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BETTER DEFINE YOUR CUSTOMERS FACILITY REQUIREMENTS
BY OPTIMIZING YOUR CUSTOMERS PROCESSES
WITH
VALUE ENGINEERING
BEFORE CONCEPTUAL DESIGN.

Raymond L. Carpenter Jr.

November 19, 1993

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MASTER

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ABSTRACT

This paper addresses a new value engineering approach successfully being used at the Idaho National Engineering Laboratory (INEL) in the design process of major construction projects. Of particular interest is how value engineers are applying the principles of Total Quality Management (TQM), utilizing value engineering techniques.

Discussed are the associated problems with how major construction projects were previously planned, designed, value engineered, and then redesigned. Benefits of applying value engineering techniques early-on in the design process, far ahead of the traditional time for VE execution, is examined.

The author provides a pro-con analysis of the benefits of early-on value engineering effort, and uses data gathered from several value engineering studies to support the conclusions of this paper.

Approved By:

A handwritten signature in dark ink, appearing to read "James R. Wixson", written over a horizontal line.

James R. Wixson, CVS

The purpose of this paper is to offer the value engineering community an alternative viewpoint of where value engineering effort should be introduced in the design of a major construction project, and how this change will provide better customer satisfaction.

Value Engineering, Value Analysis, or Value Management, have been steadily gaining acceptance at the INEL over the last several years. Value engineering studies have proven themselves to be very effective in improving technical and administrative processes, recommending changes in organizational issues, reducing cost and improving the value of many major construction projects.

Historically, most construction projects at the INEL were value engineered in the 30-35 percent design completion stage (Title I). In discussions with other value engineering consultants outside of the INEL, this appears to be the norm. At the 30-35 percent design complete stage, basic designs have been drawn for review, and preliminary costs have been developed.

The design and construction of a major construction project at the INEL is a long and circuitous process. Attachment A delineates a FAST diagram prepared during a value engineering study of the EG&G, Idaho construction process. As the FAST diagram shows, requests for various construction projects are received. The Department of Energy (DOE) then issues a Call Letter, requesting information regarding General Plant Projects (GPP) and Line Item Capital Projects (LICP). The planning and Landlord organizations identify candidate projects and determine funding types. These projects are ranked and rated against company goals and are prioritized. The project is

INEL is fixed after conceptual design approval (Title I). Any changes to the project cost creates an additional two years in the funding approval cycle. Because of this inordinate amount of time required for additional funding, most projects over budget at this stage are de-scoped.

One solution to this inefficiency occurred when industrial engineering, the parent organization of the value engineering organization at EG&G, was asked to help obtain design requirements from several branch managers of the Department of Energy's new Radiological and Environmental Sciences Laboratory (RESL) replacement facility that was being expedited. I convinced my customer, who was formulating the project, to allow me to conduct a portion of the information gathering phase with each of the customers and the design team, before conceptual design. The remainder of the VE study would be completed, as usual, after conceptual (Title I) design.

The results of this approach provided direct two way communications between the design team and their customers in order to help clarify and validate their requirements, as well as establish a good working relationship between the design team and the customers during the design phase.

The RESL design team consisted of the project formulator, the project manager, a civil engineer, an architect, an electrical engineer, a mechanical engineer, a radiological engineer, a environmental engineer, a safety engineer, and one of the RESL branch managers/customers for each session.

The objectives of the preliminary information gathering phase of this value engineering study were:

Westinghouse Electric Corporation (WINCO), Babcock & Wilcox (B&W), Protection Technology Idaho (PTI), and MK-Ferguson of Idaho Corporation (MK-FIK), would be combined into one contractor before the building was built, which would dramatically change the way the various warehousing processes were currently done. It was decided to utilize both classical industrial engineering and value engineering methodologies to determine the optimum warehouse system, before attempting to ascertain the design requirements of the new warehouse building.

The idea formulated from this situation was to push the value engineering effort as far up front in the design/construction time frame as possible. First, streamline the way the customer conducts his/her business, utilizing a three day value engineering process study, then with the customers better defined process requirements, perform a preliminary information gathering session with the RESL design team before the conceptual design. Finally, finish the VE study after conceptual design with the remainder of the 5 step value engineering job plan to determine how else can the function of the design be provided with improved quality at a lower cost. In order to design a truly efficient and useful building, the process occurring within the building must be efficient, and the designers of the building must understand how the process works. With out the early-on value engineering effort, the new building, in all probability, would be designed completely different using an existing, inefficient process.

With this new idea of improving processes before designing a building in mind, the value engineer, employed within the industrial engineering unit at EG&G, Idaho, visited each INEL warehouse. Surveys were conducted to determine

warehouse contractors.

Below is a pro-con analysis and discussion of performing early-on value engineering studies to improve the customers process before design and construction, and performing a preliminary information gathering study to validate customer design requirements at the 5% conceptual design stage.

PRO

- Provide an improved, more efficient customer process, prior to casting design requirements in stone.
- Building configuration, process layout and flow may be completely different with improved process.
- Establishes consensus of customers.
- Creates customer team building.
- Improves customer communications with the design team.
- Defines real needs of the customer.
- Provides the ability to involve outside consultants at minimal cost.
- Supports TQM philosophy.
 - Who are our customers.
 - Who we are.
 - How do we do business.
- Assures that customers receive what they need.
- Reduces risk of project failure.
- Reduces design and cost estimate changes.
- Assures design schedule adherence.

ingredient has been sometimes missing. Value engineering adds the key ingredient of utilizing the experience and expertise of interdisciplinary teams of people.

Bringing industrial engineering analysis information to the value engineering study, and utilizing it in the information gathering phase, provides the best of both worlds in improving a process. Optimizing the customers process before designing the building assures the best possible building design married to the best possible process.

- Establishes consensus of customers.
- Creates customer team building.

During value engineering studies, a great amount of interaction occurs amongst the various members of the study. Generally, the individuals involved in the value engineering study evolve into a team during the creativity exercise or when preparing the FAST diagram. The cohesiveness that develops within the team in optimizing their process usually remains throughout the design and construction phase of the project. The customer team that was formed during the value engineering process study provides the consensus of opinion that is necessary to develop an enhanced process. From the improved process, a set of building requirements for developing a design is formed in a later one day preliminary information gathering value engineering session.

- Improves customer communications with the design team.
- Defines real needs of the customer.

The customer team formed during the value engineering process study then

the design process, three additional days are required to perform the process value engineering study. Consequently, management in many organizations and companies, feel that an inordinate amount of time is already being spent on the value engineering design study, and do not want to spend additional funds or manpower on an process study.

In summary, it is felt that in any major construction project, the value engineer should first step back and review the operations and processes being conducted within the confines of the proposed new facility. The three day value engineering process study will either confirm that the existing process is sound, or suggest improvements to be made, which could radically affect the design of the facility. After the three day process study has been completed, a one day preliminary information gathering session should be performed. This session will confirm the customers requirements for the design team, and should reduce the number of design changes. Lastly, the remainder of the value engineering design study should be accomplished after 30-35% design completion. At this point, there is enough design information available to perform function analysis, FAST diagrams, and improve the design by providing the same functions at a lower cost to the customer.

The results of this method of applying value engineering early-on in the design of a major construction project is improved customer satisfaction and repeat business. The customer has received a building that suits his/her needs, for a reasonable price, with an improved process that the customer is operating in an efficient manner. That's value!

95%
Design Complete —
(Title II)

30-35%
Conceptual
Design Complete —
(Title I)

5%
Conceptual
Design Complete —

Begin
Conceptual
Design —

BUILDING DESIGN COSTS

Typical Time Frame
for Bid Over Budget
Full Value Engineering
Study

Typical Time Frame
for Full
Value Engineering
Study

3-Day
Remainder of
Value Engineering
Study

One Day
Preliminary
Information Gathering
Value Engineering
Session

3-Day
Full
Value Engineering
Process Study

ATTACHMENT A

FAST Diagram Construction Process with Organization Matrix

EXISTING PRIMARY RESPONSIBILITY

Approve Documents ²⁰¹	Receive Guidance ²⁰³	Review Documents ²⁰⁵
Prepare Cost Estimates ²⁰²	Report Status ²⁰⁴	Assure Auditability ²⁰⁶

Formulation						60,61	70,71,73,74,75,76,77				
Planning				42		60,61	70,71,73,74,75,76,77				
Landlord											
Field Engrg.											
A/E											
Project Mgmt.	10,11,12,13,14,15,16,17,18	20,21	30,31,32,33,34	40,41,43,44	50,51,53,54						
Materials Lab.											
MK											
DOE					52						

201,202,205

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ATTACHMENT B

RECEIVING INSPECTION

WINCO WAREHOUSE

ATTACHMENT C