

Tailoring Value Engineering to the Client's Demand

ir. Timme Hendriksen, AVS, ProRail, Timme.Hendriksen@ProRail.nl

Biography



Timme is the Value Engineering (VE) program manager within ProRail at the procurement department (AKI). He graduated in 2002 at the University of Twente, The Netherlands. His thesis was for a large part aimed at introducing and setting up VE within ProRail. In 2004 Value Engineering became a part of corporate policy and started to grow into a Program. From April 2005 till now 15 ProRail employees are following a training program to further expand VE activities within ProRail. ProRail is the owner of Dutch Rail infrastructure, delegated by the Ministry of Transportation, and responsible for constructing and maintaining the rail infrastructure. He is also a member of the Special Interest Group on Value Management within DACE (Dutch Association of Cost Engineers). Within DACE he is actively involved in establishing certification in The Netherlands and is part of a research team, which is doing research on the level of knowledge and application of Value Management in the Dutch construction industry.

Abstract

Meeting the client's demand could mean that a full size VE study is not an option. On the other hand when you shorten the study duration, you have to be careful not to undermine the basic principles of VE. By carefully tailoring a VE study you can shorten the study duration and still get good results. It is in fact the same value equation, wants plus needs over resources that you are trying to optimize. It is the client's perception of what he wants/needs to achieve by doing a VE study, weighed against what he wants to sacrifice in terms of time and money. The role of the VE team leader is to organize a study to achieve the required outcome with the available resources. If there is a mismatch between the three variables, work together till there is consensus or a decision is made not to do the study. In the end, it is the VE team leader's responsibility to deliver what was promised.

This paper will describe the background of this approach as it is used within ProRail, owner of Dutch railways. This should allow the readers to reflect on the context and decide whether it is applicable to their own. The conditions of this approach will be described. All the impact factors will be described and how these factors can influence each other. A description will be given on how to tailor a study to the needs. These elements are based on the author's experience and published material.

Introduction

Three years ago, VE was introduced within ProRail, owner of Dutch railways, as a part of the author's thesis (2002) on how VE could be implemented within the organization. The facilitators did not have the luxury to apply the methodology for 5 successive days, let alone hire an entire team of experts. The direction was complete a study in one day or do nothing at all. This was to make their point heard with a process they had never done before. What they finally did was to look at what it is that makes VE special including the success factors of function analysis, a

multidisciplined team, the systematic approach and the aid of a multi-skilled facilitator. To reduce time, the systematic approach was kept intact, though not all steps were executed, for example the development phase was eliminated. Also some activities in the different steps were prepared ahead of time to eliminate work done in the workshop to help save time. Yes, the quality and reliability of the outcome are most likely to be less in comparison to a full size study, although the results were still very good and they matched the requirements of the client. The approach proved successful for ProRail and was enough to start up a now rapidly growing VE program and to improve the application as people get more confident in its purpose.

Although confidence in VE is growing, there still is a demand for short studies. This paper will describe the approach used within ProRail on how VE could be used in such a constrained context. The author would like to note that this approach is based on learning. There are no illusions that the craftsmanship of a VE Team leader could be put in a model. The purpose of this paper is to make implicit experience explicit with the intent to give a better understanding of how a study is being crafted. This could be very helpful for a beginning VE practitioner who has to deal with time constraints.

This approach could also benefit other organizations wanting to introduce VE. Mind that this paper is only focusing on the study set-up in relation to the client's demand. For introducing VE a lot more needs to be done. This topic will not specifically be addressed in this paper. The approach could also be seen as an aid on how to deal with VE in a constrained setting or as a way to apply VE, as in ProRail's case.

This is not a call for shorter studies, but an argument that you can also get positive results with shorter studies. If the results still serve the purpose of the client, then why not! In regard to this, Hunter and Kelly (2004) conclude their paper 'Is one day enough?' with the following: *"Overall, workshop success will ultimately depend on the amount of time the client or workshop commissioner wants to dedicate and therefore an explanation of the requirement for each stage and the outcomes expected for each may be one way of demonstrating the requirement for the minimum of a one-day study as a continuous or split session."*

Background

ProRail has now developed its own in-house VE department. The main reason is that there is no other choice. VE has not yet been solidly imbedded in The Netherlands and more specifically in its public works sector. There is no option about hiring external (Dutch) consultants. The organization took the initiative to develop VE as an instrument to save money on construction projects. The more it has been applied the more it has become clear that it is a very useful instrument for an owner organization. A professional owner should determine what it is that provides value in a project. Since ProRail has no in-house design and construction activities whatsoever, VE is the linking pin to achieve this goal. With VE the organization has a decision making tool to decide whether a design delivers value and if not what could be done to improve value.

There are two main reasons why a full size VE study is not used within ProRail. First, project managers are constrained by time and budget. One of the main budget issues is the way ProRail is funded. A percentage of the project costs is reserved within budget for managing a project. Cost savings will lower the project costs and as a consequence lower the budget to run the project. From this point of view there is no incentive to apply VE on smaller projects. The return

on investment is not an important argument to use VE, budget is. The constraints in budget are often the cause of constraints in time. Project team members and decision makers are involved in VE studies to increase effectiveness and efficiency of a VE study when duration is constrained. This has a significant impact on the project team's resources.

Second reason why ProRail does not use a full size VE study is due to how VE is implemented within the organization. With the addition of the internal VE department, it is possible to use VE more in line with its development process. Louie (2005) mentions in his paper on VE programs that "in-house workshops have the advantage to spread out the workloads of VE team members" and that "multiple shorter VE workshops could be used, putting less stress on the workload and integrating it better with the critical path activities in a project". ProRail uses the same approach. In addition to this, VE is being used more and more as a communication instrument between project stakeholders and can help determine the total project requirements. Furthermore, VE is one of the many evolving Value improvement practices, like Systems Engineering, Life Cycle Management and new procurement strategies. Aligning other types of practices gives VE a distinctive place in the organization's approach on projects.

Conditions for successfully tailoring a VE study

There are four main conditions to take into account when using this approach:

1. Respect the basic principals of VE
2. Good preparation;
3. Absolute minimum of one day;
4. Learn.

The stated conditions are based on the author's experience and by referencing SAVE conference proceedings. These factors are described below.

Respect the basic principals of VE

The basic principals of VE are the following:

1. The systematic approach using the VE Job plan;
2. Function analysis;
3. A multidisciplined team.

Systematic Approach of the VE Job Plan. Follow the steps of the Job plan and do not skip any. When casually looking at the steps and tools separately, VE may appear to be similar to other conventional development processes. That is why many people say "they already do VE". However, this does not include function analysis. It is truly different from other processes. Each step has its purpose and is input for the next. The whole is better than the sum of its parts.

Function Analysis. As stated above, function analysis is what makes VE special. It has the following purposes (derived from SAVE Monographs(1998)):

1. One simple language for every team member to understand, despite their different backgrounds;
2. To get a better understanding of what it should do;
3. The abstract formulation creates maximum freedom to generate new ways to do the same function

A multidisciplinary team. Commitment of team members with respect to time, budget and attendance is very important, especially their attendance. Team members should attend the whole study. Furthermore, the composition of a team is a very important success factor. If the right people are not part of the team, it will affect results immediately. Some reminders to ensure the success of the team include:

- Set up a multidisciplinary team with the relevant expertise and representation;
- Use a multi-skilled facilitator, who has knowledge of the VE methodology as well as knowledge of the subject's technology and context.

Good preparation

Proper preparation is half the work! Make sure that the study takes place in a neutral yet motivating setting. Additionally, have enough time to organize the study to make sure that attendance is maximized as well as a well-organized and structured plan is necessary. To accommodate all of this is an art on its own. This paper describes this in further detail.

No shorter than one day

The author's experience is that completing a VE study of less than one day is not feasible. Moreover, one of the ground rules within ProRail is a minimum time requirement of one and a half day study. This duration is without pre- or post study activities that take place with the VE team.

Learn

To improve the application and the reliability of the approach it is very important to evaluate every completed study.

Fabrics, patterns, scissors and thread

The factors that have an impact on organizing a study are:

- The characteristics of the study object
- The study objective
- The study variables
- The constraints
- The risk of failure (not achieving the required results)

The characteristics of the study object are external factors which are provided as a given. The study objective and variables are part of the study set-up. Constraints define the scope of a VE study. Risks are a measurement for go/no go decisions.

Below, each of these factors will be further defined and some insight will be given on how these factors influence each other.

Characteristics of the study object

The characteristics of the study object are factors that cannot be altered and have an impact on the study. The characteristics are also the first indicators for selecting a project for a VE study. The most common impact factors are:

- *Size* does matter when there is not much repetition like in Construction, even when the project is relatively simple. For instance if you have a € 100 million railway project and after a VE

study 2 % savings were implemented, it is still a large saving and a good return on investment.

- *Complexity* is defined as the amount of factors which have an influence on a product or process. These factors could be environmental influences, technological complexity, risks etc. The more complex a project is, the better the use of VE.
- *Design stage* refers to the general rule that the sooner VE is applied, the more value improvements can be obtained. Next to that, the level of abstraction changes. This requires a completely different perspective and probably a different study approach. Also other issues are encountered as a project develops. In an early stage the scope is being set, while in a later stage it is more about communication and politics. This would require a completely different application.

Study objective

The study objective is what should be achieved in a broad perspective. In addition to the usual goals, it is about how the results of the VE study are being used. This determines what the deliverables, and the quality of those deliverables, should be. It also determines the required development level of ideas/alternatives.

As an example, before starting a new design stage a VE study could take place with a team consisting of members of the design team, the client and some “fresh eyes”. The purpose of the VE study is to review the latest design in respect to value and to seek recommendations for further value improvement. The recommendations have to be developed to such a level that a decision can be made on which recommendations provide value potential. Those will be further developed and if possible integrated into the design by the design team after finalizing the VE study.

Study variables

The main variables in a study set-up are:

- *Team size*,
- *Study duration*,
- *Team set-up*,
- *Tools*. In every step of the job plan different tools can be used which differ in duration and quality of the outcome. This paper will not discuss this topic more in depth.
- *Study tactics*. This is defined as the way a study is approached. This could be in terms of time. For instance the choice for a two-day study with a minimum of one day in between or five successive days. It could also be about how much preparation is done before the study or about how the VE team is used, i.e. working plenary, individual or in groups.

Constraints

- *Budget*. In most cases budget has an effect on the study duration and the team selected.
- *Study duration*. In some cases time is so limited that there is a limitation on the number of days that could be used. It depends on who needs to be a part of the VE study and whether there is a critical time path.
- *Preparation time*. In some cases, preparation time is less than desirable. To have proper preparation, six to eight weeks are needed. When there is less time, opportunities will

decrease, i.e. if there is three weeks for preparation, it is very hard to get the necessary people on the team. This means that there are greater risks of not achieving the required objectives.

Risks of Failure

On every VE study potential risks of failure should be considered. The VE Team leader should advice the client on whether the study still has a purpose.

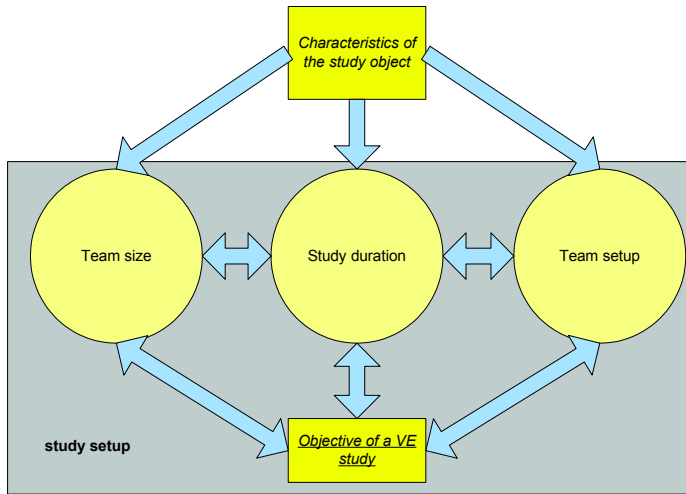


Figure 1 illustrates the direction in which the impact factors influence each other. The matrix cells in table 1 describe the nature of the influence. This model is derived from the ProRail VE manual (2005) with the purpose of providing new VE practitioners more insight on how VE study factors are interrelated. It is not complete in its nature. The study impact factors Tools and Study tactics are not included.

Figure 1: Relations of VE impact factors.

Team size	A larger, more complex project could mean more parties should be involved.			
Duration	A larger, more complex project demands often a longer duration.	The bigger the team, the more time you probably need.		
Team setup	In some cases it is advisable to use a neutral team, or not to include some of the stakeholders, due to e.g. political sensitive issues or because you know that parties won't cooperate.		The shorter the study duration, the more knowledge of the project you need within the team.	
Objective of a VE study		The bigger the teamsize, could mean less achievements given a certain time. If this doesn't match with the study objectives demanded, the team size could be altered.	The shorter the duration, could mean less achievements given a certain time. If this doesn't match with the study objectives demanded, the duration could be altered.	The set up of the VE team is usually based on the objective. On the other hand the team setup could determine what the outcome is.
	Characteristics of the study object	Team size	Duration	Team setup

Table 1: Nature of influence of VE impact factors.

Craftsmanship

So how is a VE study crafted? Figure 2 shows the tailoring process. The steps will be described down below.

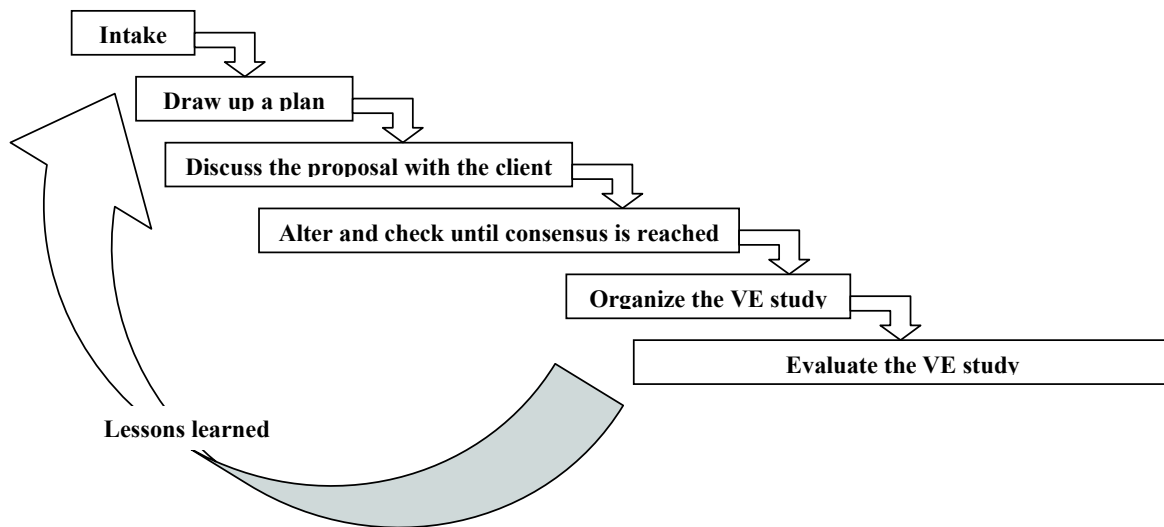


Figure 2: Tailoring process

Intake

The intake is the first gate to decide whether to proceed with a VE study or not. The intake takes place together with the client. The following items are addressed:

- Short project description (size, complexity, stage)
- What purpose does VE have on the project?
- What is the big picture? How does VE fit into the development process of the study object?
- What should the deliverables be?
- What quality and to what detail should the deliverables be developed?
- When should the study take place?

Draw up a plan

Draw up a plan on how the VE study will be approached. The plan consists of the following elements:

- Short project description
- Project goals preferably in function terms
- Surroundings
- Size, design stage and complexity
- Issues
- Study goals and deliverables
- Study scope
- VE team
- Information sources
- Study tactics
- Preliminary agenda
- Budget
- Schedule

This plan is a living document and will be altered and fine-tuned until consensus is reached with the client on the approach.

Discuss the proposal with the client

Study duration and budget will be addressed. If those are not consistent with the proposal, then the study approach should be adjusted. In this case, concessions will be made to the VE study objective. The VE Team leader should advise the client on alternative approaches, which stay within the constraints, set and on the nature of the concessions made to the objective. In addition potential risks of failure should be addressed.

Alter and check until consensus is reached

Discuss and alter the plan until the client and the VE Team leader have reached consensus. The client must decide whether the expected outcome is a contribution to his project. The VE team leader should be confident that they could deliver what is being promised. In addition, the risks of a VE study failing should be taken into account. It is very important to deliver a successful outcome, since this will promote further use of VE. As James Raines has stated "Cost savings are necessary to sell VE and maintain a VE program." Although cost savings are not the only results you can achieve, it is something to keep in mind. The situation could occur were tangible results are necessary to maintain support for the VE program, and cost savings are very convincing!

Organize the VE Study

It is now time to organize the VE study. Normally it takes about 6 weeks to align the needs of the study with all of the team members. During that 6-week period a lot of things can happen, like team members who cannot be part of the team and potential sudden changes in the project. Even then it is still possible to adjust the study approach to accommodate the new requirements. Always inform the client of possible effects of those changes, so there is the possibility to abort the study for both the VE team leader and the client.

Evaluate the VE study

At the conclusion of every study the intended objective and the outcomes should be evaluated to improve the application of this approach. Evaluation is done on the following points:

- Whether the intended objective was achieved and if not, why?
- Whether the study approach had the intended effect and if not, why?
- How each step of the VE Job Plan was performed: what went well and what could be improved.

The result of the evaluation are lessons learned, which are input for organizing the next study.

Conclusions

The application of VE has the main objective to improve value of the study object. On the other hand, value has another perspective that is from the client's point of view. It is the client's perception of what he wants/needs to achieve by doing a VE study, weighed against what he wants to sacrifice in terms of time and money. The role of the VE team leader is to organize a study to achieve the required outcome with the available resources. If there is a mismatch between the three variables, work together till there is consensus or a decision is made not to do the study. In the end, it is the VE team leader's responsibility to deliver what was promised.

Hendriksen, Tailoring VE to the Client's demand, 9

This approach is one way of tailoring VE to the client's demand. There are most likely other ways. This particular one has been successful within ProRail. Hopefully this approach can benefit other VE practitioners, whether it is to help get some guidelines to organize VE in a constrained setting or just to learn how different variables within VE can have an impact on each other.

Bibliography

Hendriksen, Timme, "*Handboek Value Engineering, RIB0106*" (VE Manual), ProRail, August 24 2005, Utrecht, The Netherlands.

Hendriksen, Timme, "*Op het spoor van VE: de ontwikkeling van een Value Engineering instrument voor RIB AKF*" (thesis), ProRail, June 20 2002, Utrecht, The Netherlands.

Hunter, Kristy and Kelly, John, "*Is one day enough? The argument for shorter VM studies*", SAVE conference proceedings, July 12-15 2004, Montreal, Canada.

Louie, Clifford, "*How to better manage and promote your VE program within your company*", SAVE conference proceedings, June 26-29 2005, San Diego, California.

Raines, James Jr., "*Creating and maintaining an effective and successful Value Analysis Program*", SAVE conference proceedings, June 26-29 2005, San Diego, California.

SAVE International, "*Monograph: Function: Definition and Analysis*", October 1998