

Analysis Phase Enhancement in Value Analysis Value Engineering (VAVE) Job Plan

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Article Info

Volume 83

Page Number: 1175 - 1179

Publication Issue:

May - June 2020

Article History

Article Received: 11 August 2019

Revised: 18 November 2019

Accepted: 23 January 2020

Publication: 10 May 2020

Abstract:

This paper proposes an Analysis Phase enhancement through the integration of Theory of Inventive Problem Solving (TRIZ) tools into Value Analysis Value Engineering (VAVE) methodology during the product development process in the automotive industry. Previous study shows the application of VAVE as one of the effective methods to enhance product value by increasing the performance without increasing the cost and affecting the quality, saleability or maintainability. However, this method is limited to the simple type of problem and needs enhancement in the Function Analysis within the workshop phase of job plan. On the other hand, TRIZ is well known as an effective methodology to solve complex problems. To balance these issues, the proposed enhancement is seen inevitably beneficial especially to achieve total vehicle cost reduction.

Keywords: TRIZ, Value Analysis (VA), Value Engineering (VE), Function Analysis

I. INTRODUCTION

Currently, Value Analysis (VA) and Value Engineering (VE) have been conducted within the Value Management (VM) practice in the automotive industry decision making processes [1]. These methodologies have been used at the different stages of the product and/or process development mainly to optimize the total vehicle cost.

Brainstorming technique has been chosen to be the main tool within the analyzing phase of VE with its known limitations [2]. In order to improve the limitations, studies were done to integrate some structured inventive tools from Theory of Inventive Problem Solving (TRIZ) into VAVE.

Figure 1 shows VAVE standard Job Plan use to govern the value studies. The integration being explored is focusing on the Analysis Phase of VE within the Workshop Phase of Job Plan.

The application of various tools from TRIZ into VAVE exercises will ensure the product to be properly developed with better specification, quality, cost and time. Thus, would increase the product value.

II. VALUE ANALYSIS VALUE ENGINEERING (VAVE)

CIMA Official Terminology: VA is “Systematic inter-disciplinary examination of factors affecting the cost of a product or service, in order to devise means of achieving the specified purpose most economically at the required standard of quality and reliability” while VE is “Redesign of an activity, product or service so that value to the customer is enhanced while costs are reduced (or at least increased by less than the resulting price increase)” [3]. In other words, VE is the application of VA to new products.

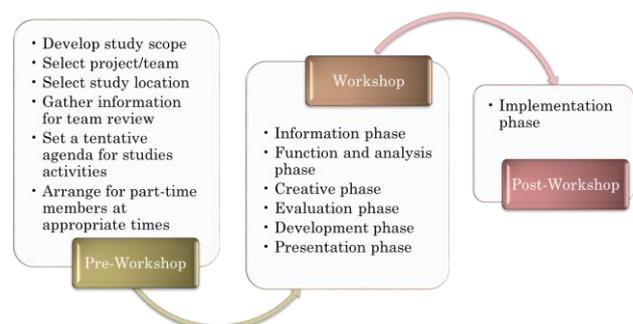


Fig. 1. VAVE Job Plan [3].

III. THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ)

Terninko, Zusman & Zlotin stated that TRIZ is the Russian acronym for “Teoriya Resheniya Izobretatelskikh Zadach”, i.e. the “theory of the resolution of inventive problems” that was formerly developed by Genrich Altshuller, a Soviet engineer,

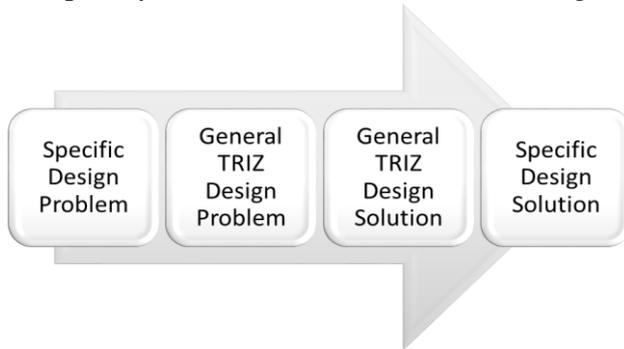


Fig. 2. TRIZ Roadmap.

IV. TRIZ - VAVE INTEGRATION

Previous works show many ways of integrating different tools between the two methodologies. I. Bukhman and S. Brown proposed ARIZ innovative technique to generate idea within the Creative Phase [2]. Other than that, J. S. Borza also recommended the use of Inventive Principle into the brainstorming session for the Idea Generation Phase [6].

Some concepts of TRIZ are also similar with VE such as Function Analysis [2] in the Analysis Phase. Even so, this concept has been applied in a different way within these two. Study shows merging between the two has produced hybrid function modelling: Enhanced FAST Diagram which include the “Negative” or “Harmful” functions supplemented with “Produces” and “Counteracts” in the analysis [6].

However, the intention to find the contradictions through identifying the harmful or useful function in FAST diagram with insufficient performance was not as efficient because in VAVE usually not many unwanted functions were found [7]. It is proposed that the concept of TRIZ Function Analysis to be applied earlier during the VAVE function modelling phase. This can give a thorough understanding with a deep logical answer to the specific problem [8].

inventor and science fiction writer based on more than 40,000 patents analysis [4].

Figure 2 summarizes on the ability of TRIZ to convert the specific design problem into the specific design solution through converting the problem into general TRIZ design problem to suit with the guided general TRIZ design solution [5].

V. PROPOSED ENHANCE ANALYSIS PHASE

The discussion of the proposed technique in this paper is structured within the analysis phase of workshop stage in job plan for VAVE using TRIZ Function Analysis as illustrated in figure 4.

A. Research Motivation

Previous studies show Functional Analysis is made through the construction of FAST Diagram in VE practice. In TRIZ, it involves the interaction from Component Analysis, Interaction Analysis and Function Model. Moreover, TRIZ Function Analysis act as an analytical tool that determines functions, characteristics, cost of the system and supersystem components. Subject and Object are both represents by the components with which the system interacts within the Engineering System under study. Figure 3 shows the relation between Subject and Object through its function.

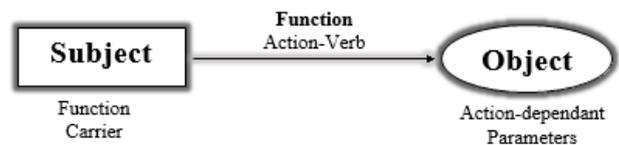


Fig. 3. Subject and Object relation in Function Analysis.

B. Reasons for the enhancement

The reasons for applying TRIZ exercises are based on the limitations of usual problem-solving method in VAVE as follows:

- To avoid the psychological inertia within personal in the area that they are not familiar with.
- To enhance the level of knowledge within the Engineering System under study.
- To create ideal objective or goal.
- To avoid conflict and contradiction.
 - To determine the actual root cause for a problem.

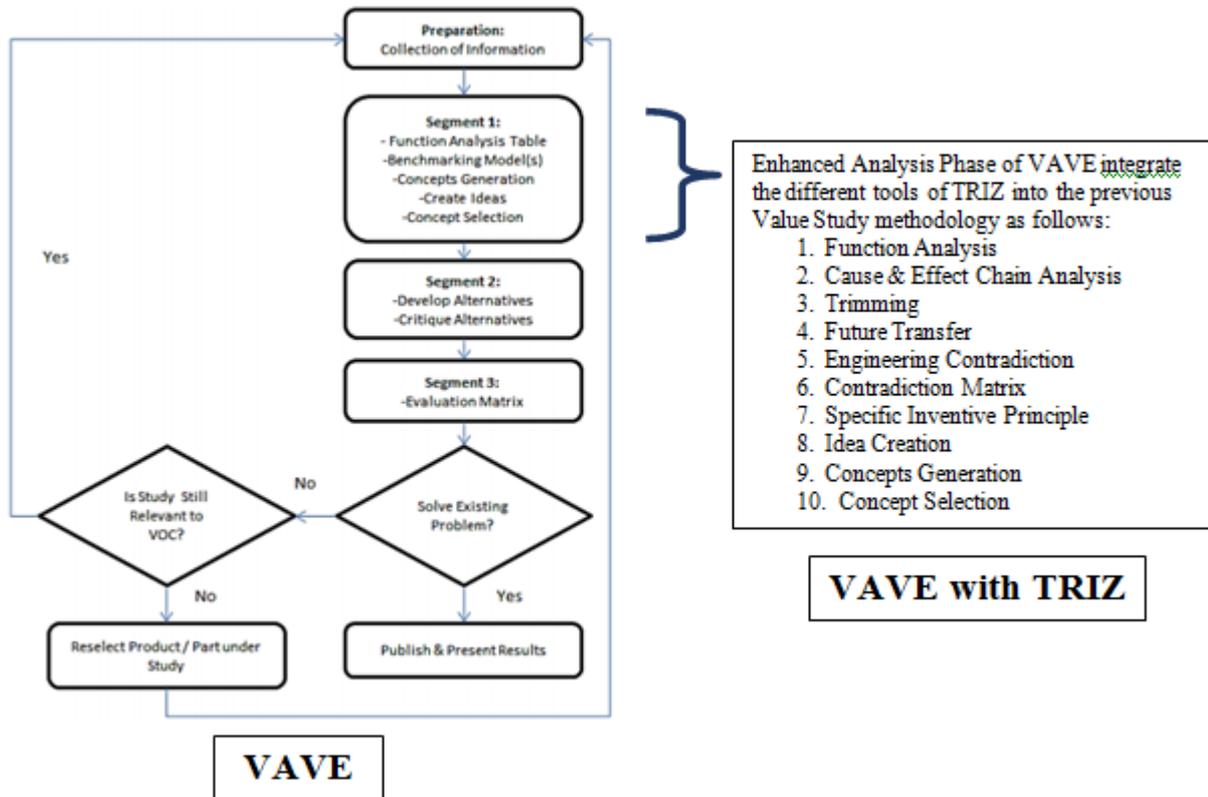


Fig. 4. The proposed VAVE with TRIZ for the Analysis Phase enhancement.

VI. DISCUSSION

A. Function Model

Function Model is an analysis involve within the analysis phase of TRIZ which analyze the relationship between the components together with the Supersystem and total Engineering System. Figure 5 depicts a Function Model Diagram for a table with a book on it. The specific disadvantages of the object – namely harmful functions as well as the useful functions (classified as normal, insufficient or excessive) are identified. While in Figure 6 shows the previous applied Functional Analysis through FAST diagram in VAVE.

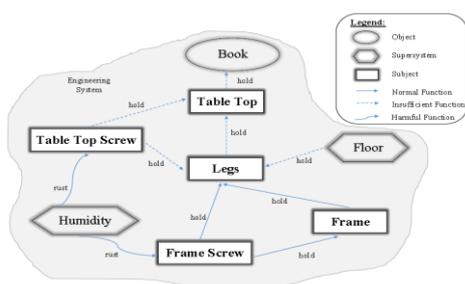


Fig. 5. TRIZ Function Model for a table.

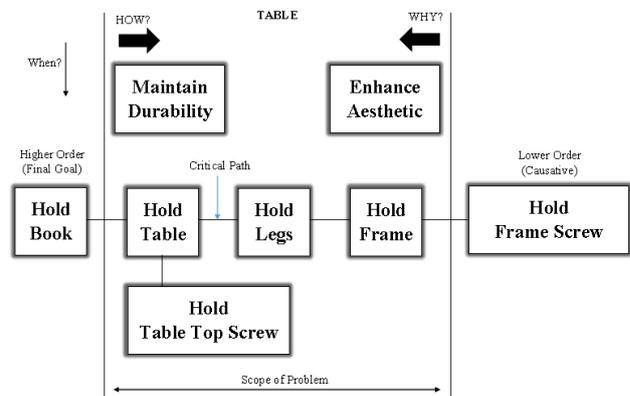


Fig. 6. VAVE FAST Diagram for a Table.

Figure 5 and Figure 6 show several comparisons within the different type of Function Analysis which can create the opportunity for the enhancement of the previous VAVE. The different should not compete but is better to be integrated and equip each other. For example, FAST Diagram is focusing on the function's acts upon the measurable noun while Function Model acts upon the Components. Moreover, in FAST Diagram the least benefit or

lower value function should be removed or replaced, while in Function Model, excessive component function should be reduced to enhance the value of the Object under study.

Other than that, focus of the FAST Diagram is based on the specification's requirement from the end customers, while Function Model is based on the product or process requirements. The most important key is, Function Model able to highlight any risk from the supersystem which may be miss looked by the designer while trying to reduce the cost or improve the performance for a higher value of product or process.

B. Advantages

The advantages of the study are as follows:

- Generate more far-reaching solution of a problem. [2]
- Provides problem solving tools which VE's brainstorming technique is lacking. [2]
- Increase efficiency and speed of innovation.
- Avoid trial and error problem solving approach.
- Produce structured and systematic problem-solving approach.

VII. CONCLUSION

In conclusion, TRIZ may be used to enhance product performance in VAVE while maintaining its intended functions for solving problems without scarifying any project requirements for safety, quality, operations, maintenance or environment. Function Model applied shows the concept of structured and systematic problem solving approach suite with the structured existing VAVE, which give new opportunities for the multidisciplinary team to work together on the basic functions and components and at the same time able to get the focus scope/Engineering System of the project undertaken without totally depending on the members knowledge, skills and experiences. It allows the unlimited alternative and innovative ideas to be generated for the specific problem solutions, thus developing their potentials.

Further study can be made on integrating the different tools within TRIZ and VAVE especially during the different product development phases such as manufacturing and distribution phases.

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