THE APPLICATION OF VALUE ANALYSIS TECHNIQUES FOR COMPLEX PROBLEMS

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ABSTRACT

This paper discusses the application of the Value Analysis technique to the transuranic package transporter (TRUPACT). A team representing five different companies or organizations with diverse technical backgrounds was formed to analyze and recommend improvements. The results were a 38% systems-wide savings, if incorporated, and a shipping container which is volumetrically and payload efficient as well as user friendly.

The Value Analysis technique is a proven tool widely used in many diverse areas both in the government and the private sector. Value Analysis uses functional diagramming of a piece of equipment or process to discretely identify every facet of the item being analyzed. A standard set of questions is then asked: What is it?, What does it do?, What does it cost?, What else will do the task?, and What would that cost? Using logic and a disciplined approach, the result of the Value Analysis performs the necessary functions at a high quality and the lowest overall cost.

INTRODUCTION

Value Analysis is a process for analyzing the worth of a product (object, system, or method) to achieve the lowest overall cost for performing a specific function. This systematic analysis highlights cost reductions while maintaining the necessary quality of the product and still permitting the product to perform its function at the required time and place. The success of the Value Analysis process has been well documented in countless applications in government and industry since World War II. The improved designs and lower costs produced through Value Analysis are a direct result of two things: synergistic teamwork and the structured Value Analysis Job Plan.

The Value Analysis technique has been applied to a variety of systems or processes at the Waste Isolation Pilot Plant (WIPP) with outstanding results. System design changes were enacted and waste transportation and handling times were reduced; this reduced cost, increased throughput of the transuranic (TRU) waste being handled, and reduced personnel radiation exposure.

HISTORY

The Value Analysis process began shortly after World War II as a result of shortages of strategic materials that had been needed for the war effort. Since its inception, the successful application of the Value Analysis process has been well documented in many diverse applications in both government and the private sector.

The Value Analysis process is not just a cost-improvement program. It is a disciplined, systematic approach which identifies the function or purpose of an item, product, or system and establishes the value or worth of the function at the lowest overall cost. The American Ordnance Association made an independent study of 193 Value Analysis projects taken at random from over 2000 Value Analysis change proposals. In addition to cost improvements, they observed the following significant average benefits harvested from the projects:

1. A 78% improvement in cycle time
2. A 64% improvement in maintainability
3. A 33% improvement in performance
4. An 82% improvement in producibility
5. A 71% improvement in quality
6. A 63% improvement in reliability
7. A 37% reduction in weight

Another example of the total effectiveness of Value Analysis can be drawn from the case history of a client of Value Programs for Industry, a Value consulting firm. Their customer selected 15 projects for a Value Analysis seminar on the bases that they did not work, they were all overweight, or they cost too much.

In addition to obtaining solutions that worked, they achieved an average 34% reduction in weight and an average 44% improvement in cost.

THE VALUE ANALYSIS PROCESS

The Value Analysis team should represent the disciplines affected by the item or process being Value Analyzed. Team size is determined by the complexity and resources or expertise necessary and is usually limited to six or seven people. The transuranic package transporter (TRUPACT) Value Analysis team consisted of the following disciplines: health physics, safety, regulatory, manufacturing, design, operations, and systems engineering. It is important that some team members have a working knowledge of the item or process to be analyzed; outside people who are not familiar with the item or process provide fresh ideas and new perspectives.

The Value Analysis process is divided into phases or steps as shown in Fig. 1. Each of these will be discussed in detail.

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Scope/Goals

The establishment of (1) the scope that the Value Analysis is to address and (2) the goals it is to seek has a large effect on the success of the project. The scope to be addressed should have quantifiable boundaries. Vague or undefined scope may condemn the project to failure before it begins. Careful thought and planning are vital. The goals should be optimistic: the idea is to promote a think-big attitude, rather than one of fine tuning. However, the goals should be realistic in respect to the magnitude of potential savings.

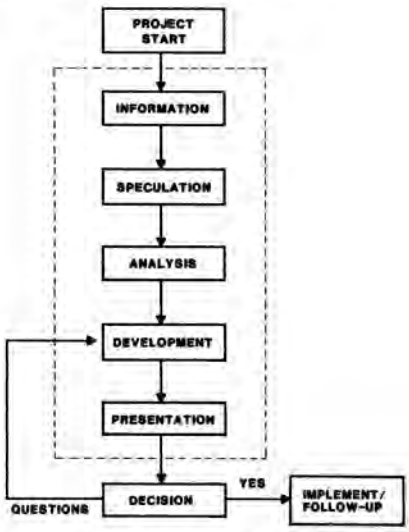

Fig. 1. Process Diagram.

Information Phase

The information phase is probably the most important portion of the Value Analysis process. It is here that all available information and data pertaining to the item or process are gathered. With these data available, the team generates a functional diagram. The functional diagram identifies all functions that the item or process must perform. The diagram uses a how-why logic and simple two-word (action verb-direct object) descriptions. An example of one function diagram for TRUPACT is shown in Fig. 2. After construction of the diagram, a cost for each function must be identified. Once these costs are defined, the high-cost areas, or cost drivers, can be seen readily. It is important to note that problems or high-cost areas should not be solved here, only identified and quantified. The next phase of the process will identify solutions.

Speculation Phase

This is the creative phase of Value Analysis. In this phase, alternative ways of performing a function are generated. There are many techniques which can be used to generate ideas such as brainstorming or blast, create, and refine. It is very important in this stage not to be critical nor to analyze ideas. Nothing should be considered too far-fetched or unreasonable; the objective is to generate ideas and alternatives.

A valuable aid in this phase is the use of outside sources. Experts from either within the group

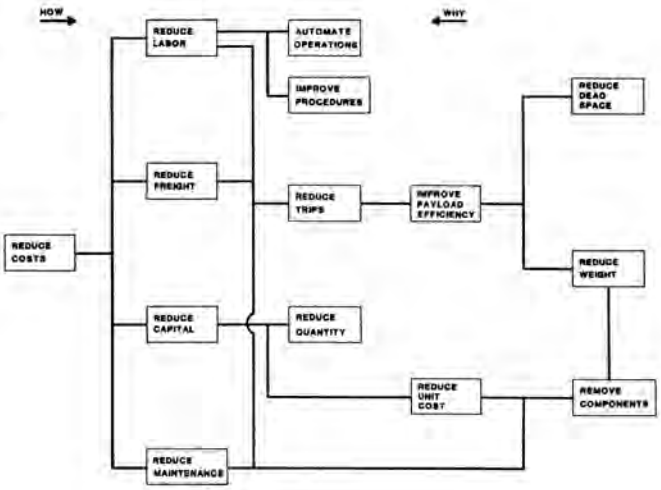

Fig. 2. Functional Analysis Diagram.

or company, vendors, or consultants can bring experience and a fresh perspective to this phase.

Analysis/Development Phase

In this phase of Value Analysis, the ideas generated in the speculation phase are evaluated. This phase is very structured. Each idea is carefully scrutinized to determine the best solutions to the problem. Subsequently the ideas can be grouped into those with a high probability of succeeding and those which may not be worthwhile to pursue. Those ideas which appear worthwhile are fully developed, and the cost of each is determined. Other benefits that each alternative may produce should also be addressed, such as improved quality, reduced cycle time, weight reduction, and increased safety.

In the development of ideas, the advantages and disadvantages of each must be reviewed. This can be done based on technical feasibility, economics, and judgment. It is important that each idea or solution adequately meet the required needs that were originally identified. In the development of each idea, not only the cost, but also the implementation costs, schedule, and changeover impacts should be considered.

Presentation/Implementation Phases

These phases are the culmination of the Value Analysis process and involve both a written and an oral presentation of the chosen alternatives to those who have the authority to approve and implement the decisions. An implementation plan is essential to ensure that the approved recommendations are enacted and followed.

Oftentimes more information may be requested. When that occurs, the team may go back to any of the above phases and expand on the work already performed.

After the approved changes or revisions have been implemented, it is worthwhile to verify that they are successful and to compare the actual and anticipated performance savings.

CONCLUSION

Value Analysis is particularly useful in evaluating complex equipment or processes because it systematically reviews each individual function, thus simplifying and making more evident changes that increase potential worth. Each individual improvement also increases the complex systems overall worth by segregating the problem, operation, or equipment into more approachable, better defined components.

The TRUPACT Value Analysis is one of numerous Value Analysis projects conducted to date by the WIPP Project and the Department of Energy. If all recommendations were implemented, a projected 26% capital cost savings on the containers and a 38% system-wide savings representing a $63 million life-cycle cost and savings could be possible. Side benefits include projected substantial reductions in costs, personnel radiation dose, and handling time if the recommendations were implemented. In conclusion, the application of Value Analysis has great potential in many diverse areas of the radioactive waste management system.