THE TIMING OF VALUE ENGINEERING STUDIES IN PUBLIC WORKS ORGANIZATIONS

Ir. Felipe Castro Arenas MSc
Email: fcarenas@gmail.com

ABSTRACT: Some authors argue that Value Engineering (VE) is just an audit exercise carried out over the work of planners and designers, and that the large success it has had in organizations like the Federal Highway Administration (FHWA) in the USA is just a proof that engineers are doing things wrong from the outset (Winch, 2002). In many cases, VE studies are executed just in a reactive manner when project managers face budget overruns and schedule delays. However, VE has shown ever more effective when it is fully integrated into the organization's project delivery framework. Nonetheless, deciding upon the best timing for executing VE studies still remains controversial. The timing is a critical factor for the effectiveness of VE studies and this article attempts to shed light on this issue.

INTRODUCTION

Public infrastructure is an essential ingredient for the economic development of society. Historically, public infrastructure projects have been an exclusive task of governments. However, pressure on capacity and the environment exerted by competitive economic development has forced many governments to adopt "regulatory capitalism"[1] measures. Among others, this has forced them to attempt delegation strategies by creating parallel independent regulatory agencies and to strive for closer collaboration with the private sector. Such a demanding context is the basic rationale behind this research project. What can make public works organizations more effective? How can they optimize their internal processes in order to keep up the pace with more challenging end users' requirements and taxpayers' demands?

Value Engineering, an optimization tool that emerged in the manufacturing sector is not a new invention. It has a long and successful history that spans more than 50 years, back until the days of World War II. Progressively, it has spread throughout all economic sectors after decades of development and practice among pioneers. Both public and private sectors have benefited from its implementation. The construction industry has not been exempted from VE's proliferation. In fact, several public works organizations around the world currently utilize VE for the inception and development of infrastructure projects and the benefits drawn from it have been so significant that governments have even enacted laws to make it mandatory among their executive agencies. VE has proven effective for improving the value of infrastructure projects, among others, through the optimization of life cycle costs.

OBJECTIVES

Despite the long trajectory of VE within the realm of project management techniques, ambiguity still remains as to which are the most beneficial moments in a project lifecycle to perform a VE study. That was the main research question in my graduation thesis and the answers obtained were particularly meant to fit into RWS's forthcoming main project delivery process – Sneller & Beter.

THE VE METHODOLOGY

This document refers to VE as a management technique that uses recognized tools in a systematic manner – the Job Plan – and that is

[1] See (Levi-Faur, 2005)

always executed by a multidisciplinary team – the VE Team. Such tools are used to identifying the function of a product, service or process and establishing a value system for that function. Ultimately, they are deployed so to provide the necessary function reliability at the lowest overall cost. This definition embraces two levels of deployment of VE: 1) strategic, which refers to the Learning Paradigm of Soft Systems Thinking (SST) and 2) tactical, which relates to the Optimizing Paradigm of Hard Systems Thinking (HST).[2]

The former focuses on creating a common language by which stakeholders can define and agree upon a value system for particular functions. This is essential during the early phases of projects where problems arise as fuzzy and ill-structured situations. The latter is more suitable during later stages of a project life cycle where problems have already been clearly defined and hence value enhancement is sought through optimization of designs and preservation of functionality.

RESEARCH APPROACH

Two public works organizations that share similarities in terms of institutional setup and business configuration with RWS were used to perform a benchmark study regarding the use of VE, with a particular interest in the timing for executing VE studies. Not only do these organizations share similarities, but also joint efforts with RWS on innovation projects.

On the one hand, the Federal Highway Administration (FHWA) – one of the operating administrators within the US Department of Transportation – has adopted this methodology to deploy in certain public projects. After all, Public Law 104-106 of 1996 (the "Construction Value Engineering Law") enforces the use of VE by executive branches of the USA government.

On the other hand, the Highways Agency (HA) – executive agency of the English Department for Transport – integrates VE in its standard project delivery framework and adheres to European standards, like the EN 12973:2000, which establish best practices for the use of VE.

BENCHMARK RESULTS

Two distinct styles in the application of VE were identified in this benchmark study, although they share basic principles in terms of VE study timing. The Americans commonly perform one single but exhaustive VE study – the 40-hour workshop – during an early stage of a project lifecycle, always before the project is procured to the construction industry market. Conversely, the English prefer executing several shorter VE studies spread throughout the project lifecycle, including construction and handover stages. Furthermore, these two distinct styles were found to be characterized by each of the two aforementioned levels of deployment of VE. The American style displays more traits of the Optimizing Paradigm whereas the English style is closely related to the Learning Paradigm.

This benchmark study also revealed VE studies' effectiveness is closely affected by the timing of the study within the project lifecycle. Accordingly, it was found that the earlier the timing of the VE study, the higher its potential for improving the value of the project (see figure 1). Particularly, the middle stage, after conceptualization and before detailed design, has surfaced as the most desirable stage for achieving better results from a value study.

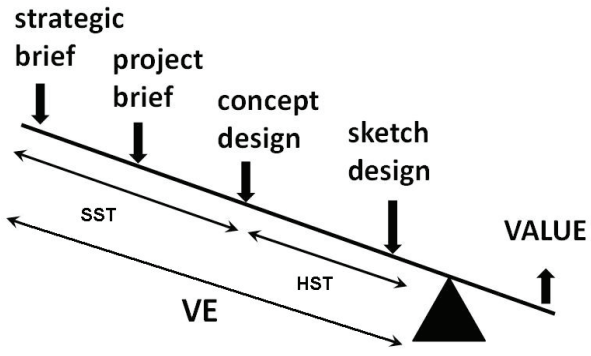

Figure 1: Lever of Value and the two paradigms of VE

The FHWA maintains a comprehensive record of over 13 years on results obtained by

[2] See (Green, 1994)

the use of VE among all State Departments of Transportation (SDOTs). Caltrans, the California SDOT, found that VE studies conducted in the later phases of a project, after significant amount of resources had been committed to a chosen design, usually reveal fewer opportunities for viable improvements without compromising the delivery schedule. They have also experienced the greatest return on investment of VE studies and most significant savings, when these are performed during the Approval phase, prior to issuing the Draft Environmental Document. Figure 2 presents such findings.

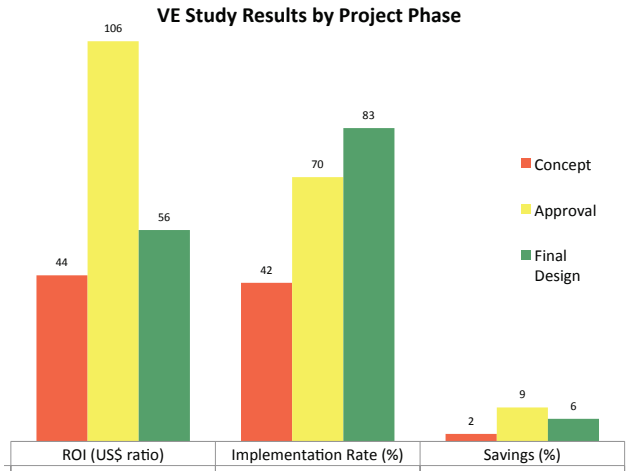

Figure 2: Caltrans VE study results by project phase[3]

Both Caltrans and the HA use VE with caution and make a thorough selection of the projects on which VE studies shall be performed. The reason behind this careful selection is based, among others, on the fact that VE studies require additional resources that must be accounted for on top of the original budget and schedule. In Caltrans, for example, VE studies are usually resourced with approximately 500 hours in the project work plan.

CONCLUSIONS

A mere straightforward comparison of institutional setups and internal processes could imply that the best integration of VE into RWS's Sneller & Beter would be that of the one used by the English HA, that is the execution of one short VE study in every single phase of a project life cycle – i.e. 1) Strategy, Shaping & Prioritization, 2) Option Identification, 3) Option Selection, 4) Preliminary Design, 5) Statutory, Procedures & Powers, 6) Construction Preparation, 7) Construction and, 8) Handover & Closeout[4]. Nonetheless, the FHWA's and Caltrans's experience demonstrates that one of the main barriers to implementation of VE recommendations is the timing of the study.

An offspring VE programme like the one being implemented in RWS must become effective and efficient soon for it to gain support from the larger part of the organization. For that reason, my recommendation is yet not to pursue such a vast integration of VE into the main project delivery process, as it is currently done in the HA, but to plan and design 4 key instances for VE studies into Sneller & Beter.

VE facilitates the creation of a value system against which robust selection between competing alternatives may be drawn. VE makes more explicit such selection processes and a wisely selected VE team may guarantee the commitment of key stakeholders to the selected alternative. Two important selection points are part of the Sneller & Beter's Exploration phase. These could certainly avail from VE. Therefore, 2 VE studies are recommended to be integrated in this phase: VE1 prior to the Options Identification step and VE2 as a prelude to the Preference Decision step. In both cases, VE's benefits would be predominantly drawn from its Learning Paradigm.

According to Caltrans' statistical records on VE's performance for its public infrastructure projects, VE studies carried out in their Approval phase normally yield the best returns

[3] Adapted from (California Department of Transportation, 2009)

[4] See (Great Britain. Highways, 2009)

on investment and the largest savings. For that reason, a third instance – VE3 – would be in Sneller & Beter's Planning phase prior to the OTB and TB[5]. Here, VE's benefits could be drawn predominantly from its Optimizing paradigm.

One final instance – VE4 – would concern the use of Value Engineering Change Proposals (VECPs[6]) during the Construction phase. Even if the TB is signed off by this moment, and only minor changes would be allowed in the overall alignment of the planned highway, contractors should be encourage to use VECPs – as it is done in the FHWA – to optimize constructability and staging of projects and/or to innovate in building processes and technologies.

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[5] OTB stands for Dutch Ontwerp-tracébesluit and TB, for Tracébesluit. The former is equal to the Draft Route Decision and the latter, to the Final Route Decision. They both define the general alignment for the new motorway project.

[6] See (Kasi, 2009)