

VALUE ANALYSIS AT HITACHI, LIMITED

1. History

Hitachi, Ltd. adopted value analysis (hereinafter abbreviated to VA) around 1960, the year that VA was introduced in Japan. Ever since, Hitachi has been utilizing it as a tool to secure and raise profits

Over the past several years, the total sum contributed from the results of VA has exceeded 1.5% of Hitachi's total sales.

These results were produced as a result of activities to attain the respective objectives of VA for every term end at about 30 Hitachi works.

The reason why Hitachi VA has become active today, producing intensive effects, is not only because it is used as a management tool, but also because it is used for management improvement, which adheres to true management.

On originally introducing VA, a diffusion of VA-mindedness and VA methods instruction to employees (especially to designers) was initiated for the application of VA to parts by several employees in the materials Department. The feature of the

class was not lecture-type instruction, and actual parts and products were always used as objects. Rather than verbal communications by adopting workshop-type instruction, enlightenment was performed so as to keenly feel with the body.

Subsequently, under the understanding of designers and works managerial staff, VA was shifted to activity aiming at cost down of overall products, and the sum of money saved thereby was gradually increased.

Thus, VA which largely effected cost down was adopted on a full scale as an effective method of profit improvement activity of each works. That is, at Hitachi, a self-supporting accounting system is adopted for each works, and each works manager is obligated to maintain profit of the works. Consequently, many reform activities were conducted to improve profits; however, improvements such as VA, in which its effect was directly observed, did not appear. To attain this objective, a cost down program was organized for each product, and under this program, VA was performed for each product, and the final objective was tied in with

an improvements of profits in each works. This commanded the extremely interest of works managers who are responsible for profitability of the works, so the VA group was formed with the combined efforts of value analysts belonging to several sections of Hitachi, forming a project team for improving profits in each works, and the team fulfilled those expectations. With these operations, VA perfectly laid the foundation as a method of improving management.

Thus, VA became an authorized activity at Hitachi, members of the value analyst staff were increased, and an exclusive post for VA was established in almost all Hitachi works. Together with this fact,\* the VA Promotion Center was organized at the Hitachi Head Office, and members were replenished; working conditions were prepared to respond to the help requisitions of each works, and an independent consultant group was formed.

After that, many projects were planned and achieved. However, recently, changes in <sup>the</sup> economic situation and the improvement of scientific technology rapidly increased, causing the life-cycle of products to be shortened; thus, it was considered effective for ultimately

\* VA GROUP INCLUDES THE VA PROMOTION CENTER AND EACH DEPARTMENT IN CHARGE OF VA IN WORKS.

improving company profits that respective products be manufactured substantially strong, rather than considering the overall situation of the works itself. Consequently, the theme of VA activity was gradually shifted to improving the make-up of each product.

Product make-up can be interpreted to consist of three important elements; that is, cost, delivery schedule, and quality. The objects of VA was required to include shortening the delivery schedule, improve defective quality, and so on--instead of being limited to the conventional cost reduction study.

These days, the objective ranges of VA are spread out not only to include product cost, and an improvement of function of parts, but also VA of peripheral costs; that is, transportation costs, packing costs, production facilities, and VA of softwares such as the flow of business and processing.

At present, owing to increased labor cost and raw materials cost, the rise of procured material cost

is the biggest obstacle to enterprise earnings; thus, we are exerting efforts to the VA of procured material costs, by returning to the start point.

## 2. Effects of VA activities

In each Hitachi works, an exclusive VA group is established and VA is always effected in that works. As to results, at the beginning of the fiscal year, VA programs for that fiscal year and the anticipated sum which will be generated from VA are generally registered at the Head Office, and works activity is continued to attain these objectives.

This effective sum is peculiar to each works, the same as its different product types and production system; however, it fluctuates from 0.6% to 4.0% of total sales. However, when totaling the effects of Hitachi overall, the average is around 1.7% against Hitachi's gross sales.

This amount was increased the past several years; however, recently, there has been a tendency for it to level off.

### 3. Organization of VA

Initially, VA was introduced through the Materials Department. Consequently, value analysts are assigned to the Materials Department of most all of our works. At present, total personnel are 125, this number representing only 0.1% of Hitachi's entire employees. Approximately 1-5 persons are distributed to one works; the average number is 3 persons.

These specialists are now working as planners and operators of the VA Task Force Project (hereinafter abbreviated to TFP), and as consultants for buyers of the Materials Department and designers. Further, they are engaged in follow-up on the results of TFP activities, acquisition of various information, dissemination of that information, correlating data of cost tables, and so on.

They are chosen from designers, industrial engineers, and purchasers of materials in works; 60% of the 125 persons are engineers.

The average experience constitutes only around four years; however, the oldest employee has 12 years' experience.

As staff organizations, the Hitachi Head Office maintains an Accounting Department, Materials Department, Technical Administration Dept., Business System & Data Processing Dept., Personnel & Education Dept., Administration Dept., and so on; however, the VA Promotion Center was organized in the Materials Department.

In the VA Promotion Center, approximately 20 persons are assigned and engaged in the business of coordination, training, analysis, and development of VA activities.

Coordination activities include totaling of the aforementioned VA result estimates of each works and follow-up, issuing reports to the management staff, and monitoring to attain the sum of effects.

In analytic activities, analysts in the VA Promotion Center are divided into a team composed of 3 to 4 analysts who are effecting analysis together with works members for two or three months on full time, staying in the works to assist works project activities. This assistance activity has been continuing for five years, and 25 projects were settled over the recent past year and a half. The

number of personnel and the period changes according to the objective project scale. Since the team is allotted different products each time, team personnel become specialists who are well versed in various information.

Development and research activities include gathering information outside the company and modifying it into forms usable inside Hitachi works, or staff members introduce papers and so on, contributing to the effective advance of the activity.

The Information Center is located in the VA Promotion Center, where its staff members gather new information from suppliers of parts and materials, and distribute the facts to each works in the form of printed leaflets.

Connections between VA specialists dispatched to various works are performed through periodic meetings for exchanging information by forming five groups of similar production systems.

#### 4. Training

Training plans aimed at Hitachi's overall employees are established in the Personnel and Education Dept. and enforced by this department.

In those courses, instructions for fundamental consideration of VA are included.

Instructions carried out by the VA are mainly issued to VA specialists, and a type of 4- to 5-day workshop seminar is adopted. (Refer to the separate table for contents).

5. Fundamental steps of VA

The fundamental steps of Hitachi VA are divided into the following eight procedures:

- a. Selection of objective
- b. Cost analysis
- c. Function definition
- d. Investigation
- e. Creation phase
- f. Evaluation phase
- g. Assurance phase
- h. Recommendation and follow-ups
- a. Selection of objectives

The object of a project is selected by the factory manager, the Design Section head, and so forth, considering the profit and loss of products and future circumstances. Especially,

at present, plans are established by setting the timing of model changes or new models.

In order to prevent any loss in production, the works for ordering production system will adopt as an objective of VA orders such as those that supposedly go into the red on an advanced comparison between the order amount and the expected manufacturing cost.

Not only the product profit and loss, but also as a means of improving profits for overall sections of the works, a project (integrated system) is adopted as one of the recent features.

Regarding small projects, sometimes they are organized by adopting common parts.

b. Cost analysis"

Contents of production costs are divided into material costs and labor costs; regarding labor costs, they are analyzed by dividing them into man-hours of each manufacturing process.

Also regarding material costs, not only raw materials but also processed parts, assembled parts, and all purchased materials are included. Thus, other than raw materials,

all parts are divided into material costs and production costs to attain detailed costs of purchased materials. Moreover, contents of costs if secondary subcontractors may be pursued if deemed necessary.

Regarding the others, we are now studying transportation costs, packing costs, installation costs, and so forth which are excluded from production costs under the concept that their contents should be analyzed in detail.

c. Function definition

Regarding the understanding of the function of an object, it is limited only to a range where the function can be grasped, and we do not extend it to fundamentals or to a universal expression. The reason is due to the complexity of Japanese terms. If we adhere to the expressing method, too much time is lost and should it entail much trouble, it does not relate to acquisition of unique ideas; thus, we judged it ineffective.

d. Investigation

This is mainly performed for market research and investigation at Hitachi's group of works. Since there are many works and different quality products are manufactured, a considerable amount of various information can be collected. For information concerning other companies of the same trade, purchase of electric apparatus for domestic use is possible; however, regarding other products, collection is difficult, and also, market research for foreign countries is not especially performed.

e. Creation phase

A brainstorming method is mainly adopted, and regarding other methods, they may occasionally be used when necessary.

f. Evaluation phase

This is a step to embody thought-out ideas among two or three groups, after dividing ideas into every function. Moreover, after performing detailed information collection, cost calculation is effected and drawings are made when required.

Adoption or rejection of embodied suggestions is determined after evaluation of each manager and head of the production line in charging the design, material, production, inspection, and so on.

f. Assurance phase

Judgment as to whether or not adopted suggestions can be technically feasible is made after testing a model. Consequently, in many cases, tests are performed after a long time has passed; thus, <sup>the</sup> assurance phase is actually entrusted to the Inspection Department on the line, since there is no special testing function in the VA group in each work.

g. Recommendations and follow-ups

Suggestion papers are prepared and submitted in a step to obtain evaluation. In the suggestion paper, the sum to be reduced and modification contents before and after VA are entered; when accepting a suggestion by the line, drawings are corrected according to these suggestion contents.

In many cases, actual modifications are completed after six months to one year from the date a VA suggestion was applied, and follow-ups are performed periodically during these periods for conditions of adopted modifications by VA specialists.

Concerning large projects, planning papers for follow-up are specially prepared according to a time series, and according to this paper, overall progressing conditions are followed up.

6. Task force projects

One of features of Hitachi's VA is VA activity by the TFP. Large projects are always completed by utilizing this TFP.

The organization of a TFP team consists of 10~20 persons, the members consisting of a designer in charge, production engineer, production line staff, inspector, material purchaser, value analyst, and so forth. Occasionally a designer unrelated to a particular product is added. Moreover, these members are divided into full-time members and part-time members who join the task when necessary.

Full-time members are almost entirely separated from their present jobs for one to two months, becoming VA specialists. The other members work about  $1/3 \sim 1/4$  of the entire planned days.

Before initiating TFP, several VA specialists and designers in charge prepare drawings, the product, cost data, and so on to rationally effect the operation. Especially, regarding the cost data for purchased materials, it is unnecessary to designate vendors to prepare data about one month before starting operations.

The first several days of a project schedule are used to explain data and product functions. Subsequently, concept of an idea is introduced, and after that a rough arrangement is performed; then information is collected to discuss the possibility of this idea. After the introduction of an idea, the same operation is not performed by all members at the same time. Some of them investigate the actual conditions of vendors, while some of them reinvestigate the factory manufacturing site; that is, they function separately.

When the respective work division receives an outline of conclusion, evaluation is reperformed, and a suggestion paper for final conclusion is prepared.

Schedules and methods largely differ according to the types of products and the project scale; however, rough procedures are the same as already mentioned.

The objective is given to a team according to reducing the rate of manufacturing costs, the rate ranging from 5% to 50%.

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)

Production Engineering and VA

While most Hitachi communication equipment is delivered to the Nippon Telegraph & Telephone Public Corporation, the specifications and drawings thereof are not easy to change since these are placed under strict control of the Public Corporation.

Consequently, Hitachi is making an effort to achieve cost reduction while giving priority to the following:

2

- (1) Improvement of work methods .
- (2) Reduction of purchase prices ,

Regarding item (1), cooperation of production engineers is required.

Thus, please supply answers to the following questions as to activities of the production Engineering Dept. and VA activities at your company:

- (1) How is the Production Engineering Dept. organized in your company and what are the contents of respective functions?
- (2) Whether or not an organization or system is established to support the Production Engineering Dept. in the factory.

For example, is such function included in the functions of the Head Office or Bell Laboratory?

(3) Mainly regarding the occupational engineers and entry engineers among the production engineers, please indicate the details<sup>of</sup> their daily operations, and their time allocation.

(4) Is the result of rationalization achieved by the company's production engineering applied to the Production Dept. of the vender as well?

(Note: In Hitachi, a part of manufacturing operations is performed by subcontractors which are the so-called venders herein, to decrease<sup>the</sup> work load.)

(5) Are there any examples of VA proposals adopted regarding changes of designs and drawings?

think

(6) At what phase among production phases is VA operation performed?

(7) What function do the production engineers perform in VA operation?

(8) With what phase of VA operation is the Bell Laboratory related?

(9) By what means is information regarding production engineering and purchasing exchanged among factories?

5

✓

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)  
RELATION BETWEEN STANDARDIZATION AND VA

(1) Regarding products of intermittent productions, or made to order, if no standardization is effected simultaneously with VA operation, it is very difficult for the enterprise on the whole to expect cost reduction. In VA proposals, on the other hand, it is often recommended to use special parts and materials to achieve cost reduction of the object, which causes the counter effect to standardization.

We would like to know how your company copes with such a contradiction.

If possible, please indicate related examples and procedures.

(2) How is information exchanged between the standardization expediting group and the VA group?

(3) Are there examples in which the standardization expediting group and the VA group jointly conduct projects of cost reduction etc.?

(4) If there are examples of the above, please explain how to measure the effect in these case, evaluation items, project management, and so on.

Std  
Profit Maker

eyelet  
Telextron  
Packaging

clock  
Packaging  
\$10,000,000  
\$34  
2

\$300,000

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)  
RELATION BETWEEN QUALITY ASSURANCE AND VA



(1) Explain under what system evaluation is made--in your company--on the qualities of parts and materials manufactured for trial according to VA proposals, or parts and materials procured as a result of market research through VA activities etc.

*Manufacturer*

(2) Regarding parts and materials purchased outside, what department executes the qualification and acceptance inspection?

*Regulator*

(3) It is difficult to previously estimate the amount of new parts and materials found as a result of VA. In case a large amount of these parts and materials is brought to the Qualification Test Dept. all at once, it takes a long time to complete evaluation, resulting in delay in manifesting the effect of VA or achieving cost reduction.

Is there any method to solve the above problems?

(4) How is the Quality Assurance Dept. participating in the VA project?

(5) In case of the VA project, what department is to plan--at what phase--the test schedule and test items according to the proposal?

*Pay extra  
to get new  
turn  
(med)*

5 ✓

Inspection  
by vendor

(6) The fact is that Hitachi so far has not been very eager to reduce inspection man-hours in the VA project for fear that reduced inspection man-hours involves the risk of lowered quality.

If your company has examples of achieving decreased inspection man-hours VA technique, while solving the above problem at the same time, we would like to know about them.

(7) In your company, is the cost incurred by the customer through use of products furnished by us (e.g., running cost and maintenance cost) taken as a part of the denominator (or cost) in the following formula?

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

More in to  
less Risk

(8) VA makes a thorough investigation of functions. As a result, the designer is forced to incur a risk of lowered quality and reliability.

Is there any measure for minimizing this risk?

6  
Both

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II).

HOW TO PROCEED WITH VA AT THE R & D PHASE

function  
market info

(1) When conducting VA at the R & D phase, at what stage of the R & D phase is it conducted?

For example, when completing the 1st design, when completing trial product, or when completing production drawings.

not  
assit-req  
meet-need

(2) When conducting VA at the R & D phase, how is the amount of cost reduction calculated?

may  
accelerate

(3) Execution of VA at the R & D phase causes delay in the production release time. What is a solution for this?

Thinking system

(4) When conducting VA at the R & D phase, are there any particular techniques employed?

(5) Is it obliged to perform VA at the R & D phase with certainty for any product?

no

(6) When conducting VA at the R & D phase, what is taken into consideration?

function  
selling price

(7) At what stage of the R & D phase is cost examined?

At start

(8) When receiving an order for a trial product, specifications changes are made many times by the customer. Are there cases of performing VA on such an article on order?

7 Both

(9) Regarding VA at the R & D phase, what department executes project management of VA?

functional study  
function cost

(10) Regarding VA at the R & D phase, what method is used for functional analysis?

(11) Regarding VA at the R & D phase, what method is used to evaluate an idea formed at the creative phase of the VA project?

(12) When setting the target cost of a product, is the target cost broken down to the level of subassembly or module?

use  
Books

functional  
assembly -  
Pages 47-49

(13) When breaking down the target cost in (12) above, how is the target cost of subassemblies or modules determined?

(14) Prior to releasing drawings to the production shop, design review is usually performed. Does the VA group participate in this case?

(15) In what formality is design review in the above item (14) conducted--e.g., committee meeting, temporary meeting called by the design department, or preliminary meeting of individuals?

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)

HOW TO EXECUTE VA ON PRODUCTS OF INTERMITTENT MANUFACTURING,  
OR PRODUCTION

- (1) Is functional analysis conducted on a complete set or a complete system?
- (2) How is evaluation performed on the appearance, maintenance, and reliability in (1) above?
- (3) What types of techniques are employed in functional analysis?
- (4) Is the VA schedule on the product definitely entered in the project schedule thereof?
- (5) What department makes the project schedule of the product in (4) above?
- (6) At what phase of the project is the project schedule to be set up in (4) above?
- (7) In case VA proposals are conducted stepwise instead of being adopted simultaneously, it becomes very difficult to acquire a grasp of the actual amount of cost reduction. Is there any adequate countermeasure for this?

✓  
 Be sure  
 cost  
 &  
 performance  
 handled  
 right from  
 start

- (8) Regarding products of intermittent production, or made to order, there is--in many cases--no allocation of time or expenditure necessary to examine VA proposals by trial manufacture and testing. IS THERE ANY ADEQUATE SOLUTION FOR THIS ?

PRODUCTION ENGINEERING AND VA

- (1) Which do you manufacture--standard products or products made to order?
- (2) What is the production quantity per month; of each product (minimum, average, maximum)?
- (3) Do customers require you to reduce prices periodically?
- (4) In the above case (3), do you reduce prices as a result of cost reduction by means of VA and so on?
- (5) In item (4), do customers participate in the VA project concerned?
- (6) How is the Production Engineering Department organized in your company, and what are its missions?
- (7) Is an organization or system established to support the Production Engineering Dept. in the factory? For example, is such a function included in the functions of the Head Office or laboratory?
- (8) Is the result of rationalization achieved by the company's production engineering applied to the Production Department of subcontractors as well?  
(Note: In Hitachi, a part of manufacturing operations is performed by subcontractors.)
- (9) What function do the production engineers perform in VA operation?

QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)

ARTISTIC DESIGN COST AND FUNCTIONAL COST

*MKTG Group*  
*Product Planner*

*TV Push*  
*Push knob*

- (1) How is functional evaluation effected on artistic design?.
- (2) Is allocation of cost accountability (allocation of target cost) applied to the Function Design Dept. and the Artistic Design Dept., or is allocation of cost reduction in the VA project applied to each Dept?
- (3) If the answer to the above question is "yes", please explain it by specific examples.

*Reling examples -*

- (4) *12. own and des*  
What basis is used for the allocation of function cost and artistic design cost?

*Develop customer automobiles*

- (5) *Red painter knob*  
In what manner does the VA group have a bearing on (4) above?

*Prod Planning -*

- (6) People of what departments participate in artistic design determination?

*all along -*

- (7) At what phase of the product cycle is the artistic design determined?

*He is a part of the MKTG group which initiates and/or sells the product*

- (8) Prior to artistic design planning, is briefing on the product function and cost made to the person in charge of artistic design planning?

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QUESTIONNAIRE RELATING TO VALUE ANALYSIS (VA) (PART II)

HOW TO PERFORM VA IN THE APPARATUS INDUSTRY

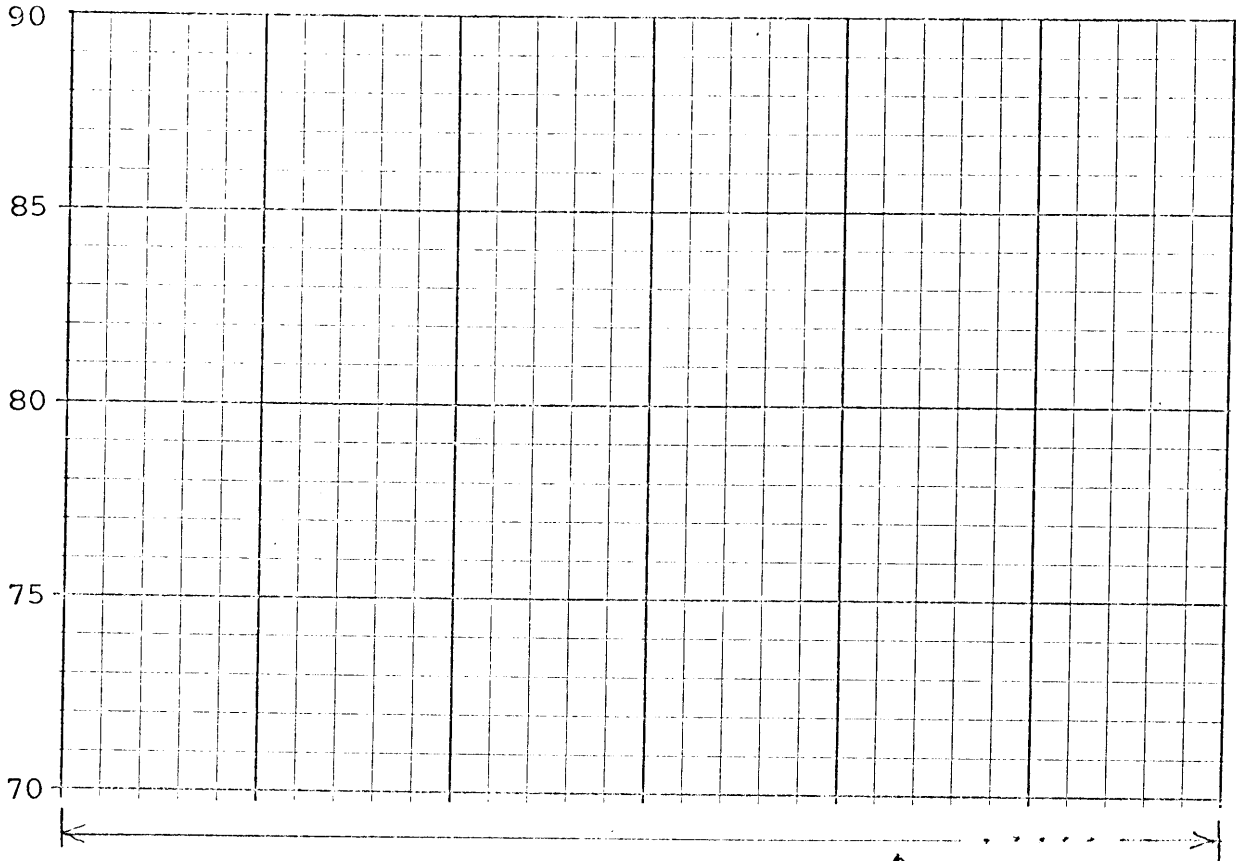
- (1) What kind of measures do you use in estimating results of VA in wafer processing steps such as diffusion and photoengraving? For example, quantity of processed wafers per head, term or cycle necessary for obtaining finished pellets from starting wafers, the rate of operation of apparatus (e.g. diffusion furnaces).
- (2) Is VA also applied to purchased equipment, auxiliary furnishings, jigs and tools?
- (3) Please describe the system of VA your company uses. Especially, how do you cooperate with people in the division of production engineering?

Should be usually is not

The most favorable, yet practical, quantity

↓

LESS  
 the  
 least  
 favorable  
 yet  
 acceptable  
 quantity



↓

←  →

Yields the R A N G E O F C H O I C E

Benefits							Relative value ↓
WEIGHTS							
Choices							

The COMBINEX Scoreboard: Use either as matrix or submatrix

VA ACTIVITIES AT HITACHI, LTD. (PART-I)

1. Outline of Business

Refer to the Hitachi Annual Report.

2. Organization concerning VA

Refer to Value Analysis at Hitachi, Ltd.

3. Full-time VA Members (at the entire Hitachi, Ltd. in 1972)

Full-time VA members referred to herein are those engaged only in VA operations.

(1) Number of full-time VA members	141
Head office	18
Works	123

(2) Ratio of full-time VA members to indirect laborers	0.3%
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(3) Position of the Chief, VA group

Head office	Equal rank to Material Dept. assistant general manager
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Works	Mostly Foreman
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Several are section managers

(4) Numbers of full-time VA group members

Head office	18
Works	Each works 1 to 5 (Average 3.8 men)

(5) Average age of full-time VA members

Head office and works	20 to 48 years (Average 31 years)
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(6) Professional background of full-time VA members

Purchasing	46%
Design	40
Industrial engineering	14

(7) Speciality of full-time VA members

Engineers	58%
Clerks	42

(8) Number of years of VA activities experience by full-time VA members

Head office and works	1 to 12 years (Average about 4 years)
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(9) Functions of full-time VA members

The VA Dept. is a staff department and is to do no more than to advance proposals or give advice to line departments.

(10) Full-time VA members are granted no special favors or treatment.

(11) VA engineers so far have no business relations with so-called system engineers who design systems such as a production control system.

4. Amount of Cost Reduction Achieved through VA

(by overall Hitachi, Ltd. in 1972)

(1) Amount of cost reduction achieved through VA

Million \$4.15/month

(2) Ratio of amount of cost reduction achieved through VA to sales

1.7%

(3) Amount of cost reduction through VA is also appropriated in the budget for each term.

(4) The Material Dept. of a works prepares the estimated amount of cost reduction through VA after effecting adjustment by mutual agreement with the Design Dept. and submits it to the work general manager for approval.

5. VA Operation

(1) Criteria for selecting objects of VA operation are described below:

1. A product which has great weight in output and makes a small profit or goes into the red.

2. A product whose output is expected to grow in the future, though presently small.

3. A product whose selling price will have to be lowered in anticipation of decrease in competitive prices, and which is large in output.
  4. A product in the R & D phase which is expected to grow in sales in the future.
- (2) An object of VA operation is determined by the following procedures.

1. Where support of VA Promotion Center, Head Office is needed:

The Material Dept. general manager in a concerned works selects an object after effecting adjustment by mutual agreement with the Design Dept. general manager, which is approved by the work's general manager. Then, adjustment is made on the matter by mutual agreement between the work's general manager and the general manager of VA Promotion Center, Head Office. While considering the relations with objects of VA operation in other works, the General Manager of VA Promotion Center examines and decides on whether or not VA members of the Head Office are to participate in VA operation of the concerned product, and

submits his decision for approval to the Material Dept. General Manager, Head Office and the executive managing director in charge.

2. Where VA operation is performed in the concerned works:

The Material Dept. general manager in the works selects an object after effecting adjustment by mutual agreement with the Design Dept. general manager. The work's general manager makes a decision on the object after full deliberation at a council of general managers.

- (3) VA operations by task force (When support is effected by Head Office VA members)

1. Number of VA operations

Average 16 operations/year

2. Number of members participating in one operation

Head Office VA member                    3 - 4 men

Members from the works                Varies according  
to the project size

3. Period of a project                    Average 2 months

4. Regarding persons participating in a project, those other than VA members also work on a full-time basis. This is especially true of Design Dept. personnel.

5. Number of days necessary for each step of VA

(Example)

	Radio	Radio com- munications equipment	Digital equipment
a.	Cost analysis	1 week	1 week
b.	Function evaluation	2 weeks	2 weeks
c.	Investigation (inform- ation included)	1 week	2 weeks
d.	Creation	1 week	1 week
e.	Evaluation and assurance	2 weeks	2 weeks
f.	Recommendation	1 week	1 week

6. Persons other than VA members who participate in VA projects:

Design engineers (electrical and mechanical)

Industrial engineers (or production engineers)

Quality assurance engineers\* , *buyers*

- In certain cases, engineers indicated by an asterisk may not participate.

7. Regarding VA operations to be executed by the task force, the operations range from cost analysis to recommendations. Upon the completion of VA operations, those jobs at the follow-up phase including experiment, trial manufacture, and qualification test are performed by works line personnel as their daily duties.

- (4) VA operations without task force organized are frequently performed at the works from an independent standpoint.

In this case, VA operations are performed--by referring a matter to the conference as necessary--simultaneously with daily operations.

- (5) Regarding a product whose function is simple and understandable by any of the VA participants, a justifiable cost for each function is determined by calculating through a forced decision method after composing a function tree or FAST diagram.

Regarding a complicated product, its cost is determined mostly by the designer according<sup>to</sup> his experience or by referring to cost data of similar products manufactured in the past.

- (6) A FAST diagram is drawn up in most cases.
- (7) Where necessary, VA operations are also performed on a product in the production phase.
- (8) While the amount of cost reduction achieved through VA in the entire works constitutes a part of the work's budget, as previously mentioned, this is a sum of predicted amounts of cost reduction to be achieved through VA on respective products or parts.

- (9) A VA proposal is advanced by <sup>the</sup> work's Material Dept. general manager to the Design Dept. general manager concerned.
- (10) The concerned Design Dept. general manager is authorized to make a decision on adopting the advanced VA proposal after examining the contents.

6. Follow-up on How VA Proposals Are Effected

- (1) Neither a computer nor a business machine is used for follow-up on how control is to be effected over the revision of drawings according to the VA proposal or on how a VA proposal is to be conducted.

- (2), (3), and (4)

EDPS is partly employed for totaling the amounts of cost reduction through VA.

If possible, the amounts of cost reduction through VA are totaled when ordering parts and materials concerned; otherwise, totaling is effected when the actual manufacturing cost of the concerned product is summed up after completion of manufacture. EDPS is employed in the former case.

- (5) Follow-up on how an individual VA proposal is being conducted is performed by the concerned line department, while it is observed by the works' VA department.

Follow-up men are dispatched on occasion from the VA Promotion Center, Head Office to the works to investigate the status of how follow-up is being conducted in the works.

- (6) A report on the result of follow-up is submitted to the work's general manager and the Material Dept. General Manager, Head Office respectively.
- (7) No priority is usually given to a qualification test concerning VA.
- (8) On and from October 1973, the amounts of cost reduction through VA will be totaled, except for factors creating an increase in commodity prices and so on, by calculating through manual operation case by case.

#### 7. Training on VA

In addition to the following, training is given at each works where necessary.

- (1) There is no official or company-authorized qualification system regarding value analysts.
- (2) OJT (On the Job Training) is given to the value analyst.
- (3) Training through textbooks is given to the buyer as a part of the vocational training program (for 3 to 4 days).

- (4) Personnel of other departments (such as designers) undergo training in VA by participating in a VA project, which is actually OJT.
- (5) A one-week workshop seminar is held for section managers of subsidiary companies.

8. Relation Between Purchase Department and VA

- (1) Regarding VA operations, the buyers mainly obtain information such as estimates from vendors.
- (2) Buyers are instructed to make an effort to achieve cost reduction by utilizing VA technique in their daily business.

9. Venders and VA

The method of handling this theme varies depending on the individual works. Given below is an example:

- (1) There are Vendor VA Proposal Handling Regulations established as regulations for handling VA proposals submitted by vendors.

The Regulations are drawn up by the VA department of the concerned works and approved by the Material Dept. general manager.

- (2) A VA proposal submitted by a vendor is handled as follows:

1. There is no provision regarding VA in a contract made with a vendor. However, the aforementioned Vendor VA Proposal Handling Regulations are delivered to the major vendors.
2. Method of sharing the amount of cost reduction
  - a. Recurrent orders

When a VA proposal is spontaneously submitted by a vendor:

Vendor share	100%
Period	6 months

When a VA proposal is submitted jointly by Hitachi and a vendor:

Vendor share	100%
Period	3 months
  - b. Nonrecurrent orders

Vendor share	50%
--------------	-----
3. VA proposals by vendors are evaluated by the VA Dept., the Design Section manager concerned, and the Production Section manager concerned, and by the Production Engineering Section manager where necessary, and subsequently approved by the Material Dept. general manager.

4. When the orderer gains profits owing to a VA proposal by a vendor, merit awards are conferred on the vendor at the end of the fiscal year, who simultaneously is given priority on orders.
- (3) VA operations are performed jointly with the vendor in certain cases.
- (4) Regarding (3) above, VA operations are performed as follows:
  1. Hitachi personnel are dispatched to the vendor where necessary to perform VA operation at the vendor's factory.
  2. While VA operation is performed on all VA steps as a rule, it is not performed regularly as for a task force project at Hitachi.
  3. The amount of cost reduction is shared in the manner previously described.
  4. Regarding joint VA operations, information to be submitted by the vendor usually includes the following, although the content varies case by case:

Cost breakdown

Material and parts list

Manufacturing flow chart

Specifications

- (5) When receiving a request from the vendor for a price increase, the buyer advises the vendor to prevent increasing the price by performing VA operation jointly with Hitachi.

When a price increase can be minimized, the amount of cost reduction is shared with the vendor in the previously mentioned manner.

- (6), (7)

When modifications of parts, materials, shape, dimensions, and so on are required as a result of VA operation independently performed by the vendor, a VA proposal is submitted by the vendor. Then Hitachi makes a decision on adoption and approval according to the previously mentioned regulation.

- (8) When a VA proposal is approved by Hitachi, the vendor makes a test sample at his own expense and Hitachi tests it at the Company's expense.

#### 10. Cost Table

While a cost table (or value standard table) is made up at almost every works, the content differs according to the individual works.

Shown below is an example:

- (1) A cost table is made up jointly by VA engineers and buyers according to information obtained from the IE Dept. and the vendors.
- (2) Such a cost table is submitted for approval to the works Material Dept. general manager.
- (3) Shown below is an example of a cost table.
  1. Labor cost per hour (including indirect cost) vs. manufacturing process (e.g., lathing, press forming, molding, and so on)
  2. Standard time of each process
  3. Select guide for machine capacities against parts shape, dimensions, and raw materials
- (4) The cost table is utilized by the buyer when estimating costs of purchased parts. The cost table is also delivered to the Design Dept.
- (5) Maintenance of the cost table is effected once a year by VA engineers and buyers.

#### 11. Obtaining and Transmission of Information

- (1) While up-to-date information regarding parts, materials, and machining method is obtained mainly by the Design Dept. and the VA Dept., it is the VA Dept. that obtains the information as one of its official functions.

An information obtaining and transmission section is established in the VA Promotion Center, Head Office.

- (2) No investigation organs of subcontractors are used for obtaining information.
- (3) Samples and data obtained by the works are displayed in a reference room to designers and other personnel.

Information obtained by the Head Office is delivered as a report to the VA Depts. of respective works.

- (4) Information is exchanged among factories in a manner that works similar in their type of industry hold conferences sponsored by the VA Promotion Center, Head Office.

(See page 8, Value Analysis at Hitachi, Ltd.)

- (5) A VA report is issued by the Head Office and delivered to the VA Depts. of respective works, so that VA experience on a given product may be applied to other products.

Case of VA operations are illustrated in the VA report.

- (6) While VA report retrieval is manually effected at present, it will be shifted to a card select system in the near future.

12. Miscellaneous

- (1) VA expenditure allocated to a task force project is set as a tentative target at one-tenth the amount of cost reduction anticipated for one year.
- (2) In many cases, the IE and QC Depts. and others participate in the task force project as full-time or part-time members.

In particular cases of products which are placed under rigid customer control, and whose drawings and specifications are not easy to modify or products with a high labor cost ratio (such as semiconductor products, for example), cooperation from the IE Dept. is especially required for the related VA activities.

- (3) Regarding those products with a short life cycle (such as consumer products), VA operation is conducted mainly on parts, materials, and the machining method.
- (4) In certain works, trial manufacture and research budgets for VA operation are allocated to VA Depts.
- (5), (6)

We have experience in VA operation on packaging and transport costs except that of hardware.

Regarding clerical works, simplification is being attempted by conducting MI Activities (Management Improvement Activities) throughout the Company.

Regarding the above, the Management Improvement Center, Head Office manages such activities throughout the Company.

- (7) Provisions are made for a system of merit awards for VA activities in works; however, the content varies depending on the individual works.

To VA activities especially excellent throughout the Company, a President's Business Prize together with a certain amount of cash is awarded.

- (8), (9)

Hitachi has experience in functional analysis of electronic circuits concerning radio communications equipment.

- (10) Shown below are the themes on which we should mainly conduct study regarding VA in the future:

1. How to conduct VA at the R & D phase
2. How to conduct VA on products of intermittent manufacturing or made-to-order products

3. Method of functional analysis of electronic data-processing system
4. How to produce innovative ideas uniquely

## Development of IE at Hitachi, Ltd.

Fundamental Engineering  
Technology Center

June, 1972

### 1. Outline of Hitachi, Ltd.

Hitachi's manufacturing activities cover such a broad range of products as power generating plants, industrial plants and equipment, rolling stock, home electrification system and appliances, information systems by way of electronic communications and computers complete with softwares, lighting equipment, measuring instruments, machines and equipment for housing, automobile appliances, and semi-conductors and other electronic components. In other words, Hitachi, Ltd. is a global industrial enterprise which serve for the benefit of human being both at home and abroad with its extensive productive capacity ranging from nuclear power down to IC's - from the development of energy generating machines to their applications.

\* Its top policy points to the development of engineering techniques of its own whereby to broaden its service area on an international basis.

### 2. Structure of Hitachi viewed from the standpoint of IE.

The company business is carried on by more than ten business groups or divisions and some twenty sales offices and some 30 business offices (works) under them, and these business groups are placed under the control of the management center which pushes forward business on the corporate planning basis.

One feature of these business groups is that they carry out their business on the self-supporting accounting system.

As for the overseas activities the Company keeps an international network consisting of branch offices, associate companies and representatives located in 20 countries.

Concerning R & D activities the Company runs six laboratories for "corporate use" (or under the control of the head office), and four laboratories are operated for "group use."

The following Departments are concerned with IE as "corporate administrative staff."

\* **Technical Administration Department:**

----- In charge of surveys and administration concerning R & D, production techniques, QC, industrial standardization, etc.

\* **Business Administration Department:**

----- Planning and adjustment for "HIMICS" (the Company's management and information system.)

\* **Planning Department:**

----- Adjustment concerning investment for equipment.

\* **Personnel Educational Department:**

----- Planning a personal inventory system and carrying out educational programs.

The Committee is composed by the Company's senior director who takes office as Chairman, general managers of the Technique Administration Department and Laboratories, and chief engineers of the Engineering Promotion Center. Each year, the Committee announces its new policy for the development of basic techniques.

### 3. Development of IE in the Company.

IE at Hitachi, offering a typical example of Japanese engineering enterprises, was originated under the stimulus of the American policy of industrial reconstruction in the post-war period and has been developed along the Company's inherited policy of nurturing its own engineering technique.

\* In addition to the efforts by the Company's top management which is closely associated with the operation of Japan Productivity Agency, Japan IE Society, and related academic societies, technical information provided by our overseas representatives, our own surveys in overseas markets, and the training of employees by way of allowing them to study in the noted institutes of the world have made it possible to keep Hitachi's IE always up to date.

\* As a sub-structure of the aforementioned Technique Improvement Committee there is an IE Sectional Committee which is intended for unifying IE activities conducted at each factory of the Company whereby to strengthen them.

\* Development of IE at Hitachi considerably differs from business division to business division since these divisions handle largely different kinds and types of products. The following is the summarized aspects of it.

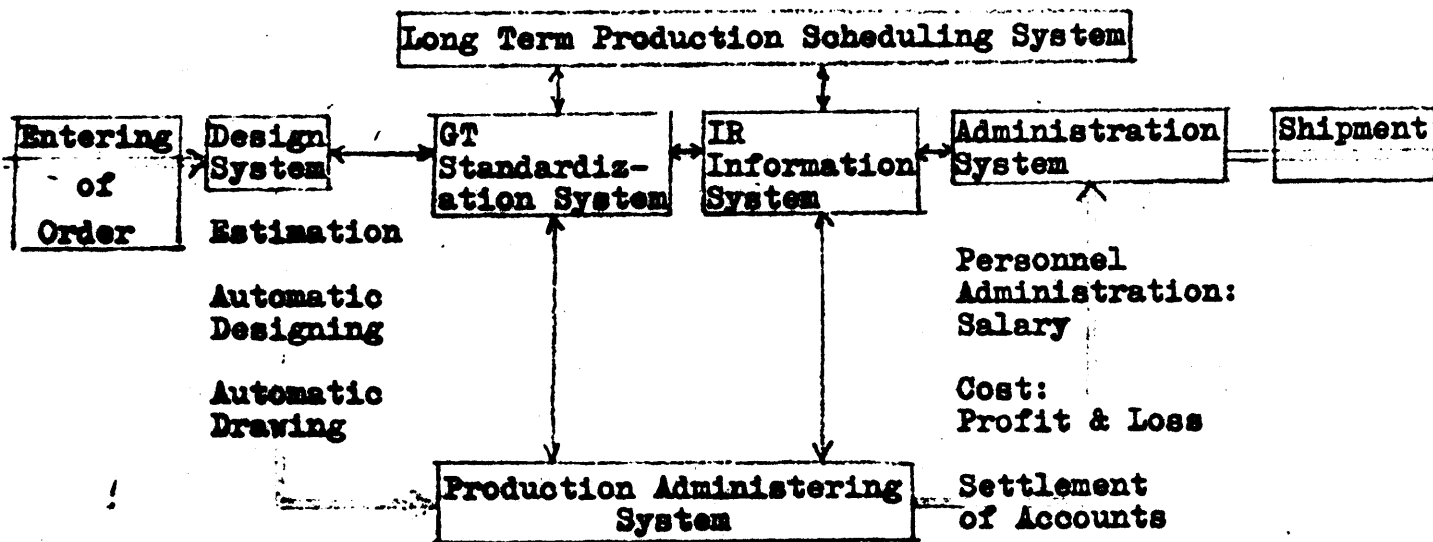
(1) In the power generating machine section, in view of the fact that the product is of a custom-made type and in the nature of community capital goods, efforts have been made to realize a thorough-going application of the total Q.C.

Especially, there has been a historical trend in the manufacturing plants towards accomplishing improvement of working conditions and establishment of ST (standard time) through analysis of each stage of manufacturing process.

- \* Standardization of design and establishment of working standards for manufacturing have been given a prior impetus.
- \* Recently, establishment of the GT system in the field of design and manufacture and a systematic introduction and diffusion of the NC process have been encouraged.

\* One typical example of a total system used at the factories in this group for production control in executing orders is given below:

One Example of "HIMICS" Applications  
 - at a factory for custom-made products



List of Parts — Production Procedure — Materials — Manufacturing Schedule

(2) In the home electric appliances and merchandize groups, for the purpose of coping with the request from the unspecified masses of customers, efforts have been made to set up such merchandizing schemes which conform with the rationalization of production by standardization and with diversifying demands and predicted needs of customers.

\* Also, quality plan and quality control schemes have been worked out with the recent consumer movements in mind.

\* In these groups of production, studies in "work measurement" and "methods improvement" have been conducted diligently, in line with the earnest prusuit of the standard time. Also, they are characterized by the active group activities concerning "Q.C.-circle," PAC (performance analysis control), etc.

\* Recently, some of the concerned factories developed their own dynamic production control system for the on-line controlling of order entries. With the completion of its hard- and soft-wares this system has been displaying its high effectiveness.

(3) In the factories for electronic communications equipment, measuring instruments and semi-conductor components, higher reliability has been pursued eagerly under the concept of "advanced Q.C." throughout the production process from design

VA ACTIVITIES AT HITACHI, LTD. (PART-II)

RELATION BETWEEN STANDARDIZATION AND VA

This problem constitutes one of the themes on which we should conduct research hereafter.

In a works in which a Standardization Promotion Dept. is created, this department has experience in participating in VA projects to work in cooperation, which offers only a special solution to this problem.

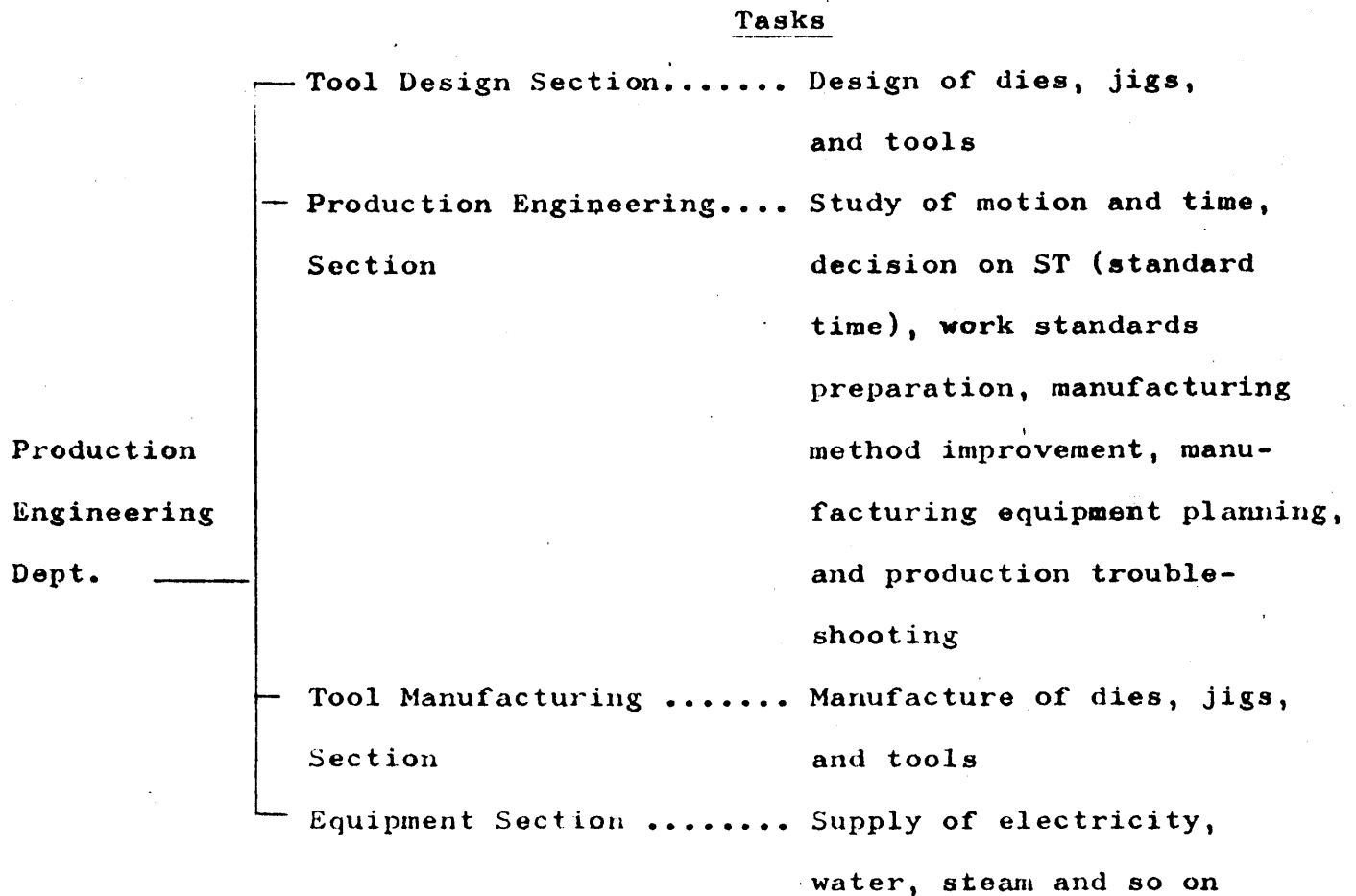
As one of the daily VA activities, a cost table or value standard table is furnished from the VA Dept. to the Design Dept. as a design guide, which is effective only in indirectly connecting standardization with VA activities.

VA ACTIVITIES AT HITACHI, LTD. (PART-II)

PRODUCTION ENGINEERING AND VA

Given below is a description of the Production Engineering Dept. at the Totsuka Works, Hitachi, Ltd.

(1) The Production Engineering Dept. is established at our Totsuka Works. Shown below is its organization chart and functions.



(2) Shown below are various establishments intended to support Production Engineering Depts. of our various works:

1. Production Technique Improvement Center  
(Head Office)

This is intended to suggest to the Production Engineering Depts. of various works ideas regarding equipment investment of our various works and automation in particular, and to design a manufacturing plant for specific products where necessary.

2. Fundamental Engineering Technology Center  
(Head Office)

This is a group of specialists intended to support the Production Engineering Depts. of our various works, regarding fundamental production technology such as welding, soldering, NC, and so on. There is a Technique Improvement Committee set up as a substructure of this organization.

3. Production Engineering Research Laboratory

This laboratory is established to conduct research on production engineering.

The Laboratory also performs, on request from our various works, design and trial manufacture of up-to-date manufacturing equipment.

#### 4. Yokohama Research Laboratory

This Laboratory conducts research on finishing, pollution, molding, and so on.

The Laboratory also conducts, on request our various works, research on specific themes.

- (3) At our Totsuka Works, production engineers of the Production Engineering Section are assigned to specific duties for manufacturing process respectively, and they individually perform the study of motion and time, deciding ST, preparing work standards, or improving the manufacturing method and so on, according to their separate assignments.
- (4) Experience on work improvement at Hitachi is applied to vendors through the Subcontracting Section, Material Dept.

At our Totsuka Works, the work of manufacturing communications equipment is divided among a number of subsidiaries--by products. When it is decided according to management policy to transfer manufacture of a certain product from the Totsuka Works to one of our subsidiaries, the know-how on work improvement concerned is also transferred simultaneously with the related manufacture facility.

Regarding the transferred product, work improvement is, as a rule, handled by the Production Engineering Department of the subsidiary concerned.

- (5) Regarding products to be delivered to the Nippon Telegraph & Telephone Public Corporation, when design or drawing changes are required for VA or another reason, an application for drawing changes is filed. The filed application is jointly reviewed by members of the Public Corporation and the Tsushin Kikai Kogyokai (Communications Industry Association of Japan) to decide whether or not the application is to be adopted.

Regarding products to be delivered to users other than the Nippon Telegraph & Telephone Public Corporation, design or drawing changes based on VA can be effected by Hitachi without external restrictions, except in special cases.

- (6) VA is conducted on occasion at the production phase in the production life cycle.
- (7) Our production engineers are ready to lend their cooperation to execution of VA operation especially in the steps of creation, investigation, labor cost estimate, and evaluation.

- 
- (8) The Nippon Telegraph & Telephone Public Corporation bears an indirect relation to VA only when examining an application for drawing changes prepared through VA activities filed by a manufacturer.
- (9) Information regarding production engineering is exchanged between the various works at the Technique Improvement Committee, a substructure of the Fundamental Engineering Technology Center.

There are special subcommittees under the Committee, which are respectively composed of production engineers sent from our various works according to their specialities.

## VA ACTIVITIES AT HITACHI, LTD. (PART-II)

### HOW TO PROCEED WITH VA AT THE R & D PHASE

This is one of themes in which we assume great interest.

- (1) Regarding VA of a product at the R & D phase, there are many cases where VA is conducted on completing a trial product.

VA operations such as functional analysis, evaluation and so on are easy to execute at this phase, since the product can be directly seen and touched; also design changes can be made to a comparatively large extent as the drawing has not yet been finalized.

In this case, another trial manufacture is effected after VA, according to the circumstances.

- (2) In (1) above, the amount of cost reduction by VA operation is calculated by taking as the base the production cost of a similar product; or if trial manufacture is completed and its cost is known, the cost of trial manufacture minus the nonrecurrent cost.
- (3) When the VA schedule is not initially entered in the R & D schedule, the R & D schedule is affected by conducting the VA operation. Shown below is our solution:

1. R & D is to be completed on schedule by temporarily increasing the design man-hours of the concerned product.
2. While continuing production according to the production drawing to which VA proposal is not applied, shift is made to production of a modified product upon completion of design changes through VA.
3. The R & D schedule is delayed and time of the product sale is postponed.

(4)(10) For (1) above, we execute VA operation according to ordinary VA procedures, without employing special VA techniques.

Regarding R & D, we think that while study of VA techniques is necessary, it is essential and effective to apply VA to R & D.

- (5) Regarding any product, it is not necessary to definitely apply VA to R & D.
- (6) We observe motivation of the designer concerning VA at the R & D phase.

Generally, a large extent of cost reduction (30 to 70%, for example) is required of most products which require VA at the R & D phase. It is necessary to improve higher level functions to fulfill the requirements. That is, a drastic design change is necessary.

This is a challenge to the designer in a sense, causing him to make a risky decision at the evaluation phase of VA operation. Also, satisfactory results cannot be achieved without the designer's cooperation at the functional analysis and creation phases.

In view of this situation, considerable efforts are being devoted toward how to make the designer participate and cooperate in VA.

- (7) At the R & D phase, cost analysis is--in many cases--made when a trial manufacture drawing is completed or when a trial product is costed.

Of course, cost analysis is made while product planning; however, the estimated cost is generally low in accuracy and considerably takes on a character of approximate target cost.

- (8) While Hitachi occasionally receives an order for trial products, VA is not presently effected on them.
- (9) At Hitachi, the Design Dept. is assigned to project management, and assumes the accountability for settlement of accounts for the project. Hence, in view of the situation described in (6) above also, the concerned designer is usually appointed to the VA project manager.

Members of the VA department, in this instance, perform the functions of coordinator and VA technique instructor, and take over--as members of the VA project team--a portion of the work respectively.

- (11) No particular method is employed for evaluation of an idea produced at the creative phase. Evaluation is effected only from the two viewpoints whether or not cost can be reduced from the existing cost, and whether or not the idea is within the limits of possibility in terms of technique.

Many of these ideas are related to functions of higher level, such as the feature of VA at the R & D phase. It is necessary to have this feature; thus, evaluation thereof should be conducted carefully and with deep, broad technical knowledge, since there is the possibility of a risky decision.

Consequently regarding important ideas, care is exercised so that they may be quietly evaluated in separate rooms and by personnel competent in the task of evaluation, rather than being evaluated by all VA participants collectively.

- (12) When setting a target cost of system product, the target cost is also allocated to subassemblies and/or modules.

(13) When breaking down and allocating a target cost, there are cases where a function-tree is made up, and the cost is allocated to respective functions, and where the cost is allocated to respective subassemblies and/or modules.

When evaluating an idea, even in the latter case, the amount of cost reduction achieved by the idea is calculated after clarifying the function area related to the idea.

Regarding the allocation method, the FD method or others are employed. When the function is so complicated that it is difficult to make the VA participants thoroughly comprehend, there is the possibility of a failure in exact allocation of the target cost. In such a case, allocation is effected by utilizing the designer's experience, cost analysis of similar product, and the Delphi method,

- (14) The VA Dept. participates in design review in some cases and does not participate in other cases.
- (15) Design review is usually conducted at a meeting called by the Design Dept. or at a preliminary meeting of individuals.

VA ACTIVITIES AT HITACHI, LTD. (PART-II)

RELATION BETWEEN QUALITY ASSURANCE AND VA

(1), (2)

Qualification Inspection System is established at Hitachi, Ltd.

This is a system of judging, according to test criterion set up for parts, the quality of trial-produced parts on a basis of ideas formed in the course of various VA activities and of general products available on the market which are found-- through market research--to have acquired cost merit.

The Qualification Inspection System varies to some extent according to office regulations of various Hitachi works. This refers to parts which Material Depts. procure from the outside. A Qualification Test Dept. is formed in the Material Dept. of a works which holds the view that "the Material Department should be totally responsible in assuring the parts quality purchased on the outside." On the other hand, inspection of parts is executed by

an independent Test Dept. in a works which holds the view that "a test should be conducted strictly from the position of a third party."

While the content of work is a qualification test in any case, the Qualification Inspection System is characterized in that, in addition to the test items set forth in the design specification, the Qualification Test Dept. further adds items or changes criteria.

(3)

When conducting a qualification test on those parts and materials whose adoption is recommended through a VA proposal; the Qualification Test Dept. tends to fall short of the man-hours capacity.

This is one of the VA problems common to the respective Hitachi works.

Shown below is an example of this kind of works at Hitachi:

This works manufactures products of refrigerator application with priority given to coolers for commercial use. Unlike works producing household electric appliance, this works manufactures products on a small-lot scale. Regarding control modules and

electric parts, therefore, cost becomes high when manufacturing products of original specifications. As a result, there are many cases where products conforming to the requirements of specifications are used after selecting from among those available on the market. Articles procured from the outside constitute 75 to 80% of the product cost; thus, great numbers of parts are subjected to qualification tests, and the Qualification Test Dept. becomes considerably busy. Hence, a considerably long time is consumed from the time a request for testing is made until completion of qualification, so that regarding parts selected as objects of VA for cost down, the effect of cost down is liable to be delayed.

With the past problems of this kind examined, improvement of test equipment is achieved. Further, all the data necessary for testing (data on tests conducted by the parts maker, specifications, and so on) are definitely collected before a request for test is made. All possible efforts are exerted to previously eliminate tests on parts not conforming

to the objective application by carefully checking specifications.

Also, additional effort is devoted to making a documentation check list for each part. A request for a qualification test is made after preparing complete data according to the list, resulting in a short test period and an improvement of the buyer's knowledge of parts and an intensification of his quality consciousness.

- (4) Generally at Hitachi, few Test Dept. personnel participate in the phase of idea conception creation phase, in VA TFP. The reason is that adhering too closely to past cases of trouble, Test Dept. personnel adversely affect other members in idea concepts.
- (5) At Hitachi, Test Depts. are equal in position to Production Depts., and schedules of inspection and/or tests are made by the Test Depts.

So far, Test Depts. are not eager to participate in VA projects.

In addition to the above-mentioned background, setting up of test items and scheduling are liable to

be postponed, since they are too conscious of grasping the effect at the phase of evaluation and effect estimation; thus, there are many cases where quality assurance at the follow-up phase is behind the schedule.

As a result, the Head Office issues instructions to the VA Depts. of our various works to set up test items and to execute scheduling as necessary by end items, subassemblies, or parts respectively, together with a representative of the Test Dept., while concurrently making a schedule of trial manufacture.

- (6) There are two or three examples of reducing inspection and/or test man-hours in VA projects. The content is mostly the improvement or introduction of test jigs and tools, and test equipment.

However, testing cost constitutes a considerably high percentage of production cost depending on the product type.

It is intended, therefore, to study the participation of Test Depts. in a VA project for achieving reduced testing costs.

- (7) One of those items which we are to effect in the future is to take running cost and maintenance cost incurred by the user side as a part of the denomination of the following formula:

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

Since running costs and maintenance costs are difficult to predict, we intend to solve this problem for the present.

- (8) The designer is placed, at the evaluation phase of VA project, in a situation where he makes a risky decision; thus, he is liable to adopt an idea of minimum risk.

However, it is difficult to expect a great amount of cost reduction in this way. We recommend, therefore, carrying out trial manufacture and testing, as far as possible, on design changes made according to VA proposals. Thus it is expected that even if a risky decision is made by the designer at the evaluation phase, a great amount of cost reduction can be achieved in return, and the decision will result in minimum risk as an overall production project.

VA ACTIVITIES AT HITACHI, LTD. (PART-II)

PRODUCTION ENGINEERING AND VA

(1), (2)

Hitachi manufactures over 20,000 different items ranging from made-to-order products such as generators to mass-produced items such as TV sets and semiconductors.

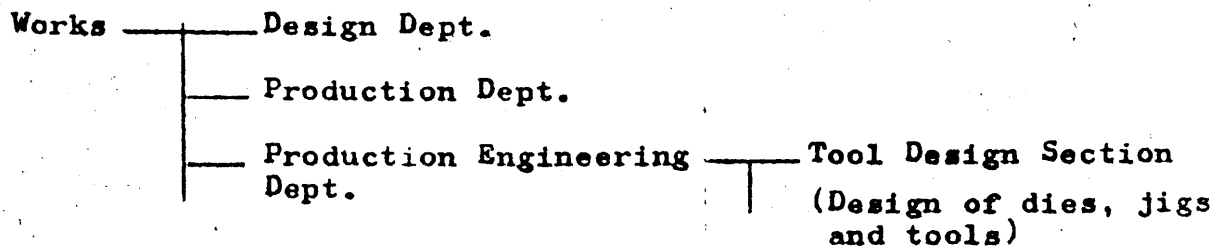
Refer to the Hitachi Annual Report for further details.

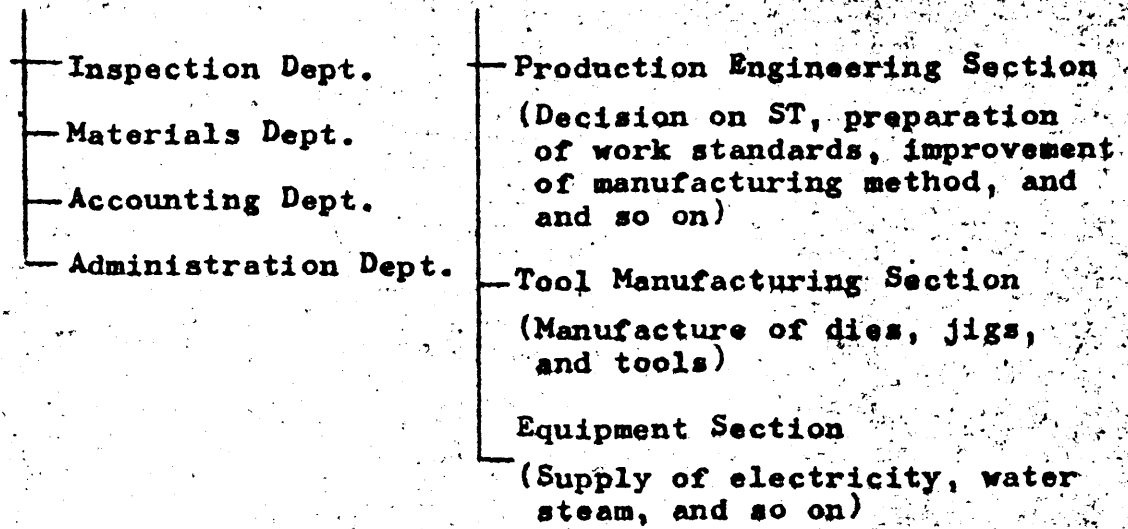
(3) Regarding a certain type of product, a request for price reduction is periodically made by customers.

(4) In (3) above, if the user's request is justifiable, as far as possible Hitachi exerts efforts to reduce the cost through VA and so on to meet the user's request.

(5) So far, Hitachi has no experience in conducting VA jointly with users.

(6) Shown below is a typical organization chart of a works, which varies according to the works:





(7) Shown below are various facilities intended to support the Production Engineering Dept of each works;

1. Production Technique Improvement Center  
(Head Office)

This is for supporting the Engineering Dept. of each works regarding equipment investment of the works (automation in particular), and to design a manufacturing plant for specific products where necessary.

2. Fundamental Engineering Technology Center  
(Head Office)

This is a group of specialists for supporting the Production Engineering Dept. of each works regarding fundamental production technology such as welding, soldering, NC, and so on. The Center has a Technique Improvement Committee as its substructure.

3. Production Engineering Research Laboratory

This is a laboratory for conducting research on production engineering.

The Laboratory also performs, on request from each works, design and trial manufacture of up-to-date manufacturing equipment.

4. Yokohama Research Laboratory

This Laboratory conducts research on finishing, pollution, molding, and so on.

The Laboratory also conducts, on request from each works, research on specific themes.

- (8) Experience gained in work improvement at Hitachi is applied to vendors through the Subcontracting Section, Materials Dept.

At Hitachi, work is divided among a large number of subsidiaries by products. When it is decided according to management policy to transfer manufacture of a certain product from the works concerned to one of the subsidiaries, know-how of the work improvement concerned is transferred concurrently with the related manufacturing equipment.

- (9) The production engineers cooperate in VA operations especially at the steps of creation, investigation, labor cost estimate, and evaluation of VA operations.

## VA ACTIVITIES AT HITACHI, LTD. (PART-II)

### HOW TO EXECUTE VA ON PRODUCTS OF INTERMITTENT MANUFACTURE OR MADE-TO-ORDER PRODUCTS

This is one of the most serious problems Hitachi must solve.

It seems that difficulty in VA operation on products of intermittent manufacture or made-to-order products is attributed to the following:

- (1) In case cost effectiveness of VA is considered, large system products are inevitably selected as objects.

These products are generally complicated in function and it is considerably difficult for all the VA participants to acquire complete knowledge of the function in a fixed period.

As a result, functional analysis is difficult to perform.

- (2) In many cases, there is no allocation of time and expenditure necessary to confirm design changes based on VA proposals by trial manufacture and testing.

When evaluating, therefore, the designer tends to make a decision involving a minimum risk. As a result, much cannot be expected of cost reduction.

The following is a description on experience undergone by two or three works from among the Hitachi group:

(1) Complete products system manufactured by the Hitachi group can be classified as follows:

1. Products system consisting of products, subassemblies, and modules manufactured on a nonrecurrent basis.
2. Products system consisting of products manufactured on a nonrecurrent basis and its subassemblies and/or modules which are off-the-shelf items or manufactured on a recurrent basis.
3. Products systems manufactured on a recurrent basis.

Regarding 1 above, no experience has been acquired so far on functional analysis.

Regarding 2 above, some works have VA experience on off-the-shelf items. In this case, a qualification test is conducted on the unit of subassembly or module to also assure quality and reliability.

Regarding 3 above, Hitachi has experience in functional analysis of a complete products system.

In a certain works, the design engineer in charge-- under time restrictions--does no more than explaining

functions of the products system, subassemblies, modules, and main parts to the VA participants.

- (2) Evaluation of functions regarding artistic design and maintainability cannot be executed merely by a works.

Presently we are groping for a method.

Regarding functions related to reliability, some works are conducting evaluation while referring to opinions of the Sales Dept., Service Dept., and the work's Quality Assurance Dept (Inspection Dept. at Hitachi).

- (3) Regarding functional analysis, there are many instances where a function-tree is made and the present cost incurred is allocated to respective functions. In some cases, however, functions are enumerated without making a function-tree.

The FD (Forced Decision) method is applied to the allocation of target cost.

When functions are too complicated for VA participants to fully comprehend, however, the FD method involves the possibility of a failure in precise allocation of the target cost. In this case, allocation is effected according to the designer's experience, cost analysis of similar products, and the Delphi method.

- (4) Under the present situation, VA phase is not initially entered in the project shedule beginning with the R & D phase and ending with the production phase.
- (5) The Design Depts. usually perform the function of project management at Hitachi, Hence, the project schedule of a certain product is made by the concerned Design Dept.

After entering production phase, however, its detailed schedule is made by the concerned Production Dept.

- (6) The project schedule is made at the product planning stage; however, it is not determined at this stage whether or not the VA phase is to be included in the schedule.
- (7) Regarding the products under discussion herein, for various reasons it is considerably difficult to total the amounts of cost reduction achieved through VA by means of EDPS. At present, totaling is manually effected by the VA Dept. according to the cost estimated by the designer.
- (8) At present, we have no adequate solution to problems of VA in nonrecurrent production.

## VA ACTIVITIES AT HITACHI, LTD. (PART-II)

### ARTISTIC DESIGN COST AND FUNCTIONAL COST

The following is a description on the household electric appliance works at Hitachi.

- (1) Artistic design is determined by taking into account the product catch phrase as well. Regarding products with high sales prices, an effort is made to improve the appearance; thus, artistic design costs tend to increase. However, propriety of artistic design is determined by objective judgment based on the sense of eye appeal, while no quantitative evaluation is conducted.
- (2), (4) Regarding a concerned Hitachi product and similar products of other companies, the ratio of artistic design cost to the product cost is obtained at the new product planning stage. Then, artistic design cost of a new product is determined through proportional allocation with the above ratio taken as a basis.
- (3) Regarding full-automatic washing machines, for example, approximately 10% of the manufacturing cost is allocated to the artistic design cost as a target value.

Generally speaking, the ratio of artistic design cost the product cost increases accordingly as the artistic design part and the functional part are integrated.

- (5) Allocation of the artistic design cost is mostly effected by the Design Dept., while it is rare for the VA Dept. to directly participate in this matter.

However, the VA Dept. participates in the following operations while indirectly supporting the Design Dept. regarding determination of the artistic design cost:

Cost accumulation of designed artistic design part, standardization of color for artistic design parts, common use of dies, and obtaining information on up-to-date technology.

- (6) Artistic design is determined after an examination executed by the following personnel:

Artistic design engineers, product design engineers, production engineers, Sales Dept. personnel, Advertising Dept. personnel, test engineers, and the works management personnel.

Incidentally, the artistic design engineers are assigned to the Design Center.

- (7) Artistic design is determined at the product planning stage.
- (8) During product planning, the product design engineer indicates to the artistic design engineer an artistic design cost allocated in a manner described in (2) and (4) above as the target cost, requesting him to effect artistic design within the target cost.

It is at the trial manufacture phase that utmost care is directed to cost; also, cost is examined in detail at this phase.

While the artistic design engineer is briefed regarding product function at the product planning phase, briefing on only the outline of function is effected at this phase.

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### HOW TO PERFORM VA IN THE APPARATUS INDUSTRY

- (1) Unlike assembling steps, wafer processing steps have proved to be very difficult when introducing the concept of a standard time. The reason for this is that even if a reduction of working hours is achieved through an improvement of photoengraving steps, rather than resulting in a reduction of total man-hours, it results in an increase of workers' idle time, since a considerably large part of the operation is affected by diffusion time.

Presently at Hitachi, the budget time (BT) decided for each operation is used for operation control. In the future, we expect to estimate labor efficiency and the effect of VA through the quantity of processed wafers.

- (2) VA is conducted on purchased jigs such as masks used in photoengraving steps, wafer handling tools, and so on.
- (3) VA members are closely coordinated with personnel of the Production Engineering Dept.

Personnel of the Production Engineering Dept. never fail to participate in VA TFP as members, and then perform the operation in cooperation with VA members in some cases.

Regarding semiconductor, the object of VA is shifting from hardware to software, and IE and automation are becoming the main constituents of content; thus, a closer relation will be effected between the VA Dept. and Production Engineering Dept.