VAVE APPLICATION IN THE OIL AND GAS MARKET

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Abstract

Due to the highly competitive oil and gas market, GE Oil & Gas recently set aggressive cost out targets on legacy products. The two main challenges in the project were to close all the necessary actions within one year and to apply a scientific-based, systematic and rigorous approach that can be applied to multiple product lines and for future cost-out activities. Extensive research has been done analyzing several methodologies to find the most effective and efficient ones including TRIZ, Disruptive Cost Workout, Competitive Teardowns and VAVE (value analysis value engineering).

This paper will describe the definition of the process starting from the initial pilot to the final setup and highlight how VAVE supported the final program results.

Oil and Gas challenge: be competitive in an uncertain world

As oil prices continue to fluctuate in an uncertain world, oil and gas customers are becoming more demanding about cost when buying new equipment, including the costs of installation and operation. In this new environment it is crucial for oil and gas equipment suppliers to look at their legacy products from a different perspective, finding new way to reduce cost while maintaining the same level of quality without impacting the safety or reliability of operations. At the same time it could also be an opportunity to find new disruptive solutions and speed up innovation.

Product company vision… aggressive target setting

After a having done a thorough analysis of the downstream industry and market conditions, the Product Leadership organization shared the landscape with the cross functional team including Engineering, Sourcing and Manufacturing at the very beginning of the year. For the main market segment selected for this project, Product Leaders performed a win/loss analysis on recent bids and set aggressive targets for new opportunities.

Cost out team… kicking off a new systematic approach

With this aggressive business scenario, it was necessary to fundamentally change the way we approach cost out activities since incremental improvements would not be sufficient to meet the program goals.

The teams were requested to be rigorous, scientific and systematic in their approach to generate ideas and execute them in short time. In reviewing previous experiences, one critical point the team faced was essentially related to the idea generation step. In the past several different techniques were used, but the outputs did not always meet business needs. GE Global Research Center, along with the GE Corporate, has recognized the power of the VAVE methodology and has encouraged its adoption by funding five-day VAVE training sessions for all GE businesses. GE Oil & Gas has taken full advantage of this support and decided to test it as a new methodology for idea generation.

The team decided to split the scope of work into more manageable subsystems to be more effective in putting in place cost out. In early Q1 the 1st workshop was organized with 3 different teams supported by an external VAVE consultant. The workshop provided training to the team on the VAVE tool by focusing on real product subsystems to maximize the training results. The selected team members were cross functional and experts among engineering, product leadership and supply chain. 70% of the team came from engineering department, while the additional 30% was equally split between Product Leadership and supply chain. The workshop was led by a facilitator applying the standard VAVE methodology.

A pre-workshop meeting was held two weeks before the event. The scope of the meeting was to introduce the project, discuss project scope and limitations and define the target product cost. Additionally the facilitator encouraged the team to collect critical data in advance to support the workshop activities and demonstrate a strong commitment to complete the program objectives.

The workshop was conducted over a full week. First, the team was introduced to the value methodology overview, focusing the team on a functional view rather than a component-level view with a simple classroom exercise.

Then the workshop moved to the functional analysis phase by practicing the random functional analysis, the Functional Analysis System Technique and the cost Function Matrix. This step has been performed on a test product, such as a mouse trap to practice the method. Then the team moved to a real subsystem, specifying all the functions for each item in the bill of material in scope. After that we spent time to correctly define the high order function, using “function glasses” to understand the real customer needs. Building FAST diagram was the next step and helped to show relationships between functions and to organize the random list of functions. These steps were useful to test validity of the function under study and to identify the basic function of the subsystem.

Figure 1

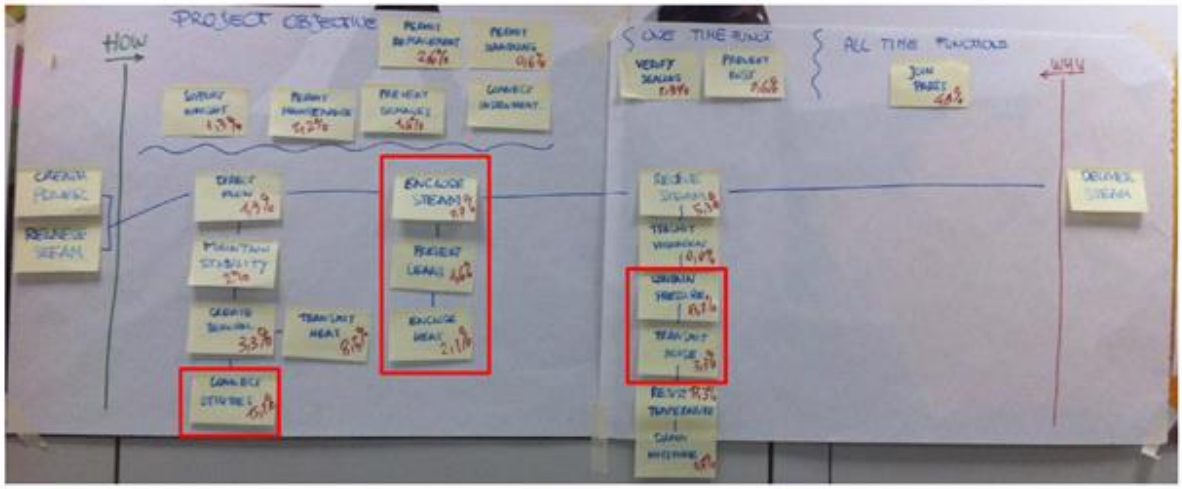

Figure 2

The creativity phase was performed by focusing on the main functions to cover approximately 50-60% of the overall subsystems cost. It was particularly exciting for the team to verify how it can be different to look to the same scope with the “function glasses” instead of the component cost list.

Function	Percentage
Resist temperature	16%
Deliver flow	15%
Resist pressure	14%
Resist corrosion	13%
Reduce temperature	11%
Control flow	7%
Reduce pressure	6%
Measure pressure	4%
Measure temperature	3%
Contain fluid	2%
Resist force	2%
Prevent backpressure	1%
Isolate flow	1%
Remove fluid	1%
Prevent leakage	1%
Protect environment	1%
Transmit signal	1%
Support weight	1%
Meet requirement	0%
Maintain operability	0%
Maintain reliability	0%

Figure 3

Before moving to the brainstorming phase the facilitator gave us many examples of innovation, highlighting that in most cases new products are created by putting together features that already exist in different environments. We also practiced many exercises to motivate people to be creative because at the end the human behavior is fundamentally open to new way to solve problems. The facilitator gave the team two important ground rules to apply for the entire creativity phase:

1) Do not judge
2) Enjoy

The team practiced these simple rules and was able to find 80+ ideas for most of the functions under analysis.

During evaluation phase we started screening out the highly unfeasible ideas. In the second run, we assessed the benefits and value of the remaining ones and we started to combine ideas within and across category lists.

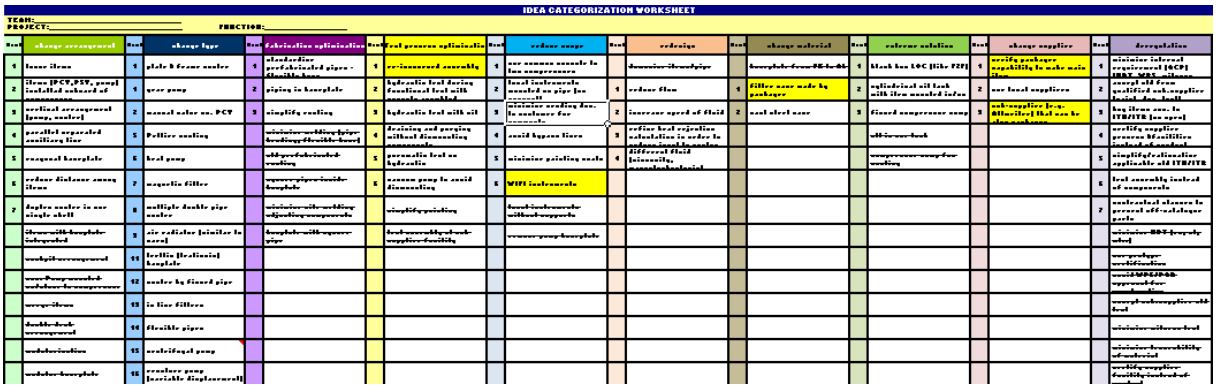

Figure 4

To build solid proposals, during the implementation phase, the teams worked hard to sketch out the new design, with an estimation of the proposed cost and the cost of change. To have solid cost data, the team was able in some cases to be in touch directly with suppliers during the workshop to have a first confirmation of the expected savings. During the workshop report out, the overall outcome was excellent, with ideas developed representing double digit savings. The team felt that reviewing the sub system with a different point of view, using a functional view instead of looking at the components themselves, was especially valuable in that it gave them the chance to work in the creativity sessions with different "glasses." Many new proposals were shared during the presentation phase. The proposals were divided into short term and long term actions giving a better scenario of the results. In the same 1st session about 70% of the team took the VAVE exam and obtained the certification with high score.

VAVE method….spread across the organization

The positive results of using the VAVE approach moved the organization to apply the methodology as much as possible but with one additional step. The team decided to add a decision point, "go/no go" step. The target threshold was identified by referring to the savings estimation with no workshop activity. If this amount was lower than 5% versus the subsystem target, VAVE workshop became a "must" step for the team to speed up with the idea generation.

In second quarter 3 additional workshops were held with 6 different teams. The 2nd workshop was also facilitated by an external consultant to give the team an additional opportunity to become even more familiar with the methodology. The selected members were again cross functional, mixing together different expertise from product leadership, engineering and supply chain. This time, the team decided to also invite one supplier to use his experience and to involve him in the design change phase. The outcomes of this second workshop were significant, generating a significant amount of new design

proposals. This fact pushed the team to again change the process and add a dedicated program manager to build a clear action plan with idea owner, completion dates and deliverables. Moreover as per the detailed VAVE job plan, a weekly operating review was scheduled to assure execution progress.

Additional workshops were scheduled in Q3 with 4 different teams. As one build to the Q1/Q2 experience, team members were selected by mixing senior with junior design engineers (DE). In general, we noted that junior DEs were less conservative in the creativity phase, while the more senior ones helped in the evaluation phase to build feasible proposals that could be actually implemented.

One additional best practice identified was to select, where possible, the same resources that would take ownership of the idea execution to have their buy in from the beginning.

Mix different techniques to meet aggressive target

Thus far, VAVE has been the key tool to reach the Oil & Gas business product cost out targets, but it has also been necessary to mix different methodologies to leverage additional expertise across the company. For example, Should Cost and supplier rationalization were utilized successfully as well, so they have been applied in the 1st step of the process. The aim was to check how far the current design cost was from the supplier cost. If the delta was large, this means that we could have room for cost out during supplier negotiations without any design changes. Moreover it helped to review the suppliers landscape to start looking at volume rationalization. Should Cost was also used down the line in the VAVE workshop by validating that the new design can meet the savings hypothesis to avoid starting the execution of a more expensive solution. Finally, Lean manufacturing techniques were also used where the direct labor cost of a subsystem was dominant versus the direct material expense.

VAVE… what next

The results related to the introduction of the VAVE methodology to drive lower product costs confirm the need to engrain this as part of the culture in the worldwide organization. One of the key steps to success is to build “gurus” capable of ensuring the program is sustained, by training others and by focusing the team on the real benefits and to apply the method in many different products lines. Moreover, different tools such as TRIZ can be integrated with the traditional VAVE plan to enhance the brainstorming step. In fact TRIZ could help to channel creativity by reviewing multiple solutions for a particular problem, many of which have already been encountered by someone at some points.

An additional opportunity is to apply a value-based methodology process in the early stages of new products or technology before production. By introducing a VAVE workshop in the early stages of product development, the best solution to fulfill customers’ needs can be selected before a detailed product design is complete. On the same track, it seems that the integration with a Fast Works approach can also

support the business by helping reach decisions on which solutions can fit the customer need at the best cost.

Conclusions

The table below summarizes the team's effort to apply the VAVE methodology over the program schedule.

2015 VAVE summary table

Q1	Q2	Q3	Q4
January	**April** **FW16:** 3 teams, *external consultant* **FW17:** 1 team, *external consultant*	**July** **FW30:** 1 team, *internal facilitator*	**October**
February **FW8**: Program KOM **FW9**: 3 teams, *external consultant*	**May** **FW20:** 2 teams, *internal facilitator*	**August**	**November** **FW48:** 1 team, *internal facilitator*
March	**June**	**September** **FW36:** 3 teams, *internal facilitator*	**December** **FW49:** 1 team, *internal facilitator*

Figure 5

The team plans to adopt the same approach in the coming years since it allows engineers to think out of the box and generate new ideas to optimize product cost in a number of areas, and then create a pipeline of actions for buyers to negotiate with vendors and team members to execute around to drive product cost savings.

References

- Books: Various authors, 2008, "Value Methodology", GOAL/QPC,

Contact

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