

Description of a large strategic value engineering study for a shipping company with help of the Design for Value model.



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ABSTRACT

Value Engineering often delivers remarkable results and food for thought. This article tells another remarkable story of a strategic value engineering study with four Ministries, a shipping company and matter experts. The study was designed and executed by Timme Hendriksen and the author of this article Hein de Jong. In this article, also the Design for Value® model is introduced and describes how the study is designed with elements of that model.

The key success drivers for the study are generic and commonly known for successes of value engineering: sharing information, analysing functions, mutual understanding, group wise idea generation, iterative designing, and formulation of the next actions. The area of application and scale of this case are somewhat unusual: how can four ministries and a shipping company optimise the utilization of their 12 sea vessels and reduce that number? In the meanwhile, some reorganisations occur and needs are changing rapidly in the years to come (e.g. internet, international databases, GPS controlled vessels, drones). To start well, it was necessary to investigate the client’s needs prior to the workshops, and to position the team within the organisation to get the necessary acceptance and support for the study and its outcomes. Therefore, this large and prolonged study is shaped with the Design for Value model, addressing topics *insight, organisation, and design*. It resulted in some well-prepared VE-workshops in which the fifty participants (from engine-driver to colonel) discovered how to reduce the number of ships while improving performance for their business and organisations. The solution is found in *cooperation, clever planning, time sharing* and *multipurpose vessels*, reducing the need with 5 (from 12 to 7) vessels in the coming years and insight in the fleet renewal strategy for the next 10 years.

THE CASE: SHIPPING COMPANY

When four ministries have their own sea vessels (12 in total), it may occur that the utilization of each ship is not optimal. Why? Because the degree of utilization of a ship is usually not the key concern of a Ministry. For them, core functions are e.g. *making strategies for a healthy society, fight criminality and defend borders*. The link between available budget, core functions and utilization, is difficult to discover and there is a distance



Figure 2: Future vessel for Dutch coast guard?

between ‘the client’s areas of interest’ and ‘our (shipping company) system of interest’ (see graph). The ministries involved are about Defence, Infrastructure, Economics and Justice. The ships are operated by the State Shipping Company and its task is to transport people and materials, optimize usage, lower cost, maintain and renew vessels if necessary, and innovate (change

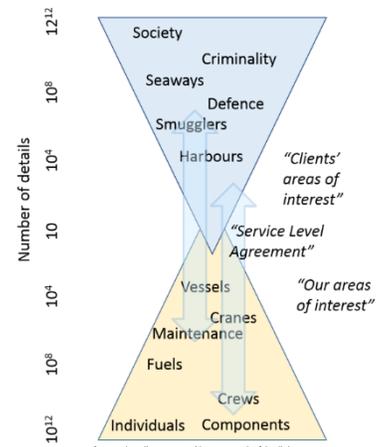


Figure 1: Levels of detail in a system (after Gerrit Muller, 2012)

functionalities) when clients' need dictate to do so.

Limited communication between the shipping company and ministries led to a low level of sharing strategic information about the ships. Or, from another viewpoint, the clients' changing needs were not explicit enough to feed the renewal program of the shipping company. The low degree of utilization of the ships (5% to 40% of the time) and a lack of forecasts for the near future (1 to 10 years) made the shipping company decide to organize a value engineering study into the renewal program for the next 10 years. Questions to be answered were:

- Is it possible to reduce the number of ships?
- What will the ships be used for in the near future?
- What are certainties and what are uncertainties?

DESIGN FOR VALUE (DV4)

Setting and overview

The larger organisations become, the less agile they tend to be. They spend a remarkable effort into self-preservation and defined tasks, leaving less energy to focus on clients' *changing* needs. However, there will always be some employees who see Value Engineering as a refreshing opportunity to renew the vision and to come in contact again with their clients. With such persons this VE-study started, and the D4V-model assisted by focussing on the three essential pillars for effective value engineering studies: *Insight*, *Teamwork* and *Design*. This article describes the D4V-model incorporating the lessons learned and examples of the Shipping case. It shows where, why and how values were discovered, one by one.

Insight

Insight in clients

The first subject in the D4V-module *Insight* is focussed on the Stakeholders. Therefore a strategic *stakeholder analysis* is performed answering questions like: who are the stakeholders? What are their stakes? What is their power to influence the outcome? What are their interests? What is their attitude towards the project? Which 'client requirements' do they have?

After those investigations, some entanglement within the project team may occur: there are so many stakeholders and they all look very important: leading to "analysis paralysis". This is often the case with 'line infrastructure' like roads and railroads, which are virtually never ending systems going through densely populated areas with many (system) users.

However, by applying Pareto's law, it becomes less complicated: it is discovered that only a small number of stakeholders generate most requirements. An average of 20% of stakeholders generating 80% of the requirements is quite common. Didn't we hear that before?

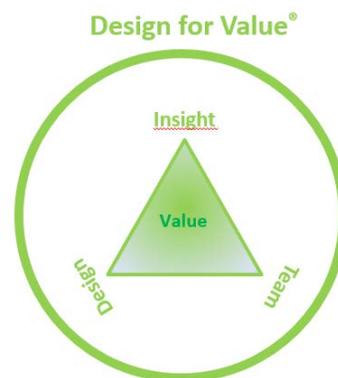


Figure 3: Design for Value model: overview of the main topics

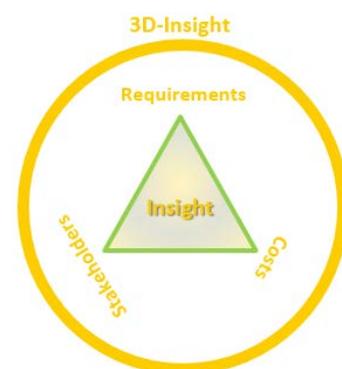
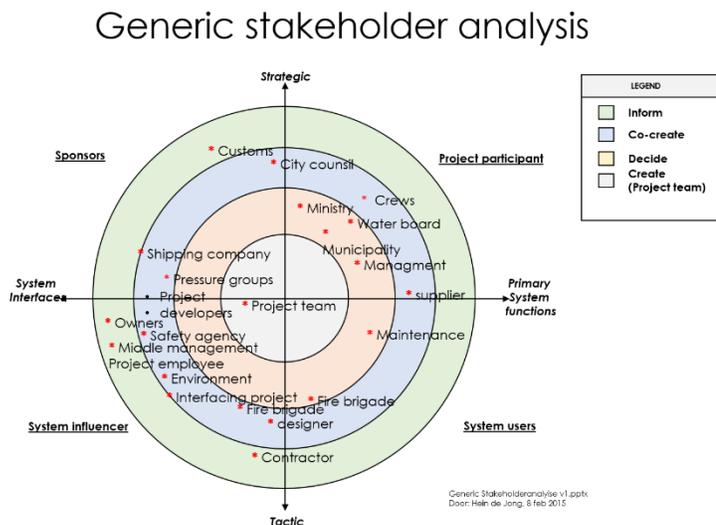


Figure 4: Design for value model: Details of "Insight"

Insight in Client Requirements

The next action implied by the D4V-model is identifying and analysing the client requirements: which performance does the client really want? What is really of value for the client? It takes a good system engineer or value engineer to analyse the clients' documents, to hold interviews to discover *real* client needs, and to decide if all is set and ready for the value engineering workshops. There *will* be confusion on the client's side because their mind-set differs from the value engineers', and because the value engineer uses unusual words like *functions, performances, performers, systems, values* and *objects*.



Often clients have a relative small set of requirements that are really relevant to the project's outcome (creating value). Probably twenty percent of the requirements cause eighty percent of the desired *value*. Those requirements have to be discovered and should be focussed on. The remaining requirements are e.g. too detailed, less relevant, not worthwhile focussing on, or even worse: are *off topic* or specify *solutions* instead of *functions and performances*.

Figure 5: Generic stakeholder analysis example

It depends on some factors if this 'client requirement'-discovery is performed *during or prior to* the plenary VE-sessions, e.g. how easily does the client handle the VE- and System Engineering (SE)-definitions, how well known are the stakeholders with each other, and how well known is the client with the topic of the VE-study itself (varying from very familiar to unknown and uninterested). If the investigation is performed before the plenary sessions, then sketches, FASTs and value profiles may be drawn in advance, but the required functions will always be reviewed by the whole VE-team during the plenary workshops. Furthermore, clients should present their required performance levels.

Insight in costs

Value Engineering stands out as a design method because of the continuous feedback during workshops within the triangle stakeholders-requirements-costs; those fast (time boxed) loops are rarely seen in other design methods. And also here Pareto's law is relevant: usually 20% of the objects cause 80% of the costs.

Insight, conclusion

- 20% of the stakeholders are accountable for 80% of the *requirements*
- 20% of (all) *requirements* deliver 80% of the *value*
- 20% of the *objects* cause 80% of the *costs*

Those percentages are not mathematical truth by definition, nor are subsets of each other. It therefor is surprisingly complex to understand the dependencies of the percentages. However, the Design for Value model helps by addressing and analysing these topics, one by one. And value engineers have a good understanding of the relationships between stakeholders, users and customers, requirements, costs, objects and value. And then, with the help of value engineering techniques, it can be understood why there are costs that no one wants to pay for: frequently 10% up to 30% of the *costs* has no *stakeholder* or

customer that is willing to pay for it. This is often the starting point of a value engineering study.

Team@work

Team@work is the second pillar of the D4V-model.

Besides the three types of Insights described before, there are three types of 'team' within a study. It is the people in the 1) *project team* who are doing a major part of the job. The team itself is embedded into a larger 2) *organisation* and may hire 3) *experts*. If all are set and ready (enabled to co-operate), they can start organising the VE-activities.

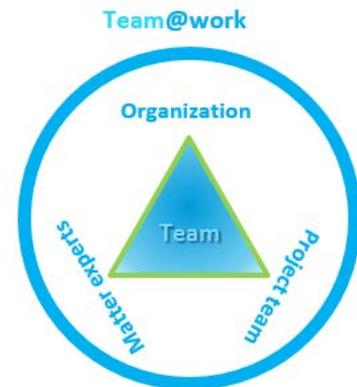


Figure 6: Design for Value model: details of "Team"

Team@work: Organization

This is about the organisation that is the principal of the project. In our case: the shipping company. They are the *organisation* that *embeds* the *project team*. That organisation is designated by the stakeholders in a more or less formal way and asked for to deliver the results (on a project basis), sometimes including maintenance and operation. E.g. the shipping company is asked for to renew the fleet and do the upkeep and management of it, for the next 20 years. That organisation continues when the project team is dismantled. It is therefore vital for the proper implementation to secure that e.g. client communication, system maintenance, fee collection, but also alterations into the system and disposal, can *and* will be performed by the Organisation. That may be part of the project teams' concern and certainly so if the organisation is e.g. reorganising, under/over manned (leading to resignations and reorganisations in the near future with a high degree of certainty). In our case, the alignment of project team and organisation took quite some effort but necessary to ensure a fair degree of implementation after the VE-study.

Team@work: Project team

The project team is often the team that organises the Value Engineering study. They have come to a point in their project where a VE-study is appropriate and hire a facilitator to design the VE-study. The project team discusses the setup with the facilitator who should be a temporary member of the team. Obviously, the discussion is about which 20% of the stakeholders (that cause most requirements) is invited? An important question is: *on what level of detail are we yet?* Other important questions are e.g. *what echelons should be asked to join?* Questions that are immediately followed by: *how large groups can we handle?* and *will there be parallel or sequential sessions?* (with days or weeks in between). Often a team is composed from various organisation levels and levels of skills, since VE-sessions focus on many abstraction levels in e.g. their function analyses, or issue analyses. And that raises the question if all necessary knowledge is gathered in the proposed value engineering team. In the VE on the shipping company, the project team consisted of the project manager, a technical manager and a stakeholder manager. They had been working on the project for about a year. The experts had to be found outside the team but within the organisation (generic fleet architect, costing).

Team@work: matter experts

Finally, we look for the right people who have the expertise that is still missing in the team. Who has the knowledge, is he/she able to share it? Is there information that is too sensitive to share? Is he willing to do his best to serve the organisations' mission? Are there no conflicts of interest (earlier or in future involvement)? Can and will he be called in for the next actions (e.g. detail designs, or to solve some issues)?

Team@work, conclusion

A VE-study enhances the performances of the team members, so the better the team right in the beginning, the better the final results will be. This type of workshop usually takes about only two to five days, so the costs of people are actually irrelevant. It therefore is logic to strive for getting the best team experts, ensuring long lasting valuable results and ideas. There won't be a second change, and there is probably no reference project for benchmarking. You therefore will never know exactly if results could have been better. Therefore a very good preparation is recommendable.

The organisation itself has to have the *capabilities* to incorporate the *changes* that inevitably will result from the study. And must have the capabilities to perform as promised in the period *after the study*.

Design

Design is the third pillar in the D4V-model. This is the process where solutions are designed that perform very well and don't cost too much.

Design consists of Information, Analyses, and Creativity. These are most commonly associated with value engineering. An explanation of each is given below.

Design: Information

In the third pillar Design, *information* is about data on the system we are investing in, e.g. ships. We need information about their system functions, their relevance for the users, relation with maintenance and e.g. configuration changes. How much, how often, who, where and when. The How and Why are for the Analyses phase and are depicted in the FAST.

Information was the subject where much effort was needed in the

shipping VE-study. We saw an unexpected lack of information and became aware that the real clients' needs were unknown in the way we, as value engineers, would like to see them. The clients were facing difficulties with thinking in terms of functions and performances as needed for fleet renewal. Therefore the VE-workshops were delayed to gather the relevant information first within the ministries and e.g. the maintenance departments of the clients. Those pre-workshop meetings were about 2 to 4 hours each, consisting of the validation of a prepared FAST as they were thought to be correct by the project team, followed by the filling of a function performance specification (see screenshot below). Fast was made on project level, on the operational processes on sea, and of the processes of the shipping company itself. How many ships are to be visited for drugs and smugglers, which timing, and where? How often, where and when are fish to be counted? (by the way: that led to some innovative ideas already in this phase). What are the tasks of the shipping company itself?

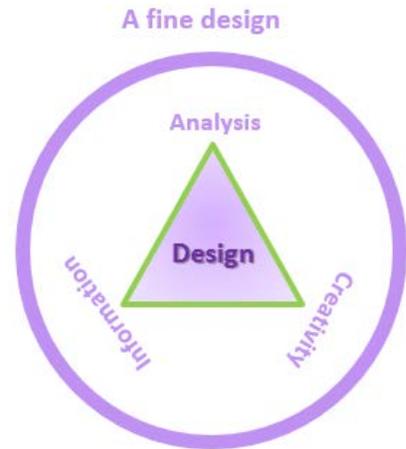


Figure 7: Design for Value model: details of "Design"

A	B	C	D	E	F	G
1		Rijksverheid	Shipping company	Customs / coast guard		
2			FPS workshop	Attached to FAST version v33 of June, 26th 2013	File: FPS customs June 2013 Sharepointversie.xlsx	
3	ID	Function	Criterium	Performance range	Flexibility	Remark
4	function ID #	Description	measurement unit for this function	from.. To .. (unit)	0=no 1=minimal 2=moderate 3=very	-
5	144, 171	Physical check suspected transport at sea	Number of checks	a to b (confidential)	2	-

Figure 8: screenshot of Function Performance Specification Customs/coast guard

Design: Analysis

Function analysis is the process of making a FAST or another graphical representation to show the main functions and some of their relationships.

In our case, an important intervention was the title of the FAST: "Function analysis on *Offering valuable services on sea with an optimum number of vessels. Focussing on tasks leading to a need for transport at sea*". For quite some employees this required explanation, although we thought we had made this clear. It wasn't. We made a FAST that barely fitted on a large A0-sized paper, consisting of number of small FASTs: for every of the eight identified processes we made one (sub-) fast. During the workshops the participants were presented for the first time the complete overview and were asked to validate it. They did so in mixed groups. Each group had the knowledge to explain the whole picture. The first reaction when they entered the rooms was "What is this"? but later on "We can now see the complete picture". That implies they agreed with the title (and so: focus of the study), and they started to see what the functions of "an optimum number of vessels" are. That also made it clear to them that *how* it is done (by means of an optimum number of vessels) is actually a non-issue for them; "it just has to work". To give them more insight in the *how*, the creativity phase was used, enabling them to explore areas that are not their 'daily concerns'.

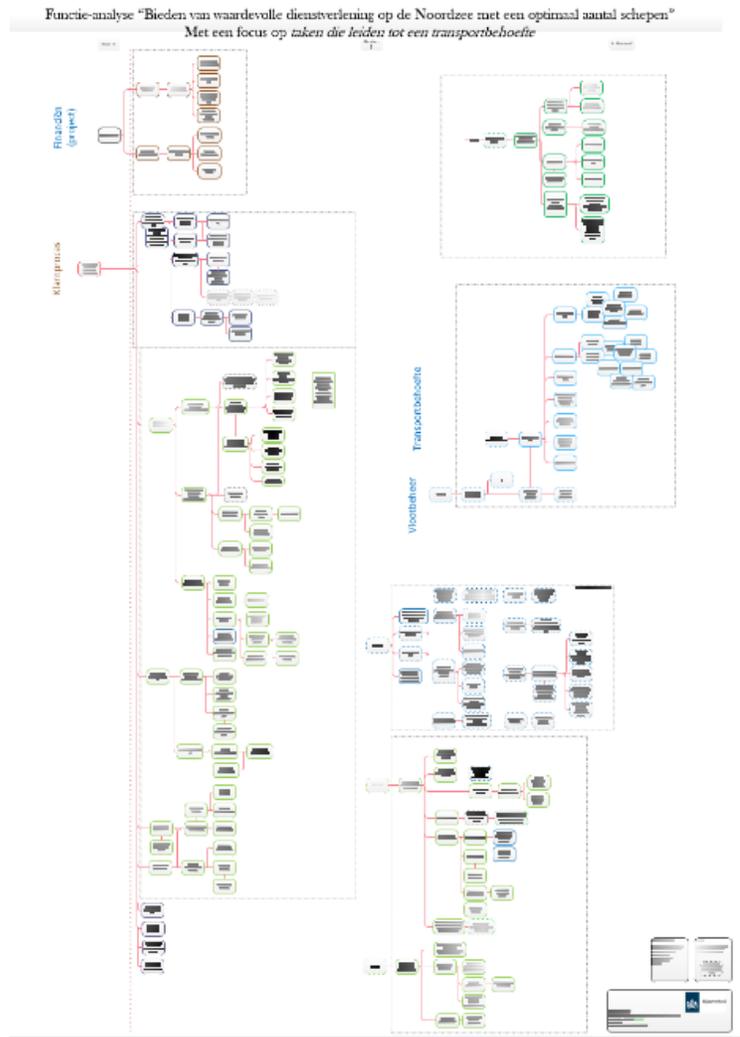


Figure 9: All FASTs combined

The cost component was not extensively investigated, since the aim of the study was to have a far more efficient usage of the ships, which in its turn would lead to far lower costs anyhow. Besides, the financial system was redesigned and not yet ready to be used on the required levels.

Design: Creativity

Good knowledge of the functions of a system is an excellent basis for *creativity*. Creativity is the *third item* in the pillar *Design*. It is enhanced by focussing on main costs of functions, on important issues and by identifying the main functions.

Due to the long preparation time (it started months before the plenary workshops were held) many ideas were already thought of. There was even a large picture book with different kinds of vessels: small, large, single and multipurpose. However, the start of the creativity phase was like releasing the cover of a pressure cooker: several hundred ideas emerged. This was a remarkable change since the beginning (see §2.2: Insight). Due to the large group of participants and the fact that we were working on multiple levels of abstraction, we divided the group in three groups of about 15 people each: operations, vessel configuration and management. Half way day 1, groups were mixed and the creativity continued once more with "throttle open". Already by now it was clear that some groups were advancing fast while others were still asking for more information.. On the second day participants made scenarios, plans, schedules and designs. It was clear that all participants from the different ministries and other organisations were very well prepared now and willing to come up with solutions. In the end of the second and last day of the workshop, several configurations of a new fleet were presented, requiring 6 to 8 vessels with 2 or 3 multipurpose vessels, some mixed functions on 3 vessels, and the other single purpose vessels remain. That is more than 40% reduction of vessels plus insight is obtained into the fleet renewal for the years to come. Those are remarkable achievements!

It was up to the shipping company then to continue with the new concepts, and to stimulate cooperation to implement the new system. For a video on these workshops, visit <https://www.youtube.com/watch?v=Z61H7kgklvU> (English subtitles).

CONCLUSION

We have rarely performed a VE-study where the three pillars of the D4V-model were tuned well right from the beginning. There are lots of pitfalls when pillars of the model are wobbly. Looking at the examples of the shipping company, you will realise the 'wobbly pillars' will decrease the effectiveness of the VE-study. If those pillars are identified and addressed properly, e.g. with help of the Design for Value model, that effort will create tremendous added value. The success may be caused by *understanding underlying relations* of the model, e.g. *relation of the system and its stakeholders, the costs and performances*, or the *planning of system usage and space requirements*. Asking about those relations really challenges entrenched ideas and reveals indispensable data. Leading to cost reduction, insight into the future and e.g. business changes. And *those* are main functions of a VE-study.

References and useful sources of information:

1. Kelly, Male and Graham, 2012. Value Management of construction projects. 2004. ISBN 9780632051434
2. Muller, Gerrit, 2012. Systems Architecting: A Business Perspective. 2012. ISBN 9781439847626
3. Taylor Models. See: the seven stages of the creative process on: www.mgtaylor.com/mgtaylor/glasbead/expmodel.htm
4. Short introduction of Value Engineering at Rijkswaterstaat: https://www.youtube.com/watch?v=V_h9P83L1Ok (English spoken)
5. www.value.fm
6. Information about the author: <https://www.linkedin.com/in/heindejong>

File: Description of a large strategic value engineering study for a shipping company with help of the Design for Value model v5.