance of standards, we are at our worst (imprecision) when setting standards for executive performance——the very place where we need standards the most. At the bottom of the company, the organization of work has generally been such that objective standards can be set with confidence. As we get away from the countable, measurable activities and move more and more into variety, creativity, judgment, and leadership, our ability to measure seems to fade out. How then do we go about setting standards when we cannot measure the results? We go at it in several ways.

1. We set quantitative standard anyhow.
2. We set qualitative standards.
3. We set verifiable standards.

10. Maltiple Use of Standards.

A widely prevalent fallacy is that standards are used only as a basis for comparison with actual performance. Standards are indeed used for this purpose. But standard have a much wider range of use, and this range should be understood.

For example, labor standards are used to judge the performance of operators and clerks. But these same standards become the basis for costing, for budgeting, for pricing for judging potential cost reductions, for estimating labor requirements, for estimating machine capacity, for planning of inventories, purchases, money needs and many olhers.

Standards for executive performance likewise serve a variety of purposes : the very act of preparing the standard clears up many vague notions about the job.

The publication of the standard is an act of communication to many people on an important subject.

The published standard becomes a guide for selection of men for the post and for there subsequent tranning and development.

The standard becomes the reference for the boss in supervision of the job, in appraising performance, in merit reviews, and in salary administration.

The advocates of setting standards for executive performance feel that the exhaustive discussions which must precede the setting of such standards result in a new debth of understanding of the job, the responsibilities, the relationships, etc,. This deeper understanding is so rewarding that a considerable body of opinion regards it is as the main value of setting these standards.

The multiple use of standards is also decisive in chois of dialect and terminology. For example, if standards were to be used only as a basis for control, the local terminology of vats bays, stacks could became the units of measure, since the natives would understand the dialect. However, with broader usage, the units of measure must be in widely understood language-gallons, sguare feet, reams.

Before there is a big undertaking to set standards, there should be a look around to see just how widespread will be the use of standards. This spread will then decide how broad should be the participation, and how broad (or provincial) should be the resulting concepts langage, and applications.

11. Tool for Standards Setters

Setting of standards can be a most elaborate activily. The annual budgeting preempts the time of many men in the company, for many hours. Scheduling of a large construction project is a considerable feat. So is the scheduling of a mass-production and mass-marketing activity. A stand cost system requires a prodigions amound of detail work. So does a system of piece rates, of job evaluation.

Those who draft proposals for standards have by now acquired a proved kit of tools to aid in setting standards. For example :

Tool

Engineering synthesis·····
: Setting standards for material usage chemical reaction, electric-power usage.

Time study·····
: Setting standards for labor hours machine capacity. machine time.

Statistical analysis·····
: Clarifying history, discovering seasonal trends, variations by product type, etc. Analyzing engineering data to "purify" standard and make them applicable to various situations. Discovering what is the market.

Engineering or business Judgment·····Filling in the gaps not supplied by other more objective means.

The emergence of modern high-speed computers has made possible the standardization work which here•to•fore has been too forbidding in time and effort.

A familiar example is the scheduling of customer orders. Here, a computer carrying the part list in its memory "explodes" the orders into parts, These

orders for parts are then analyzed in relation to the part-inventoly record, which the computer also maintains. Next, the production schedule is prepared from load vs. capacity analysis. Finally, the computer prints out the standard, i.e. the delivery schedules.

Additional tools for standards relate to the form of the standard itself. The variable budget is an example. It separates the constant from the variable expenses, and the job of standardization is greatly facilitated.

As in all other cases of use of tools, no practitioner need to do much inventing if he will but took around. An immense amount of effort hase gone invention of tools, and the results are available for use of anyone who will trouble to inform himself.

12. Statistical Aids in Setting Standards

When historical data are to be used a basis for setting standards, some useful aide judgment can be got by analysis of the data.

Historical data are usually derived from an assortment of experiences—data from many machines, many branch offices, many weeks of operation, many customers. There is "Variability" in these data and one of the needs is to discover what is "normal."

The statistician is able to analyze the data in a way which sheds light on the variability. He also has some clever tools for distinguishing "abnormal" from "normal." Through this analysis, the make up of past performance is better understood, and the determination of what is "normal" can be better defended.

So far, the procedure has dealt with doing a better job of understanding history. Now comes an act of judgment. It is decreed that the standard for the future is to be either :

(a) The "nomal" of the past.

(b) The upper quartile of the past, i.e., the performance attained by the best 25% of the weeks, office, machines, or whatever.

(c) Some other improvement over normal past performance.

There is much to commend such an approach to setting standards. If the proposed standard has been met 25% of the time, it can hardlty be attacked as unattainable. But let no one be deceived into thinking that use of a mathematical formula confers science or precision. The basic act of judgment in choosing the upper quartile is arbitrary. The soundness of the judgment is demonstrated by the subsequent results, not by the prior logic.

13. Participation in Setting Standard

There are strong arguments for giving, to the man who is to meet standard, a voice in setting them :

1. The standards become more realistic (really attainable) if they have first been tested the against the arqument of the men whow face the practical problems of meeting them. "Applieability" is a most sensitive area. The conditions under which the standard is to apply vary considerably. Total activity varies ; there are variations in product type, process conditions, packaging. Unless the standard provides the necessary allowances or flexibility to handle these variable conditions, the resulting performance will, in part, measure these variations rather than the performance of the men.

2. The psychology of participation makes for a genuine acceptance of the standard, and hence a genuine effect to meet it.

Despite these compelling reasons, there is much setting of standards without participation. Some of this is for reasons of principle. "The crew can't run the ship" Some is for reasons of classified information——a plan for abolishing exchanging the jobs of the very men who would participate. Their first reaction could well be that they are being invited to dig their own graves. Some lack of paticipation is for pretty weak reasons——the boss is insecure, or closed-minded. Some is due to a confusion of "participation" with "consent." But some is done on sound ground of experience. Many an executive can point to cases where his subordinates succeeded in meeting the very objectives they had once regarded as unattainable. These same executives point out that they retain the means for easing the objectives if the unfolding events show them to be really unattainable.

Even when participation is present, the biases show. Manager try to arrive at a budget which is attainable ; so do salesmen respecting their quotas ; so do factory hands respecting piece rates. But in the absence of participation, mutual suspicion runs high. The lack of confidence then results in arbitrary setting of objectives, e.g., arbitrary cut in budgets. In turn, men faced with threat of arbitrariness set up defenses in the form of restricted production, padded budgets, etc. Some of the case of fantastic military requisitioning during World War II were the result of each level adding a generous safety factor to the requisition submitted by the levels below.

In contrast, when participation takes place in an atomosphere of confidence, it is common for line supervisors to propose goals which seem surprisingly severe to the bystanders. When the supervisors are questioned about it, the response is in the form "We are the ones who really know what can be done." And often they are.

Participation is not merely a relationship between boss and subordinate ; in many companies, the real problem is between the line supervisor and the staff specialists. Uninitiated staff peeple —industrial engineers, accountants, controllers, procedures analysts, etc.——can be so impressed by there own logic that they consider the standards they work up should be adopted forthwith. Upper managers seldom raise a hand in initiating these staff people, leaving the staff and line relationships to be "Worked out." They do

get worked out, but the process is long, and the casualties many.

14. Consent in Setting Standards

The concept of consent involves a head-on coutradiction of two great principles :

1. The needs for decisiveness and clear responsibility, To date, no way has been found to meet these needs adequately without use of a chain of command, and thereby, the opportunity for decision in the absence of consent.

2. The need for consent of the governed. Inherent in the human sense of justice is the idea that laws are to be based on the consent of those who are to be governed. The human being who joins an industrial company brings this idea into the gate with him.

These two principles are so important that neither can be ignored. A manager may dismiss "consent" with truism that "the crew can't run the ship." But no one can brush off a basic human drive without paing the price. In the managerial levels, the spirited men may leave, lowering the average of managerial competence and morale in the process. In the ranks, the men do not quit——they organize into unions, after which the bus jolly well discovers the meaning of consent.

An important factor in the need for consent is whether we are dealing with proved or unproved standards. By the very nature of things, we have already met most of the historical standards, many of the market standards, and some of the engineered standards. In constrast, we have not already met the plans for *Value engineering*. These latter, untested standards require (and generally receive) more participation and consent than do standards proved by prior usage.

A further factor is the rigidity of the subsequent accountability for result. When review of results is done with fairness, the need for prior consent shirinks markedly. Undue rigidty at the top breeds blind obedience at the bottom, but only after the men of spirit get out. The habit of blind obedience has value only when the top man is all-knowing.

The dilemma of decisiveness vs. consent is probably best resolved by the concept of revision of standards. When the results are up for review, one of the alternatives is revision of the objective. If the boss is flexible on this score, the need for prior consent again shrinks markedly.

15. Maintenance of Standards

Standards start to deteriorate from the day they are established. This deterioration continues as conditions keep changing. In time the standards can get badly out of date, unless provision is made for review and maintenance.

Some of this provision is made at the time of major changes. Part of the job of introducing a major change is to review the standards which might be affected, and to change them as well.

But there is also need for periodic review to deal with creeping and with undisclosed changes. Such reviews are known as audits, and are properly conducted on a scheduled bassis——quarterly, annually, every 5 years, or whatever is deemed to be appropriate.

Maintenance of standards is greatly aided by adopting a formal approach toward standardization.

Having decided what the problem was, we made a rather simple decision,

We decided to standardie on standards standards. All of this procedure and policy information was to be written up as standards. It was to mean that each of our supervisors would have his own standards book, to be used as his primary on-the-job refernce. Just one book look in ; just one book to keep up to date ; just one numbering system to become familiar with ; just one index to refer to. That was idea behind our original conception of administrative standards.

The standard becomes our decision of what we should be doing, Now we need to know what we are doing.

Finding out what we are doing requires, in every instance, a device which scans or senses the deeds we are performing, and converts this sensing into communicable language.

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