

EFFECTIVE PROPULSIVE TECHNIQUE ON 2ND LOOK VALUE ENGINEERING

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ABSTRACT

In this paper the "Value Engineering (VE) item system-development table" and the "VE portfolio" are introduced and the effective VE is investigated through our actual 2nd-Look VE propulsion.

INTRODUCTION

The origin of a manufactured induction motor dates back to 1893, when Westinghouse produced a completed motor. The induction motor, since then, has played an extremely important role as a mechanical motive power. As for the demand for these motors, it has constantly increased even under economic fluctuation. Especially from 1986, Stimulated economics resulted in the reception of more orders which have exceeded production recently in Japan.

The economic circumstances, however, are not satisfactory for motor manufacturing, because of several troublesome factors, such as increasing material and personal expenses. These factors are active and thus VE activity becomes more necessary for expanding current corporate profits.

The induction motor, which is one of long life products in the market, cannot be expected to offer chances of O-Look VE or 1st-Look VE activity, so the 2nd-Look VE should have a central role in the VE of this motor.

Although 2nd-Look VE activity is usually performed under many limitations as it is targeted to current flow products. We derive creative ideas from on-site products to produce profitable results in VE. We arranged the ideas in order of importance, that serves to provide the clarified starting order for the systematic VE

process.

BACKGROUND

Needs for 2nd Look VE

The 2nd-Look VE is not as profitable when compared with the O-Look VE or the 1st-Look VE in the products planning and development stage. With respect to "mature" products such as an induction motor, that has a long-life span in the market and also has a long time between model changes, we must concentrate our efforts on the 2nd-Look VE. In general, there are limits in the intended modification of the component configuration or materials in the 2nd-Look stage, and these limits tend to hinder productive results.

We must, however, break through these obstacles when we take the truly productive ideas from the enlarged scope of the current products or components and develop effective 2nd-Look activity with its standardized procedure.

The O-Look VE and 1st-Look VE are usually performed at the planning stage, where VE activity is considered as creative or high-potential work, while the 2nd look VE is inevitably done for "mature" products, such as an induction motor at the unspectacular middle stage.

During the intervals between model changes, the appreciable results from the VE activity generally change like a "bathtub" curve (Fig 1). The most important point is how we can raise this bottom portion.

In this long, middle interval, the 2nd-Look VE should be activated to maintain manufacturing profits.

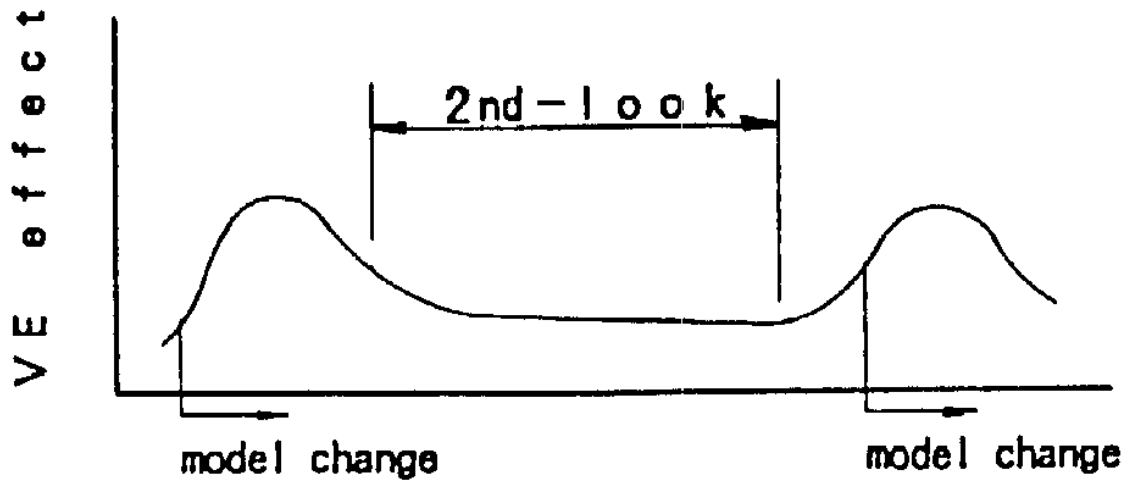


Figure 1 Trend in VE effect

Problem on the VE propulsion

In general, the 2nd-Look VE has its own limits, because this activity should be treated with already-designed, current products. Up to now, the VE items have been considered as having very low potential and lead to small profit, even when they do not come to a deadlock.

Therefore, we should enlarge the applicable scope for the products or components and derive more creative ideas which can lead to effective VE items. Usually these items are merely assigned to the staff in the section, and they tend to treat the items in their own way, which does not always bring about effective results. In such processes the results depend on the ability of the staff. Furthermore, the management activity scope is inevitably enlarged due to complicated item relations and shifting cooperative relations with other sections, that often leads to the failure during planning or in the budget in the VE activity.

CONCEPT

At first we visualized what the staff usually thought, i.e., how the discovered items should be arranged or on what basis the first-examined item should be chosen. At the same time we introduced many new techniques which provided more simplified management as well as the idea development system.

The concept of our 2nd-Look VE propulsion technique comprises the following principles:

1. Establishing the procedure to determine the starting order of items
2. Making sure that the reliable follow-up management can be performed.
3. Producing the method of the associative development of ideas.
4. Determining these data to be treated on the personal computer (PC) tabulation-retrieval system.
5. Coding these data to be treated on the PC tabulation-

retrieval system.

CASE STUDY

Outline of the technique

According to the steps as shown in Fig. 2, we will explain the important points of our VE technique while comparing with other usual VE steps. The VE propulsion process consists of several steps ranging from the first step, Discovery of ideas, to the last step, Realization. The steps ranging from arrangement of items to decision of the starting orders have been, in other usual techniques, performed only in the staff's minds.

In this paper, we introduce the new VE technique to visualize these in-the-mind steps, which can produce a simplified, effective VE process. The items picked up from the VE item lists are arranged in order and developed with the System-development table to produce the associative development of ideas. The starting order of these items can be determined by the quantitative method using the VE portfolio. The schedule and other necessary points of the items are entered in the Follow-up charts, with which we can manage and check the overall VE progress.

Detailed explanation for process

We will explain each step according to an actual case in which we performed the 2nd-Look VE activity on the induction motor.

VE Item List: Many ideas produced by the idea discovery meeting and so on, are entered into the VE item list. At this time the No., Titles and Contents of the items are entered, and the other details are entered at the planning step (the follow-up chart). In this process we used the general technique which does not need to be explained in length at this time. We did add a new item, Code No. which is explained in the System-development Table.

System-development Table

The entered items on the VE item list are in a no-fixed order and their relations with each other is not clear.

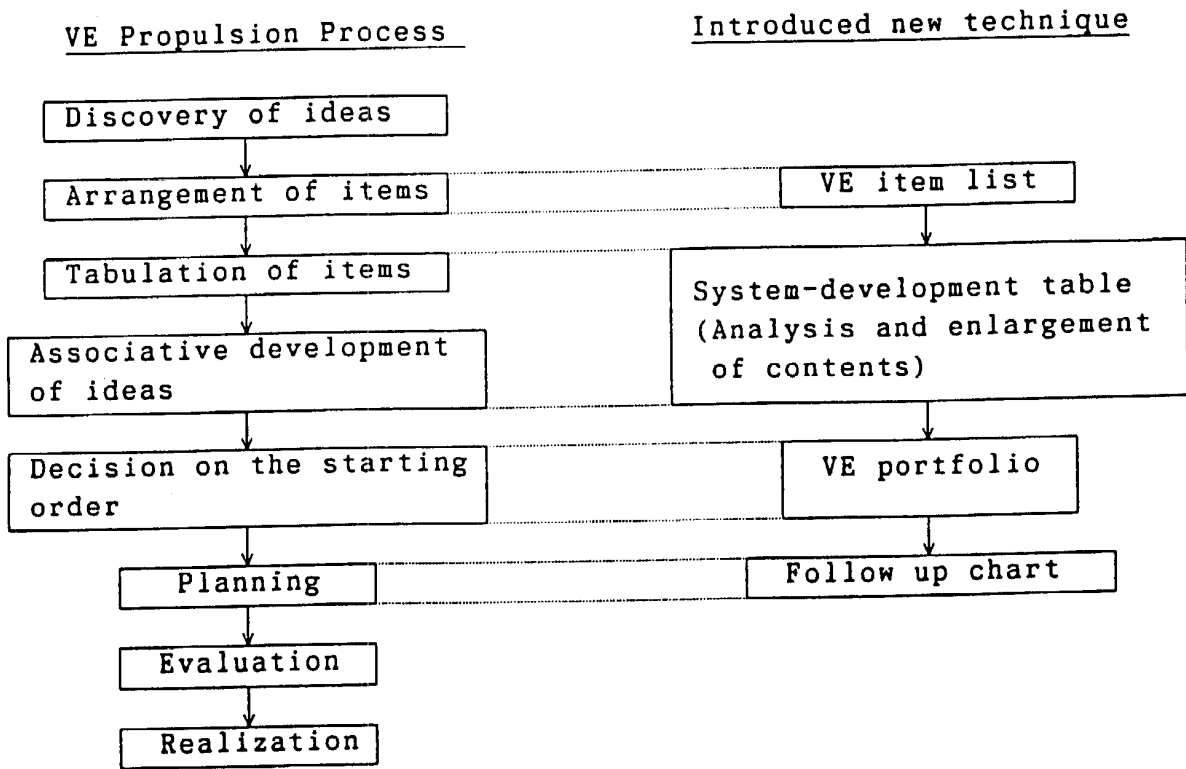


Figure 2 VE propulsion step

To arrange these items in order, a quality-function development table (an orthogonal two-way layout table) was applied to these items, and we introduced the VE item system-development table. We can classify these items according to the function unit and

component unit groups in this development table. This provides easier associative development of ideas and mutual clarified relation of the items in the VE application level development process. (Table 1)

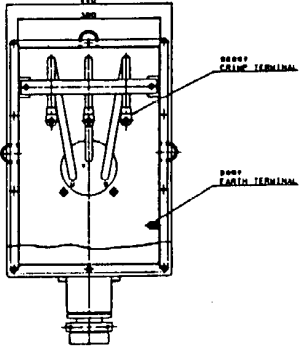
D. Terminal Box				Parts name	1. Main terminal box										
	Fin frame type — Horizontal (SH) Vertical (SV)		VE ITEM Modifying the application of low-voltage terminal box Modifying the application of high-voltage terminal box Shortening the dimension of standard terminal box Simplifying the formation Modifying the welding method Decreasing the number of lock nuts Discounting the cleat Discounting the terminal middle base Unifying the specifications of the drilling holes	Code No	1	2	3	4	5	6	7	8	9		
	Top-hat type — Horizontal (TH) Vertical (TV)				Classification of motor type	SH SV	SH SV	SH SV	SH SV	SH SV	SH SV	SH SV	SH SV	SH SV	SH SV
	Difficulty Easy — Middle — Hard Effect Small — Middle — Large Point 1 — 2 — 3 — 4 — 5 Weight				Degree of correlation Strong Medium Weak No relation Blank ◎ ○ △	TH TV	TH TV	TH TV	TH TV	TH TV	TH TV	TH TV	TH TV	TH TV	TH TV
VE application-level development				Motor type Weight Difficulty Effect	2	2	2	2	2	3	3	3	3		
Lowering the material expenses	Lowering the material unit cost	Improving purchase -policy	Overseas purchase												
		Improving the purchase cost	Two-route purchase												
		Improving the purchase -method	Purchase cost down												
		Changing materials	Collective purchasing												
		Using the standard -component material	Substitution, the alternative material												
	Saving the amount of material usage	Modifying the manufacturing process	Material on the market, stock parts												
		Modifying the machining process													
		Diminishing the amount or number of material unit				◎									
		Discontinuing or omitting									◎	◎			
		Improving the yielding rate						◎							
Lowering the machining cost	Revision manufacturing plan	Lowering the defect rate					△								
		Improving the machining method	Sheeting, welding, cutting			○	◎	◎	◎	△					
		Modifying the treatment process	Surface treatment, heat treatment										◎		
		Changing the dimensional tolerance													
	Preparing the cost table	Modifying the manufacturing process											○		
		Estimating the standard man-hour													
		Improving the estimation method													
	Ordering the optimum	Avoiding the extra order amount													
		Ordering the collective amount													
		Lowering the setting-up man-hour													
Lowering the net man-hour	Modifying the machining and assembly process														
	Modifying for easier material handling														
	Shortening the material handling time	Diminishing the waiting time													
Lowering the administrative expenses	Shortening the design time	Standardizing		◎	◎	△	△			○	○	◎			
		Register in 12-code CAD system													
	Lowering the material control cost	Improving the material administration		△	△										
Rationalizing the acceptance inspection								○							

Table 1 VE item system-development table

Format of VE item system-development table

Head listings:

(a) Grouping and encoding of items:

Large group : Classified according to the function unit. (with A,B,C ..)

Medium group: Classified according to the component unit. (with 1,2,3,....)

Small group : Classified according to each VE item. (with 1,2,3,.....)

The classified items are numbered in order of group size (e.9., A-1-1, D-1-2, etc.) and are entered in the code number space. These encoded characters are available later for the item directory in the PC reference-tabulation system.

(b) Classification of motor type

The corresponding motor-types to which the item belongs are indicated using motor-type codes.

(c) Weight

The difficulty and effect of each item is classified in five steps, which are explained in the following paragraph VE portfolio.

Left Listings

The VE application Level development in these listings contains the application points available for the VE activity, i.e. these contents can be used as an important point for proceeding with the VE activity. They can also be used when searching the intended section to cooperate with for material supply, machining and assembly, and production management and delivery sections.

Application of the table

The blank space is to be marked with the following symbol according to the degree of the correlation between VE items (at the upper side of this table) and the application point (at the left side of this table).

Degree of correlation:

Strong	-	double circle
Medium	-	single circle
Weak	-	triangle
No-relation	-	Blank.

Comparing these marked lines with each other, we can pay attention to the frequently marked lines, which indicate the important VE application point.

In the case of Terminal Box in Table, for example, these frequently marked lines indicate the points, i.e. Lowering the machining cost, Improving the machining method, Lowering the administrative expenses and Standardizing. Then the realization of the VE item, e.g. Terminal Box, can be implemented based on the following points.

Improvement of manufacturing:

Modifying the material trimming and the method of welding.

Standardization:

Changing the current manufacturing oriented standardization into the customer or user-oriented standardization. (For this, ideas are further developed in detail).

VE portfolio; The starting item order is then determined based on the degree of difficulty and effect to realize each item arranged in the VE item system development table.

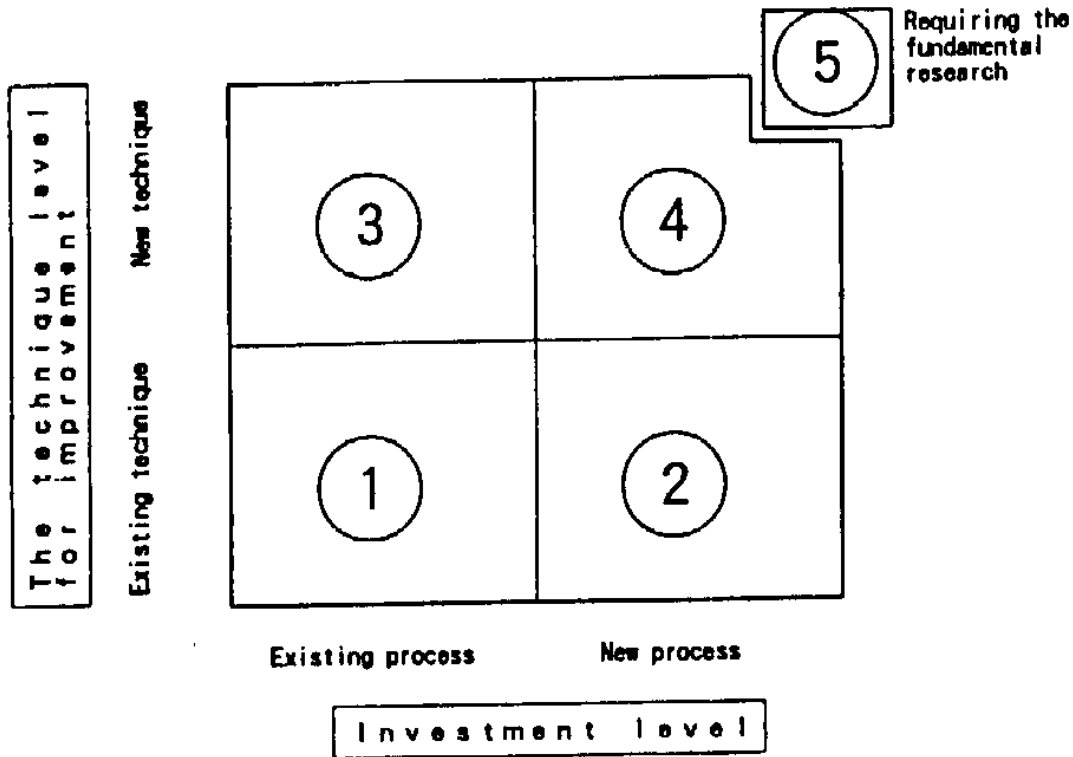


Figure 4 The degree of "Difficulty"

Vertical direction

The vertical line indicates the degree of difficulty in realizing the VE item. The degree of difficulty is measured by actual criteria, such as the technique level, the investment level, the evaluation time (length) and other levels required for improvement. In this case the degree of difficulty is determined by the correlation between the technical level and the investment level required for improvement as shown in Fig. 4.

These correlated levels are divided into five-degree zones. For example, the realization of the item requires the existing technique and existing process, this item belongs to level 1 zone. When it requires new techniques and new process, the item belongs to level 3 zone and when it requires fundamental research, it belongs to level 5 zone. Thus the degree of difficulty can be determined.

Horizontal direction

The horizontal line is used to indicate the amount of effective profit (thousand yen/ month).

This scale is divided into five sections to indicate the degree of profit.

Application Method

According to the determined degree of difficulty and profit, the Item No. should be plotted in the appropriate zone. Each zone has different meanings as follows.

A zoneThe most significant zone. The items should be worked on at once

B zoneThe zone for profiting with VE effective in quantity. All items should be promoted to be realized.

C zoneItems near A zone are possibly effective. The items distant from A zone are considered merely as data in a data bank.

D zoneTo be considered as a data bank zone. The items will be useful for O-Look VE and Ist-Look VE for new products or model changes. At first we should pay attention to the A zone, where items are most useful, because they can be realized easily and furthermore are expected to be very profitable.

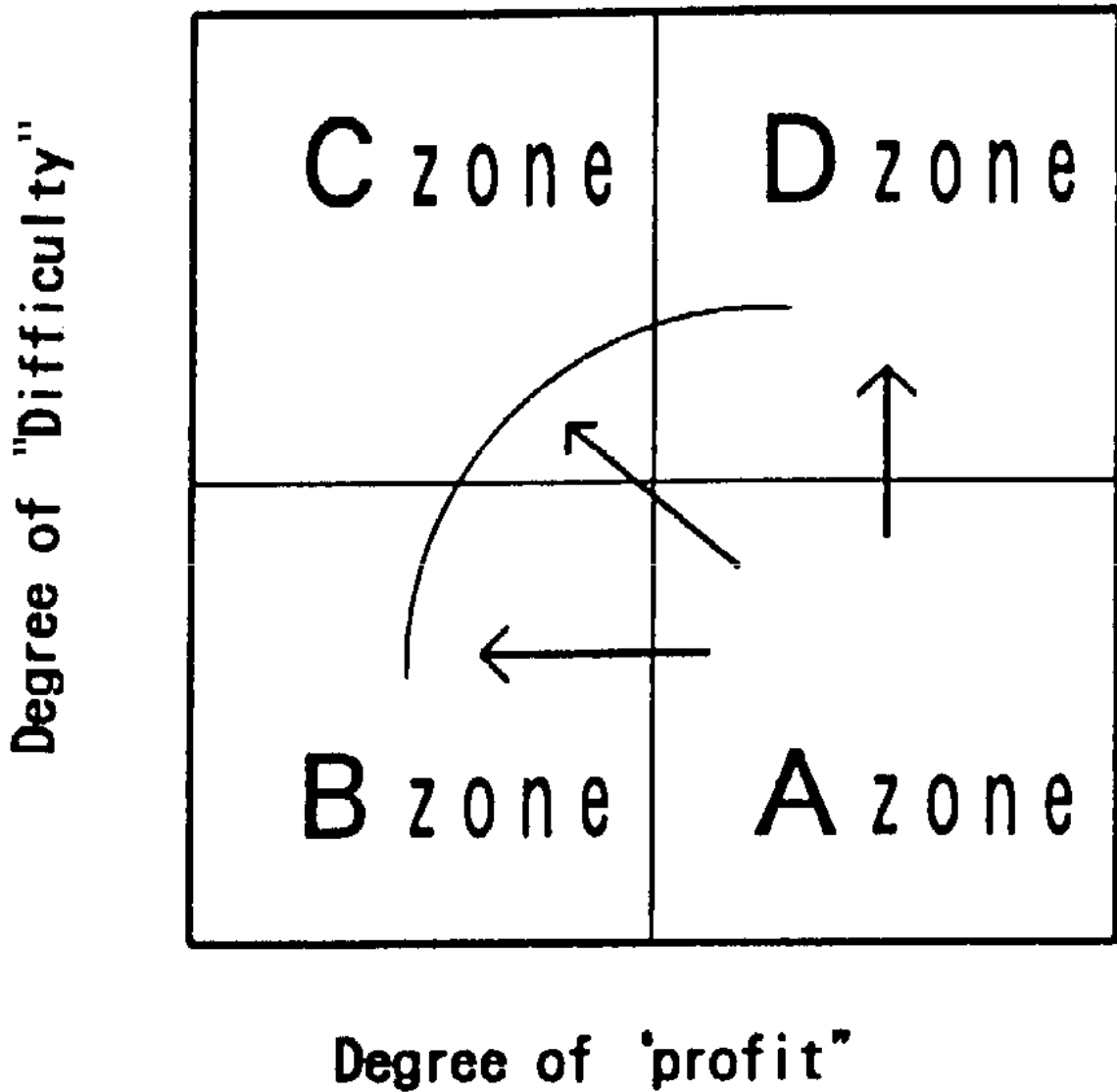


Figure 5 Degrees of "Profit". Four zones

Thus, we should begin working on the items in the A zone (fig. 3) and enlarging these treated zones in sequence as shown in Fig.5. Thus, all items (figures) in Fig. 3 should be checked one by one according to the following three action steps:

Start evaluation: Simply circle the figure (e.g. 7 as circled 7).

Implement: Ready to be implemented after evaluation. Shade the circle of the figure as implemented (e.g. circled 7 as circled

7).

Don't adopt: Negatively evaluated items (figures) must be crossed out [e.g. 44 (crossed out)].

Follow-up chart: The item code numbers and their schedules are entered on the VE follow-up chart and can be checked according to the sequential order arranged in the above steps.

Item No	Code No	Item	Contents	Charge name	Schedule & Sum of VA						Sum in the first half
					Apr.	May	Jun	Jul	Aug	Spt.	
81	D-1-1	Modifying the application of low voltage Terminal Box	Expanding the application of low voltage Terminal Box	M. Y	200	200	200				600
82	D-1-2	Modifying the application of High voltage Terminal Box	Expanding the application of low voltage Terminal Box	M. Y	1200	1200					2400
83	D-1-3	Shortening the measurements of standard-type Terminal Box	The height of Terminal Box 767 -- \blacktriangle 20%	Y. K	50	50	50				200
84	D-1-4	Simplyfing the formation	Change ridge of fitting face on stator frame for plane	Y. K	70	70					140
85	D-1-5	Modifying the weld-method	Butt welding fillet welding	Y. K	50	50	50				200

Plan/Estimate
Actual results

[The Apr.-Jul. time-frame represents such preliminary steps as Examine, Evaluate, Adjust, Drawing & Conclude.]

Table 2 Follow-up chart

The 2nd-Look VE technique resulted in effective profits as follows:

1. Discovered ideas are classified into functional unit groups and also component unit groups, and the associative development of ideas becomes easier with these classified items. At the same time, we can get inexhaustive ideas from this associative development of ideas.
2. Visualization of these processes provides reliable item control and follow-up checks, while all discovered ideas are verified and most of them become useful for VE realization.
3. Clarification of the starting order and the importance degree of items makes the VE activity more systematic than ever.
4. The VE item system-development table functions as a databank and provides a useful source to develop the O-Look VE and 1st-Look VE activities for the new type or next series products.

5. As we can find how these items are related with each other in an early stage, we can develop more detailed relationship with the VE activity related sections.

CONCLUSION

As already mentioned, the 2nd-Look VE is usually considered not to be as profitable as the O-Look or 1st-Look for planning and development. But now we are certain that the 2nd-Look VE is essential for mature products to maintain their profitable and productive manufacture. We will continue to improve these practical VE activities and hope that we will receive valuable advice from many people concerned to help us create a more complete technique.

REFERENCES

1. SJVE Research Report, Vols. 19 & 20
2. Yasuo Ishimatu, "Cost Control and Cost Improvement for Design/ Manufacturing Groups", Nikkan Kogyo Press.