OPTIMUM VALUE ENGINEERING FOR AUTOMOBILE MAKERS AND PARTS SUPPLIERS

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ABSTRACT

This paper is a consolidated report of a 3-year research work jointly done by members of 21 affiliated companies of Isuzu Motors Ltd. under the overall theme of "What is the most effective VE technique that can be widely adopted by medium and small suppliers and affiliates producing automobile components and parts?" The study was to eliminate or reduce prevailing obstacles and handicaps confronted by these firms traditionally operating in the Japanese hierarchy.

INTRODUCTION

These makers, rather well enlightened in promoting only in the "2nd. look VE," remain "under-developed" in accomplshing "1st. look" VE results. The report emphasizes it should help those suppliers in upgrading their 1st. look skills closer to their more familiar 2nd look application technique.

OPTIMUM VE FOR AUTOMOBILE MANUFACTURERS AND PART SUPPLIERS

Automotive industry in Japan has a typical pyramid structure, in which automobile manufact-urers at the top are supported by a great number of parts suppliers. In other words, second and third suppliers supply parts to automobile manufacturers, who are the final assemblers. Hence, lack of advanced technology on either side is critical-to the production of inexpensive, yet high quality goods.

At present, approximately 70 % of the total production of parts is assigned to outside specialized suppliers. These suppliers are actually in charge of basic studies, engineering and manufacturing, and are making efforts to improve their own state of the art.

This paper deals with value engineering (VE) techniques which are essential to the survival of automotive parts manufacturers in tho tough competition as well as to their growth with automobile manufacturers.

ISUZU SUPPLIERS ASSOCIATION AND VE STUDY ACTIVITIES

Isuzu Suppliers Association, comprising automotive parts suppliers for Isuzu Motors Ltd., aims at the promotion of mutual friendship and refining of the state of the art. VE Study Meeting, participated by 21 suppliers, is a part of this organization. This Meeting has been conducting study activities with Isuzu Motors to improve their VE techniques. Behind the popularity of these activities, the stark reality exists: if suppliers cannot supply high quality products for low prices, they will lose their competitiveness and cannot survive. Therefore, the suppliers are enthusiastic in these activities.

This Meeting plays an important part in cooperating on the VE activities and feeding VE results back upstream. For these reasons optimum VE has been selected as the theme of our study.

PROBLEMS IN DEPLOYING VE TECHNIQUES IN SUPPLIERS

The following three problems are the main difficulties in. deploying VE techniques:

(a) Suppliers are so specialized that action to keep pace with changes in the adjacent parts is difficult. If suppliers of alternators and the brackets for them are different, optimum system design would be difficult to achieve through the development pursued separately.

(b) Information about development plan is not conveyed swiftly and precisely from automobile manufacturers. Automobile manufacturers' requests for cooperation to parts suppliers are different in scope from supplier to supplier in accordance with suppliers' capabilities. If the suppliers are regarded as competent, an automobile manufacturer will consult with those suppliers even at the stage of product planning or concept making. On the other hand, if suppliers are not so competent, product concept must be fixed and thus room for improvement is limited.

(c) Small-to-medium-sized suppliers have difficulties in educating employees on VE and thus are ready to fall behind in improving the state of the art. These suppliers lack in technical information, leaders, and time to educate employees on VE. Radical improvement is hard to achieve because these suppliers are not given a chance, to challenge a big theme.

The following factors are considered to be the causes of these problems: Heavy dependence of automobile manufacturers on these specialized parts suppliers, very short development cycle, and difference in VE education level of the participants. For example, from a company with 200 employees to a company with 6,000 employees.

IDENTIFYING PROBLEMS

From the standpoints of VE education and benefit, we have implemented activities strictly in accordance with the established VE procedural phases.

In experiencing approximately 170 activities in 3 years, we were confronted with several problems in these VE phases. The solution to these problems were found to be clues to the problems mentioned. Bottleneck phases are information collection, function definition and idea generation, and we found that the problems in these phases make up 80 % of the total problems:

(a) VE phase: Information Collection

Problems: 1. The commitment to this activity is low. Necessary information is lacking.

2. Information on the entire system, including the adjacent parts, is lacking.

(b) VE phase: Function Definition

Problems: 1. Function diagrams are difficult to make.
2. Omissions of functions is difficult to check.
3. New functions arc difficult to incorporate into the diagram.

(c) VE phase: Idea Generation

Problems: 1 There is no stimuli for retrieving ideas from memories.
2 Expressions of functions are not effective.
3 Scope of obtained techniques are too narrow to be applied to other cases.

These problems were grouped for each VE phase, and study groups were created for each VE phase to investigate causes and seek for correctivemeasures.

IMPROVEMENT IN VE PHASES

A new model flow was conceived as the most effective method of applying VE techniques. See Fig. 1 for the model flow of VE development. Features of this new model flow are that the three bottleneck phases are rearranged in two phases and that the phases of Function Evaluation and Proposal are omitted.

Purposes of this new model flow are:

° Difficulties in the bottleneck phases are overcome by repeating each VE phase twice, first by conventional method and second by using a checklist. (Procedures in VE Manuals are to be revised.)

- In Function Evaluation phase, evaluation is restricted to the specific function groups that target at the core of ideas, or just keywords are confirmed. (It is not necessary to conduct evaluation by function.)

- The phase, Proposal and Follow-up, is omitted since some members of the staff are engine-ers concerned with aiming at feedback upstream in development.

In this model flow, key to success in VE activity is the checklist. This checklist aims at avoiding procedures ready to fail or be forgotten, based on methods the staff members found effective. On a theme too general, efforts have been made to make it more specific and useful by quoting specific examples and considering what each staff member should do.

IMPROVEMENT IN INFORMATION COLLECTION

Conventional way of collecting information will seldom improve VE results. In other words, winning customers' satisfaction requires finding customers' requirements and latent needs, based on Customers' consciousness. Therefore, we decided to make a checklist on which customers' consciousness is' reflected. Moreover, in manufacturing processes people in all the downstream processes, such as machine and other operators, are regarded as customers. Information from customers' viewpoints is thus collected.

FUNCTION DEFINITION

In the Function Definition phase, some functions are unnoticed, some cannot be understood, and some should be added at tho upstream develop-ment stage of VE activities. Therefor, items and check points are listed with specific examples in the checklist.

IDEA GENERATION

There are different methods of generating ideas. But full education of the engineers in small-to-medium-sized parts suppliers in these VE methods is impossible to achieve. In addressing a problem the most popular way is to look at the problem from a different angle by referring to a checklist which lists, for example, a change in the surroundings, etc. Method is not always important in generating ideas, but what is essential is an encounter with radical ideas by generating as many ideas as possible.

CONCLUSION

Our study this time deals with efficient deployment of VE activities in parts suppliers in the automobile industry. Checklist method was employed in VE phases, which is found to be very practical and helpful to everyone. As activities have been conducted under this method, parts suppliers have been making significant improvements in VE results in cooperation with automobile manufacturers.

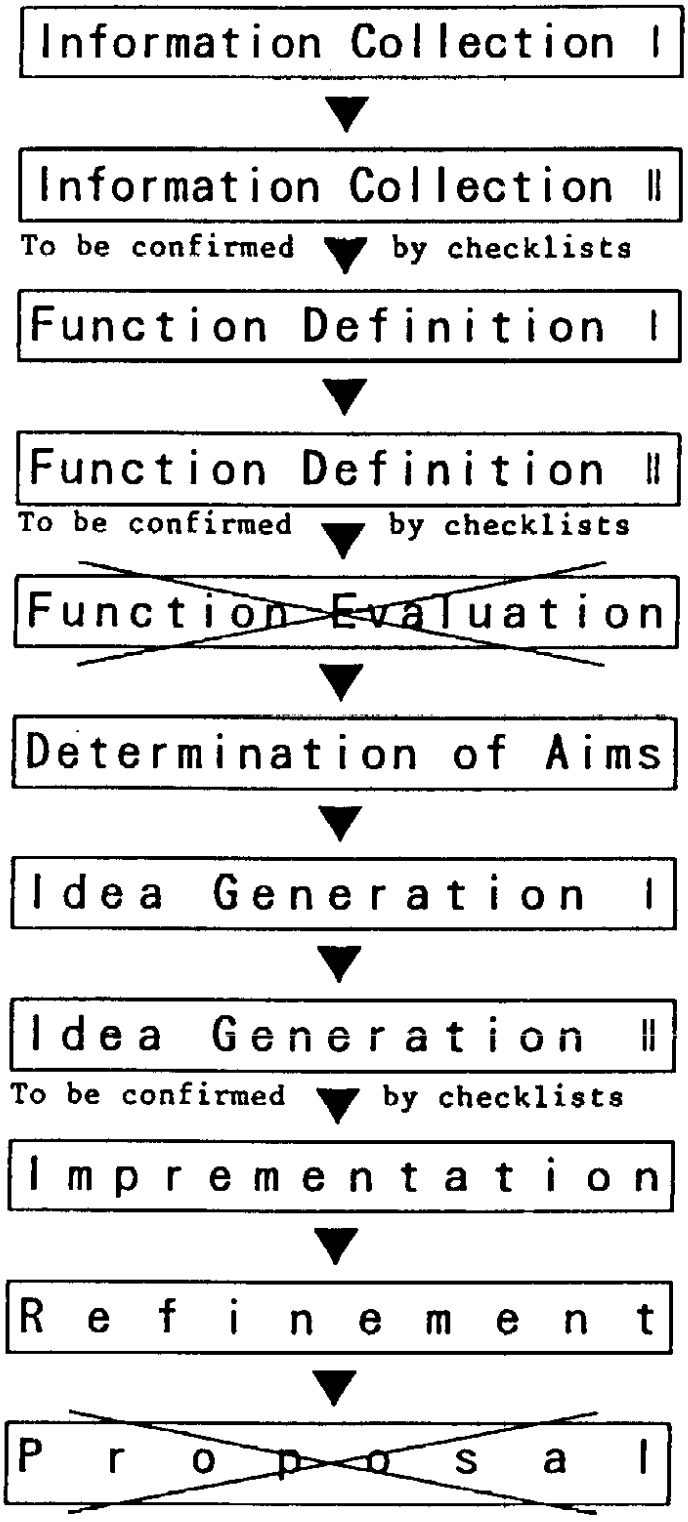


Fig. 1: VE Development Model Flow-chart

Use Information

Purposes : (1) Clealy required functions.
(2) Criteria for adding functions

① Use
(1) Application : Is your customer using the vehicle in accordance with engineer's intentions? If not, how is he/she using it.
(2) User : Age group, occupation, sex, disposition of users
(3) Field : Distination(domestic, export), model(gasoline, diesel), type(any difference in use between 2D and 4D? Is the place to be mounted appropriate?)
(4) Environment : Any difference in use between seasons, climate, tamperature, time, etc.?

② Dimands of customers(manufacturers, end users, next processes, recycling)
(1) Satisfaction: There must be something that the customer feels no way but to accept.
(2) Demands : Do you find out customer's wants (additional functions)?
(3) Complaints : Is there any bad information not refrected on statistical data?
(4) User-friendliness : Did you use it for yourself? Did you frankly talk with the customer?

Design Information

Purposes : (1) Clarify required functions and confirm required conditions.
(2) Clarify the extent of value improvement
(3) Acquire understanding of technical conditions
(4) Share vewpoints on new information and improvement

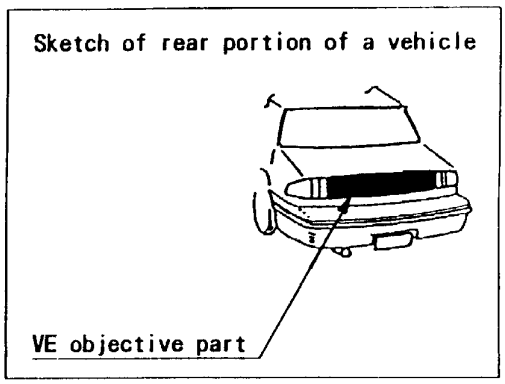
① Conditions
①-1. Specifications (current specifications in drawings cover the required conditions?
(1) Rules : Domestic, export, in-house, customers'
(2) Customers' specification : Design, appearance, mounting space, size
(3) Weight
:
:

② Easiness in mounting and fitness
(1) Mating parts : Possible VE objectives as a system
(2) Relation to adjacent parts (layout) : Hove you obtained planning drawings? Have you obtained the drawings of the mating parts? Dose the part or assembly assume any functions of the mating(adjacent)parts?
(3) Easiness in mounting at customers' site : Are the mounting procedures and operational methods appropriate?

③ Evaluation conditions
(1) Test items and methods : Standards for bench tests and vehicle tests appropriate?

Figure 2 Checklist for Information Collection

What one often forgets in collecting information



(Ⅰ)Possible Differenciated Products?

(Function System Diagram of Garnish:Rear end)

Purpose: Upgrade the rank of a vehicle

Basic Function

Improve Attractiveness
- Prevent heat distortion
- Prevent scratches on vehicle body
- Prevent water intrusion
- Improve Appearance

Differenciation of Products
- Provide a sense of unity with vehicle body
- Apply hair-line treatment
- Make appearance more colorful
- Make appearance more glossy

(Objective) —— (Means)

Any other means?

(Objective) —— (Means)

(Ⅱ)Possible New Products?

Open and close doors
- Apply oil pressure
- Apply force to door
- Guide door
- Make door slide smoothly

(Objective) —— (Means)

★Many possible means
- Use oil pressure
- Motors
- Mechanical means
- Air pressure ・・・

★Conceive alternative means to achieve basic functions to acquire another products. Think about means to embody the use objective of basic functions. (Think about theories and principles.) If an objective "open and close doors" is assumed to shut out outside atmosphere, doors can be replaced with curtains(or air curtains). The extent of generating ideas thus expands.

Figure 3 Development of Ideas into New Product

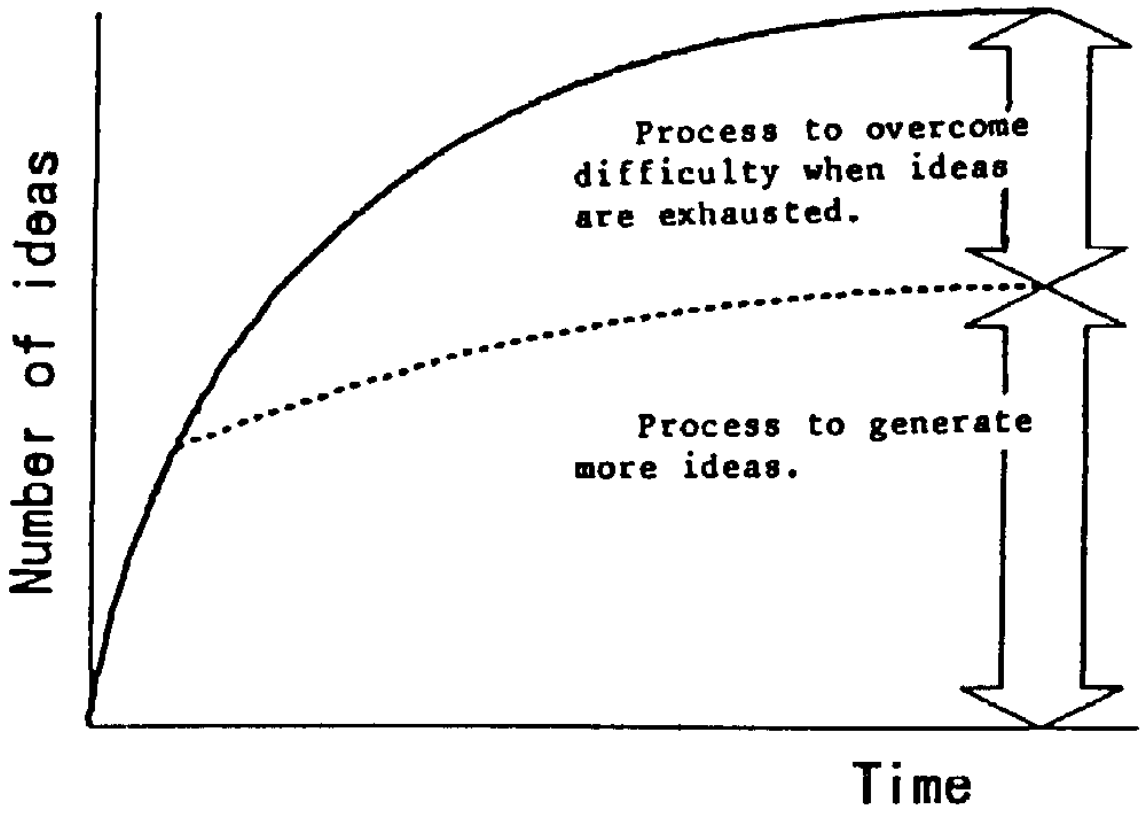


Figure. 4: Number of Ideas vs. Time

Process of generating more ideas

Methods	Notes and Points
① Conceive means to achieve an objective, based on principles, listing products whitch utilizes the principles. •••Toys, electrical appliances, automobiles, buildings, ships, railways, household commodities, etc.	Objective here is application of principles. Do not be captured by a product itself.
② Generate ideas by producing a chain reaction, in a way for example, of finding things in nature that work in a similar way : Sea → Wave → Rain → Cloud → Wind → Thunder → Earthquake, etc.	However innovative your invention may be, remember that it is always based on rules and laws in nature.
③ Develop ideas horizontally, considering differences in feelings and life styles between age groups, and between the sexes.	Women's participation from the beginning is also effective.

Process of overcoming a difficult situation in case ideas are exhausted

Methods	Notes and Points
① Refresh minds by giving puzzles, not so difficult ones, intermittently. If you find them difficult, go ahead and see answers. Then, start again generating ideas.	Relaxing as well as concentrating yourself is important.
② Change expression of function definition. (Example) Separate → Set apart → Divide	Objective here is to avoid being captured on certain ideas.
③ Change environment•••Go outside and take a deep breath, or quit the meeting and resume on other day.	The interval should not be so long that you forget about the meeting.
④ Reflect on goods, for example, those sold in do-it-yourself shops. If you have enough time, go there and take a look.	Be curious about anything around you so that you become more creative.

Figure 5 How to Generate Ideas Smoothly

•••How many ideas, clues to improvement, can you generate?