

VALUE METHODOLOGY – THE LINK FOR MODERN MANAGEMENT IMPROVEMENT TOOLS

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ABSTRACT:

The Value Methodology, the oldest, most complete process for identifying problems or improvement opportunities in products, processes or services, has not been adopted nor does it enjoy the visibility of the more popular management tools in today's competitive environment. Total Quality Management, Theory of Constraints, Quality Function Deployment, Design of Experiments, Design for Manufacturing/Assembly, TRIZ, Target Costing, Lean Manufacturing, Six Sigma, etc., are a few of the tools being employed by organizations to resolve problems and improve their bottom line. While these tools may work well within their focus, many lack the broad scope necessary to resolve the overall business concern.

This paper will provide a brief survey of these tools and how they relate to the Value Methodology Job Plan. In many instances the most beneficial management approach would be to employ the value methodology as an overarching approach to addressing management concerns and inserting the appropriate tool when conditions warrant.

INTRODUCTION:

The Value Methodology (VM) had its origin at General Electric during World War II with Larry Miles' breakthrough thinking that "understanding the function" of a part, assembly, component, product, or process is critical to meeting requirements and developing improvements.¹ These improvements may be alternative ways of providing the function or improving the value of an existing part by reducing its cost to procure, produce or assemble. When Miles was given the task of developing his thinking into a process that could be deployed throughout GE, the result was Value Analysis (VA). While Miles could have documented his Function Analysis (FA) tool and left it at that, he realized that a complete decision making methodology was needed to make it a viable management process. Thus, the VA job plan with Function Analysis as the unique tool was created. Over time, VA developed and evolved into Value Engineering, Value Management, and Value Methodology. Function Analysis System Technique (FAST) was developed and added as an additional significant tool in the mid 1960s. FAST further evolved from Classic to Technical or Customer Orientated models, and added dimensioning to the models by including various responsibility or cost matrixes.

VALUE MANAGEMENT JOB PLAN

The original Miles "Job Plan" consisted of five steps: Information, Analysis, Creativity, Judgment (Evaluation) and Development (Planning).² Fallon described another five-step job plan that introduced a presentation to management within the Development step.³ For the purposes of this paper an enhanced six-step job plan as shown in Figure 1 will be used.

Value Management Job Plan

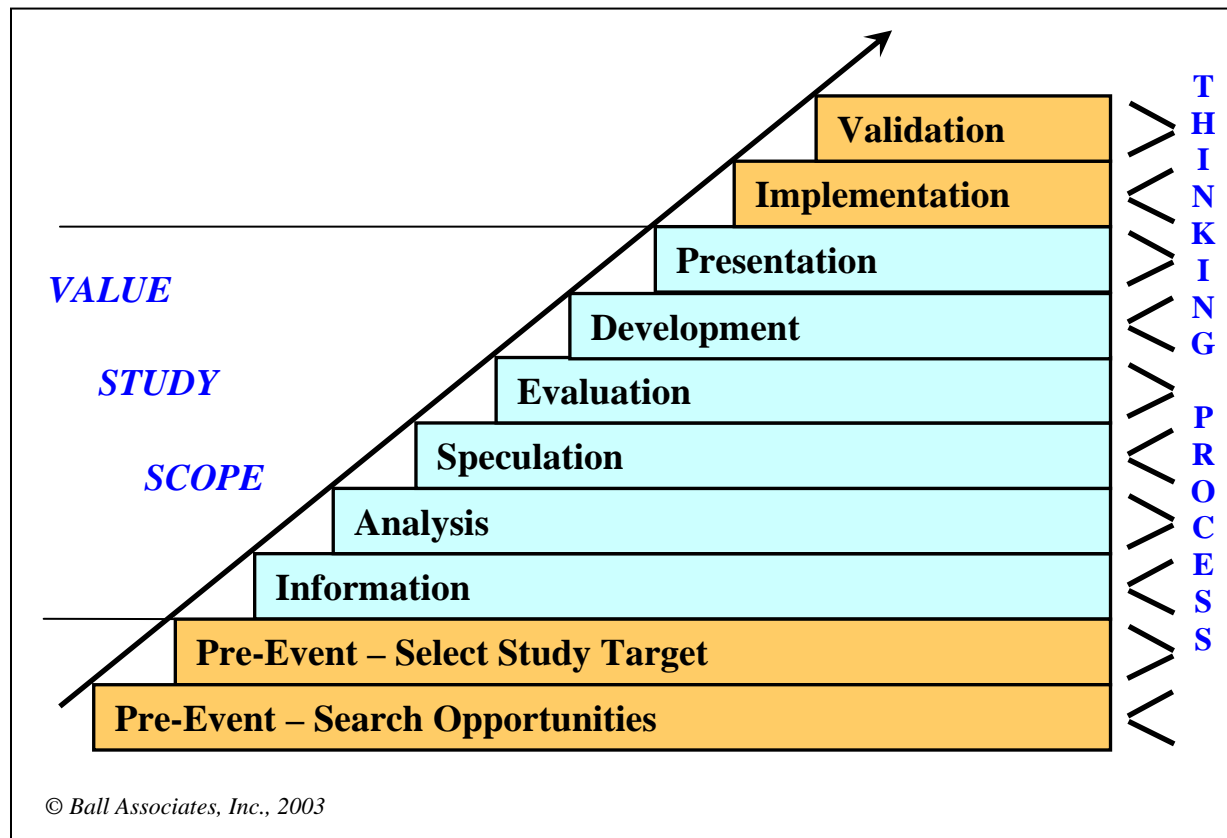


Fig. 1

In addition to the six-steps included in the basic value study scope, the Pre-Event and Post-Event phases have been added. The Pre-Event phase is critical to a successful study as it allows management to identify the opportunity (problem) that the study team will address as well as set the study scope, target goals, and attributes to be used by the team to evaluate potential solutions as well as the constraints the team must consider. Other elements of the Pre-Event identify the proper skill mix of participants and the information that will be needed for the study. The Post-Event phase, like the Pre-Event, is in two steps, Implementation and Validation. The Implementation step plans for and incorporates the approved recommendations from the Value Study. The Validation step is the final step of a project. It measures and reports the results of the changes and often can be used as a starting point to go through the entire Value Management Job Plan under the philosophy of continuous improvement. Many practitioners of the Value Methodology tend to discount the Post-Event Phase as these activities are conducted outside the focused workshop. The tendency is that “others” within the organization will take care of this. However, the importance of the Post-Event phase cannot be emphasized enough. Without implementation and validation, one will not have achieved success regardless of the design improvements and potential savings that may have been identified during the study.

Miles, in describing the job plan, noted that the steps require different types of thinking.⁴ The thinking process may be described as divergent (<) or right brain thinking where an individual is opening up to gather information, creating alternatives or developing business scenarios. On the other hand, convergent (>) or left-brain thinking is the more decision-oriented process such as that used during analysis of information, evaluation of creative ideas and presentation of developed recommendations. The right side of Fig. 1 reflects the type of thinking, < or >, for each step of the job plan. Understanding the type of thinking process that is taking place in each step aids the value team in remaining focused as they proceed through a study.

MODERN MANAGEMENT IMPROVEMENT TOOLS

Over the years, especially since the mid 70s, there have been a plethora of new tools introduced to management that are purported to resolve their design, production, cost and quality problems. Interestingly, some of these tools originated in the United States where they achieved only limited early success. It was only after they were introduced to and incorporated by Japanese industry that they became the “must have” tool for US industries. The remainder of this paper will provide a short synopsis of several of these tools and how they relate to the Value Methodology job plan.

TOTAL QUALITY MANAGEMENT (TQM)

TQM in and of itself is not a methodology. Rather, it is a philosophy of continuous quality improvement. A major objective of TQM programs is to reduce process variation. Statistical measures are used extensively to document the processes. A six-step problem-solving method is generally followed. These are:⁵

- Define the problem
- Analyze the problem

- Generate and select a solution
- Implement the solution
- Evaluate the solution
- Document the results

A large toolbox of idea-generation, analytical and statistical tools may be employed during the problem solving exercise. Many of these tools may also be applied in a VM study. Function analysis and FAST are not typically used. The “analyze the problem” step may be excluded if the “solution” to the problem is known. The result of following this problem solving process without performing Function Analysis is that the team often addresses and solves problems that do not contribute value to the product or process. In one case, a team worked diligently to become world class in reworking parts that failed quality inspections. While they addressed what they determined to be the root problem, defective parts, they should have identified and fixed the process that made the defective parts in the first place.

THEORY OF CONSTRAINTS (TOC)

Theory of Constraints is the brainchild of Eliyahu M. Goldratt. “Eli Goldratt is an educator, author, scientist, philosopher, and business leader. But he is, first and foremost, a thinker who provokes others to think. Often characterized as unconventional, stimulating, and ‘a slayer of sacred cows,’” Dr. Goldratt exhorts his audience to examine and reassess their business practices with a fresh, new vision.”⁶ In many respects, Goldratt is like Miles. Both developed new ways of thinking; Miles focused on “function” and Goldratt focuses on the bottlenecks or “constraints” in a manufacturing process flow. Goldratt identifies a five-step process in resolving constraints:⁷

1. Identify the constraints
2. Exploit the constraints
3. Subordinate everything else to the above decision
4. Elevate the constraint
5. If in the previous steps a constraint has been broken, go back to step 1.

Though it may be argued by some that TOC can be used in most all business settings, it is most effective on those processes that are continuous and repetitive such as large quantity manufacturing or assembly processes. To some it may be frustrating to employ the TOC process as, by definition, once a constraint is broken (no longer the pacing step in a process) there will exist a new constraint. This is true. However, it is imperative that management be able to identify when the marginal improvement is not worth the effort to attempt the change.

The use of TOC and the VM job plan work well together. Function Analysis and FAST modeling helps identify constraints. These are the Information and Analysis steps of the VM job plan. Exploiting and subordinating the constraints is similar to the Creative, Evaluation and Development steps of VM. And, finally, elevating the constraint relates to the Presentation, Implementation and Validation steps of the VM job plan. Additional sources of information on TOC can be found in the References at the end of this paper.

QUALITY FUNCTION DEPLOYMENT (QFD)

Quality Function Deployment was developed in Japan. It is used primarily by technology driven industries that target export customers. QFD is a process to plan and design new or improve existing products and services.⁸ QFD:

- Focuses on customer requirements
- Designs or improves goals based on the competitive environment and market potential
- Incorporates heavy statistical and graphical tools into the documentation

There are four steps in the QFD process as described by the American Supplier Institute. The steps are a series of matrices with inputs and outputs. These are:⁹

<u>INPUT</u>	<u>STEP</u>	<u>OUTPUT</u>
Customer Requirements	Product Planning	Design Requirements
Design Requirements	Part Planning	Product/Part Characteristics
Product/Part Characteristics	Process Planning	Manufacturing Operations
Manufacturing Operations	Production Planning	Product

The primary “tool” used in QFD is the House of Quality (HOQ). The HOQ is a matrix that is used to record and analyze data gained from customer inputs. Once the first matrix is complete and the design requirements are identified a new HOQ is built for the next step. This process continues through all four steps. The goal of the QFD process is to get new products to the market and that these products incorporate the appropriate level of customer desires.

QFD techniques can be beneficial in the Information step of the VM job plan. The better a VM team understands the customer requirements the better it should be able to relate these requirements to the functions of a product.

DESIGN OF EXPERIMENTS (DOE)

Design of Experiments (DOE) is a powerful statistical technique introduced by R. A. Fisher in England in the 1920's to study the effect of multiple variables simultaneously.⁸ The methodology is frequently associated with Dr. Genechi Taguchi. Taguchi’s contribution was to develop a standardized method for setting up and conducting the experiment. This method is now referred to as the Taguchi method or Taguchi approach.⁹

The focus of DOE is to identify the variables that are possible in a product or process. Experiments are then conducted where all the variables are changing at the same time. Finally, the results of each experiment are analyzed with the outcome resulting in the optimization of the product or process. Addressing and controlling the primary variations in the product or process will improve the overall. While an interdisciplinary team often conducts DOE exercises, it is necessary that the team has an experienced facilitator in DOE (Taguchi) methods to properly set up and analyze results from the experiments. DOE can be a very beneficial tool to be used during the Evaluation and Validation steps of the VM job plan.

DESIGN FOR MANUFACTURING/ASSEMBLY (DFM/A)

It is fairly accepted that approximately 70% of the cost of a product is locked into in the design phase of a product's life.⁹ DFM/A is both a philosophy and a set of tools with the objective of optimizing the production process in a factory. For new products, the objective is to get the design engineer to consider the production and assembly methods while designing the part. If a part is already designed, DFM/A uses a detailed process of identifying every component, fastener, tool, step and activity in the assembly process. Using a database of standard times for each activity and adding penalties for using tools ("x" seconds for a hand tool and "y" seconds for a jig or fixture, etc.), a team calculates a base score. These activities relate to the Information step of the VM job plan. The primary approach of DFM/A is to then eliminate as many of the activities as possible. Typical solutions are to design a more complex assembly that combines several other components. In that manner they eliminate fasteners. This step of the methodology may relate to the Speculation step of the VM job plan. Finally, DFM/A uses the Delta of the time count as a correlation to savings. The DFM/A methodology is limited to more complex products that require significant man/machine interface.

TRIZ (Pronounced "trees")

TRIZ is the Russian acronym for "Theory of Inventive Problem Solving". The TRIZ methodology and tools have evolved over the past 50 years through the study of over two million patents.¹⁰ TRIZ focuses on the contradiction of characteristics of a product or process, e.g., "Coffee should be hot, for enjoyable drinking, but cold, to prevent burning the customer."¹¹ It is a powerful tool for identifying solutions to complex engineering tasks and, depending on the tool employed, may be very software driven. Special training and understanding of the TRIZ theory is necessary to successfully accomplish a study. TRIZ relates to the Speculation step of the VM job plan. This is a much more intensive method of identifying potential solutions than generally used in a VM study.

TARGET COSTING

Target Costing is a business management approach that first determines how much the market is willing to pay for a product or service. Second, the required profit margin necessary to achieve the strategic objectives of the business is deducted. The remaining proceeds are then allocated to the development and production of the product.¹² This approach is contrary to many product-pricing models that determine the production and marketing costs first and then strive to price the product competitively in the market. Target Costing uses a sequential process for bringing products to market. Benchmarking and market research tools are used at the front end of the process to establish the market price and to characterize the features of the product. After costing initial designs a comparison is made to the target costs to establish a cost gap. Target Costing proponents endorse the value methodology to then design out costs. So, in essence, the VM job plan uses the inputs from the front end of a Target Costing exercise as its goals and measurement attributes. The outputs of the VM study are the designs released to production.¹³

LEAN MANUFACTURING

Lean Manufacturing is not a methodology with a defined "job plan" similar to the VM. Instead, Lean is a philosophy where value is created by eliminating or at least minimizing waste throughout the value stream.¹⁴ Waste, in the Lean lexicon, may be grouped into several typical classifications. These include the waste of:

- resources, time and material, in correcting errors
- time in operating inefficiencies
- over production
- personnel movements
- material movements
- idle or queue time
- not producing what the customer wants

Lean Manufacturing is the Americanization of the Toyota Production System model developed by Taiichi Ohno and his colleagues after WWII. Although developed in the production arena, Lean is currently being adopted in Engineering and other departments throughout an organization. This newer application of the Lean Principles is now termed “Lean Enterprise.” Unlike several of the tools and methods discussed above, Lean does not fit well into the VM job plan. However, VM is an excellent enabler for achieving Lean objectives. An example would be a complex part that is difficult to produce in a consistent manner due to several tooling and jig changes needed before the part is complete. The part could be the subject of a VM study that addresses the function of the part and creates a new design that is more producible. The overall objective of Lean is to redefine or create an enterprise that is driven to produce just what the customer wants in the most efficient manner. If adopted by an enterprise, it will become a continuous flow “pull system” from the customer’s order through delivery and will include all elements of the supply chain.

SIX SIGMA

“Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process -- from manufacturing to transactional and from product to service.”¹⁵ The modern version of the Six Sigma concept was developed at Motorola in the mid 1980s. But it took a champion at the senior level of a corporation, in this case Jack Welch of General Electric, to provide visibility and convert the thinking of many organizations. The underlying principles of Six Sigma are to know the customers requirements, collect and analyze performance data at all levels and develop and manage processes using the data. The overarching objective is to have no more than 3.4 errors in one million opportunities. As Six Sigma processes are data driven, the information derived is excellent inputs for a VM study. The steps of the VM job plan where the Six Sigma data applies are the Information, Analysis, Evaluation, Development, Implementation and, especially, the Validation step.

CONCLUSION

The many philosophies, methods and tools that have come to the forefront in the business boom of the 80s and 90s have contributed significantly to improved productivity and quality of products and services. Some of the tools are single-focused while others have grown to become broad business improvement roadmaps. The Value Methodology, the oldest of those discussed above, is the only one that has ‘function’ as a basic tenant. By incorporating the tools and techniques described above in a function-structured VM study, an organization can gain an edge on creating true value for the consumer as well as market margin.

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