SAVE PROCEEDINGS 1994

IMPROVEMENT OF THE CONCEPTION AND THE DEVELOPMENT OF NEW PRODUCTS

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ABSTRACT

This paper describes the application of VE/VA process for setting up a framework to improve the concepts for customers and the development quality of new products. For improving product development process, the Quality Function Deployment (QFD) is mainly applied. This paper offers an effective tool for a company to be successful in marketing operations of tomorrow.

INTRODUCTION

The paper covers the time span from the development of the first conception until a product is put on the market. We call this method "Planning Analysis" (PA) that supports the new product conception and development using the VE/VA process.

Heavy electric equipment, customers will generally furnish equipment suppliers with customer specifications to specify values and prices desired by customers. The equipmentsuppliers, in turn, will only have to consider the supply of trouble-free products. With an increase in products for many and unspecified customers, it has become essential for a company to create a specific concept for a customer ahead of other manufacturers. Also, a change in the concept from "how to make" to "what to make" has become an important issue.

In production goods, a "salable product" means a greater customer profit, deducing an equation "Customer Profit V = Customer Income F/Customer Expense C", thus enabling us to identify sales points quantitatively.

It is believed that 'salable products" can be predicted with a probability of 80% at first conception. The supply of higher product value for customers is of the prime importance and the trouble-free characteristic of a product is additionally required.

According to the trouble analysis we conducted, trouble is invited of a probability of 90% to 95%, where changes are made to design,manufacture, and application. What is more, insufficient examination accounts for 70% of all the causes of trouble. To reduce the frequency of trouble, therefore, exhaustive verifications for all the changes or alterations are pivotally important.

DEVELOPMENT AND IMPLEMENTATION OF PA

Eight PA projects launched at four plants as pilot phase of the process improvement in the product development. In the past two years we have formulated an eight-step working procedure for our product development process by the decision of top management.

In dissemination phase, the following actions have been taken to spread the application of the PA method:

- Publication of PA practice manual and implementation of extended seminar courses as in Pilot Phase for 800 persons engaging in marketing, engineering, and manufacturing.
- Research meeting by PA leaders: refinement and further development of the PA method.
- Extended practicality of "on the job training".
- Continuation of the training for additional personnel.
- Meetings to announce the accomplishments for wider dissemination.

METHODOLOGY

As shown in Figure 1, the PA comprises eight steps of the product development process, with the Quality Function Deployment (QFD) placed in the core position.

Before explaining the PA working procedure, the following preliminary preparation is discussed to facilitate the implementation:

- Defining the project and setting up a cross-functional team,
- Setting the PA objectives and final goal, and
- Coordinating the PA with defined development schedule.

The PA covers a time span required from development of conception until the supply and service of products. The PA is made up of three major tasks; namely, Conception PA, Development PA, and Sales-service PA.

The Conception PA can be divided into Conception Planning and Product Planning.

Conception Planning Phase

The following items are investigated to build hypotheses in the steps of Customer Survey, VA to Customers, and Conception QFD:

- Where are receptive market segments located?
- How much is a forecasted demand for each market segment by years?
- What are prospective customer needs?
- How many types of product series should be prepared?

After these studies, we determine the concept for customers and sales points.

At the initial stage of the development, the development policy can be shared by all the project team members by identifying the concept for customers.

Product Specifications Planning Phase

The following items are determined in the Standardization QFD and the Product Specification QFD:

- Formulate a standardization policy by weighing various requirements of customers.
- Generate function-oriented ideas by the function analysis of the concept for customers.
- Determine the optimum value for products through analytical and creative thinking in the VE/VA process.

At this stage, quantified product specifications can be generated by optimizing functions, quality, and cost.

Development PA Phase.

The Design QFD and the Manufacturing QFD realizes the best quality at the highest customer value and the lowest cost. It also realizes the profitability of a company through exhaustive verifications and visualized know-hows by experienced design engineers in combination with advanced production technologies and systems.

Sales and Service PA Phase

Before products are placed on the market, the PA will involve the following studies from preliminary services to after-sales services:

- What to do to please customers to buy the company products?
- What to do to induce customers to buy the company products again?

WORKING PROCEDURE

Product Development Potential can be conceived as follows: Product Development Potential = Product Development Process x Development Personnel Aptitude x Enthusiasm.

The PA improves the Product Development Potential by reducing the influence of Development Personnel Aptitude through an improvement in the Product Development Process. To improve the Product Development Process, the following steps of the PA work plans are proposed:

Step 1 Customer Survey

- Comprehend market size and market viability.
- Analyze the competitive products.
- Implement the market segmentation and positioning.
- Forecast a demand for the life cycle period.

Step 2 Value Analysis for Customers

- Express mathematical hypotheses of customer value.
- Verify a mathematical expression of customer value by interviewing with customers.
- Define the optimum value for customer needs.

Step 3 Conception QFD

- Quantify customer's required quality.
- Compare the company products with competitor's ones with respect to customer's required quality.
- Select the best quality with greater customer value to determine the concept for customers.

Step 4 Standardization QFD

- Collect information on a variety of customer requirements, such as customer's dissatisfaction and special specifications.
- Weight customer requirement frequency, degree of sigifi-cance, productivity, and marketability and determine the standardization policy.

Step 5 Product Specifications QFD

- Apply creative techniques to implement the concept for customers.
- Lead group discussion based on function analysis and rough sketches of ideas.
- Determine product specifications that define targets of functions, quality, and cost.

Step 6 Design QFD

Develop the product specifications into the design specifications in detail.

- Utilize know-hows of experienced design engineers and research workers.
- Verify design specifications thoroughly to prevent the occurrence of trouble.

Step 7 Manufacturing QFD

- Pursue the company profitability.
- Define a manufacturing policy and determine targets of quantity (P), quality (Q), cost (C), and delivery (D).
- Improve a bottlenecked manufacturing process on a priority basis.

Step 8 Sales and Service QFD

- Summarize customers, and company's requirements.
- Extract pivotal improvements in sales and service processes and implement them.
- Upgrade the sales and service values.
- Utilize know-hows of experienced sales personnel

In the PA working procedure, VA for Customers, Conception QFD and Design QFD are explained with examples.

VALUE ANALYSIS FOR CUSTOMERS

A value in the PA is the same term as in VE/VA, and can be expressed by an equation, V=F/C.

Since "salable products" are higher in the customer value, we can assume that the customer value is V of the equation. In the case ofproduction goods, we can assume that customer value is of the customer profit. This profit is calculated from the following equation: Customer Value = Customer Profit = Customer Income/Customer Expense = (Added value per unit x Work load rate x Working rate x Failure rate) ÷ (Depreciation expense + Operating expense + Maintenance expense) /

As shown in Figure 1, by making up the equation interrelating the customer value with market position, the following can be deduced:

- Influence of competitive products
- Customer needs that will maximize the customer's value
- Influence of new products

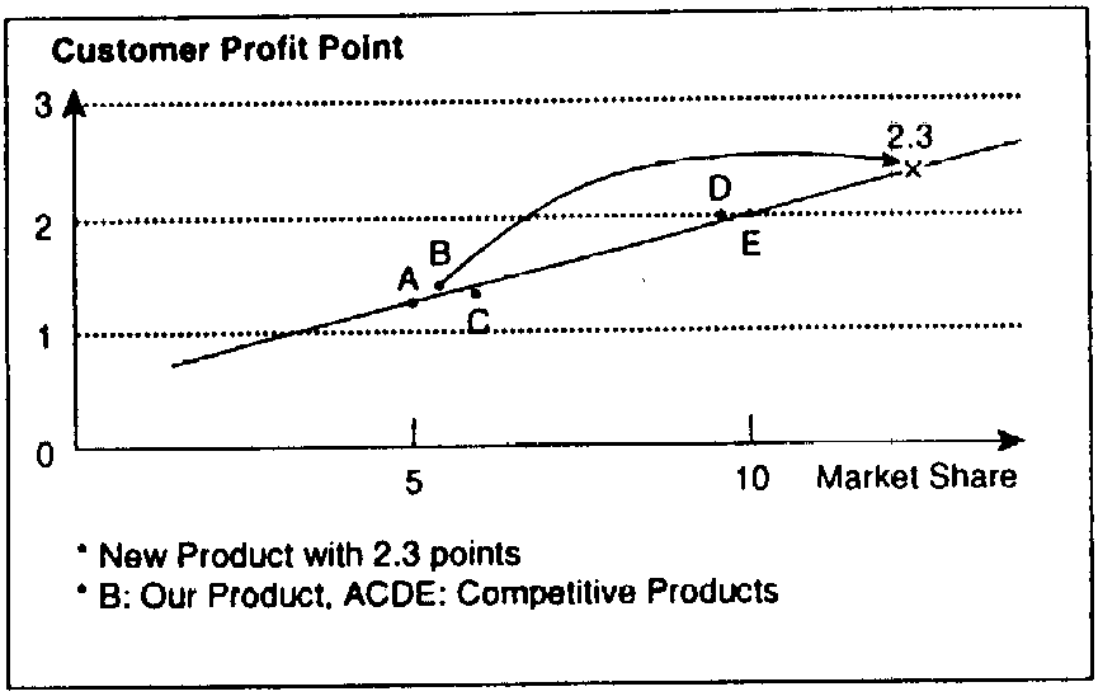

Figure 1 Customer Profit against Market Share

CUSTOMER-ORIENTED CONCEPTION

The Conception QFD, as shown in Figure 2, is formulated in the steps described below. In this QFD, sales points are selected from Customer Required Qualities (equivalent to customer specifications).

Conception QFD			Customer Profit		Sales Point	Market Segment						Our Product		Competitive Products		
Customer Required Quality			Amount	Influence Factor		User		Environment	Purpose			OLD	NEW	C	D	E
Level 1	Level 2	Level 3							Cutting	Welding	Treatment					
Expense	Low initial cost	Low price	.....	48.1	△	△	△	○	○	○	○	3	4	4	3	3
		Small	.....	24.8	◎	△	△	○	△	○	○	2	5	4	4	4
	Low running cost	Low energy	.....	3.4		△	△	△	△	○	○	4	4	5	4	4
			.....													
Income	High operation rate	Short operating time	.....	23.0	◎	○	○	○			○	○				
		Short set-up time	.....													
						△	○	△	○	○	△	△	4	4	3	3	3
					Customer Profit								1.3	2.3	1.2	2.0	2.0

Figure 2 Conception QFD

Step 1 Customer Required Quality

- Develop the customer value formula to formulate customer specifications.

Step 2 Influence factor

- Calculate the amount of money for Customer Required Quality at level 3.
- Calculate an influence factor, with the numerator and the denominator assumed to be 100% each.

Step 3 Market segment

Determine how many types of product series are needed by analyzing the Customer Required Quality in terms of the user, operating environment, and application.

Step 4 Competitive products

- Compare and evaluate the company's present and new products with competitive ones.

Step 5 Determining sales points

- Determine sales points and the concept for customers from evaluations of these customer value, market segment and competitive products mentioned above.

  The concept for customers and sales points are determined by quantifying customer needs and by identifying the company's strong and weak points.

TROUBLE-FREE PRODUCTS BY DESIGN QFD

In Product Specification QFD, Customer Requirement Quality is broken down to the design specifications. And also, society requirement quality and company requirement quality are broken down to the design specifications.

The QFD shown in Figure 3 is created in the following steps:

Step 1 Function deployment of required quality

- Apply the function deployment to customer, society, and company re

Step 2 Significance factor

- Make a general evaluation taking into account the frequency of customer complaints, the degree of design changes, and significance to customers.

Step 3 Drawing list

- Sectionalize drawings for checking individual units and parts.

Step 4 Verification list

- Enter verification items in the order of design, examination, and field test.

Step 5 Matrix table

- Assign verification numbers to intersecting points where the required quality and the drawing are crossing each other.

Step 6 Follow-up

- Follow up until the verification is completed.

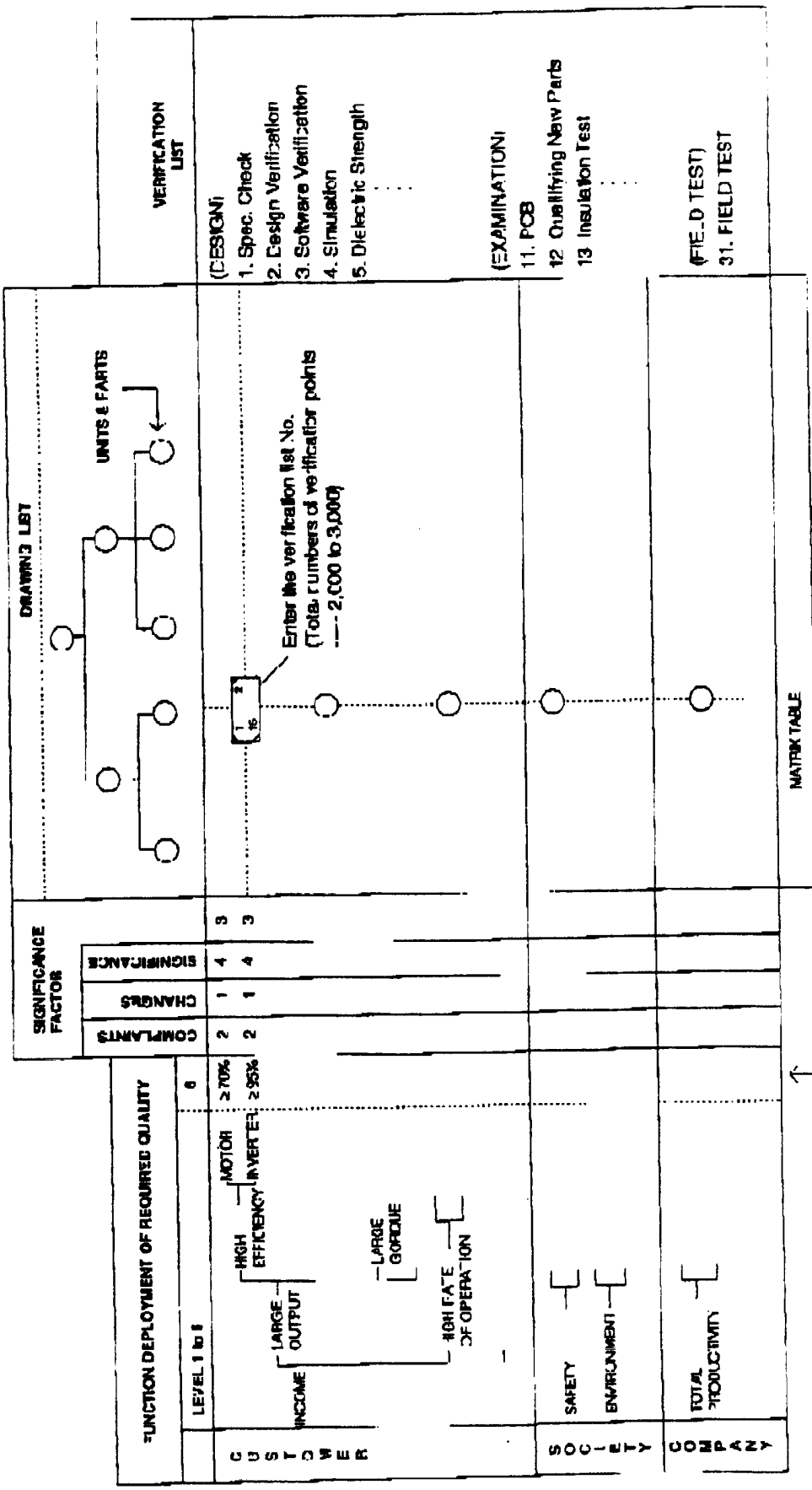

Figure 4 Design QFD

The objective of the design QFD is to improve the design quality by eliminating a failure in verification through an increase in the verification point numbers.

Figure 4 shows a relationship between the numbers of verification points and the frequency of customer complaints before and after the PA implementation. By increasing the number of verifications 2.7 times before marketing products, the number of verification after marketing the products has decreased to 1/7, thus reducing the customers' complaints to 14%.

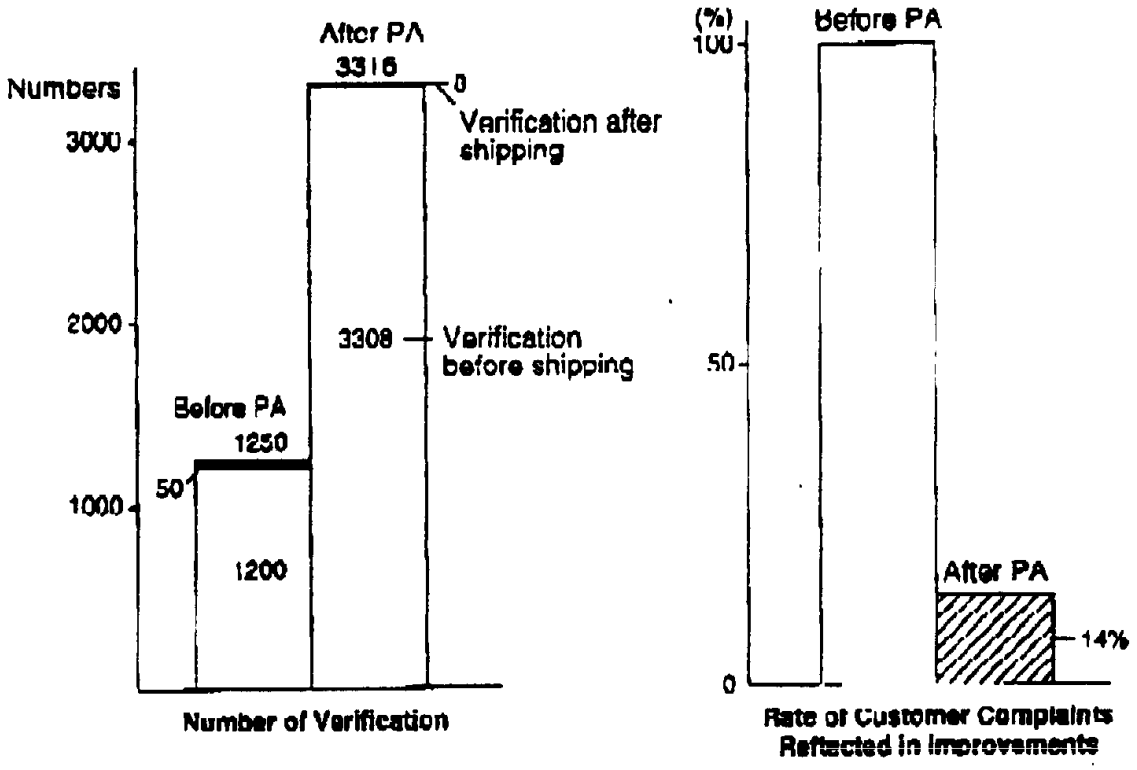

Figure 5 Result of Design QFD

SUMMARY

As of September 1993, the PA has been implemented for 36 kinds of new products and 26 kinds have been marketed. Although some products have already registered remarkable sales records, the improvement in development process and the evaluation of new products will be made from now on, while obtaining feedback information, because after marketing products it normally takes one to two years for the product evaluation.

Key characteristics are enumerated as follows:

- We can describe the information on sheets of paper for each step with the PA working procedure, so that we can realize the products of the best quality with the highest customer value and the least possibility of causing trouble and that concurrently we can improve development process.
- We can define the concept for customers and sales points at the initial stage of the product development, so that all the members of a project team can be fully concerted with eachother in the product development.
- We can make preliminary evaluation by simulating product competitiveness, product quality, productivity, and marketability in the product development working procedure.
- We can set up a cross-functional team by representatives from product planning, marketing, engineering, design, manufacturing, and sales/ servicing, so that we can provide the greater satisfaction for customers.

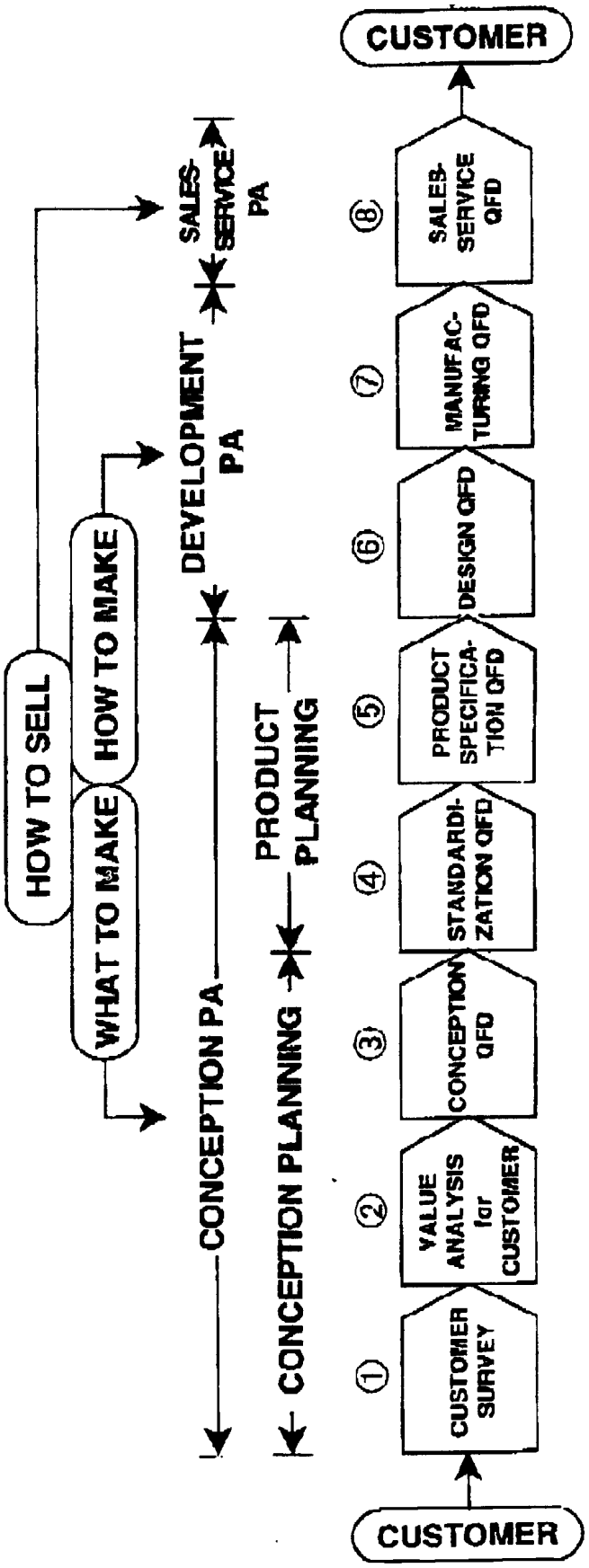

Figure ③ PA Procedure