

A NEW METHOD TO COMPILE AND USE INFORMATION NEEDED FOR BUILDING A NEW PRODUCT CONCEPT THROUGH IDENTIFYING USE FUNCTIONS

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ABSTRACT

This study has been carried out by considering a product concept as "a message from an enterprise given to a product by searching the needs (subconscious) from the customers' side, deciding the functions/benefits which will respond to them, and by adding management policy" and to propose a new method for supporting the conceptualization of new products from the use function which are to be introduced into the existing market with existing and improved technologies. It's special features are to classify

use function into mechanical/structural function and in-use/convenient function, to clarify the subconscious for each of them, to collect and arrange information concerning them, and to come up with an integrated table. This study has constructed a methodology for integrated product conceptualization by being paired with "A New Method to Compile and Use Information Needed for Building a New Product Concept through Identifying Use Functions" which complement each other.

INTRODUCTION

This study has been carried out to classify use function into mechanical/structural function and in-use/convenient function, and to supply information (Product Concept Table) to support product conceptualization during new product development, and to promote its usage.

METHOD FOR THIS STUDY

This study is constructed of 3 phases as shown in Figure 1. Its details will be given following this procedure, using a high grade ball-point pen as an example.

CLARIFICATION OF THE REQUIRED FUNCTION

- (1) Prefer the object product
We will consider here the case of developing a high grade ball point pen and take up 4 high grade ball point pen products (A,B,C,& D) which compete with each other and are considered to be advantageous for product conceptualization.
- (2) Market segmentation
The consumers' desires are various, so it is necessary to divide the market into homogeneous consumer groups from some viewpoint, focus on some specific target, and make the marketing

activities more efficient. Here, two sub-markets consisting of product groups which compete with each other from the standpoint of a homogeneous consumer group (=segment) and consumers will be set up. The following segments and markets (=sub-markets) were set up here.

- Segment (object) : consumers in the twenties
- Sub-market (purpose of use) : (a) personal use, (b) gift use

(3) Deployment of the Required Function

A functional block diagram is made for the required use function as shown in Figure 2 by using the "required items study 1" from the consumers' side etc., as reference and arranged them by the "purpose → means" relationship.

ANALYSIS OF THE REQUIRED USE FUNCTION

ANALYSIS CONCERNING MECHANISTIC/STRUCTURAL FUNCTION (ANALYSIS 1)

It is necessary for deciding the basic specifications for a new product to clarify the desired mechanical structure which the consumer has in mind. Here, the following method of analysis is proposed in which Conjoint Analysis which is attracting attention in the marketing field was applied based on the findings of the "required items study 2" from the consumers'

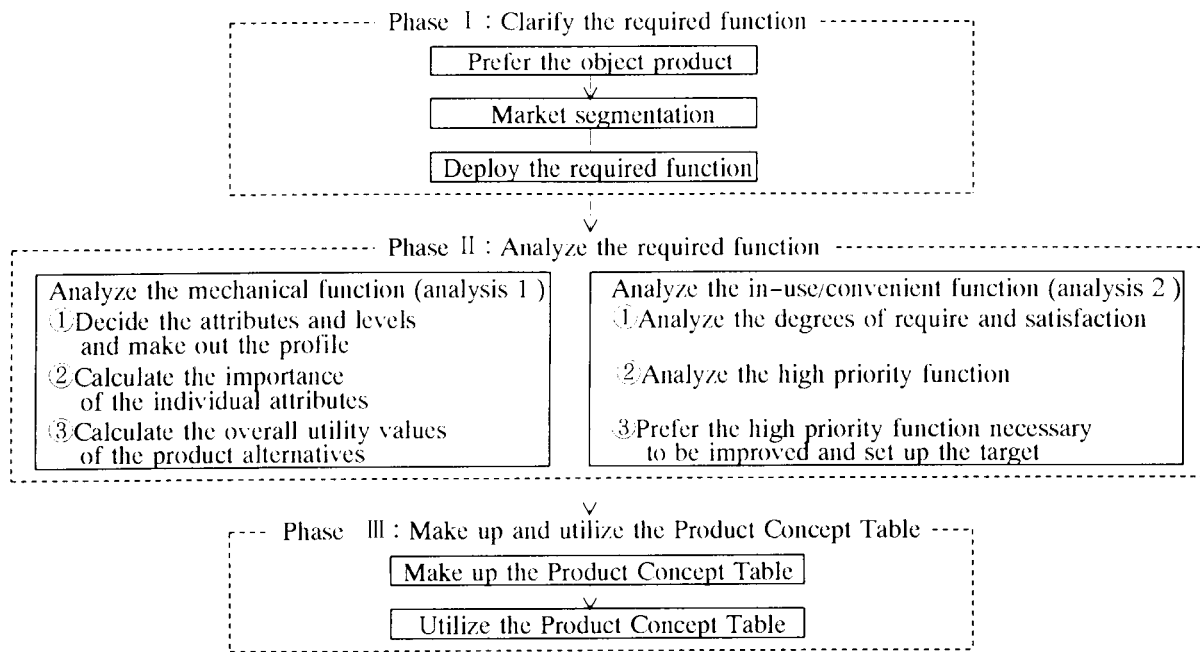


Figure 1 Outline of this Study

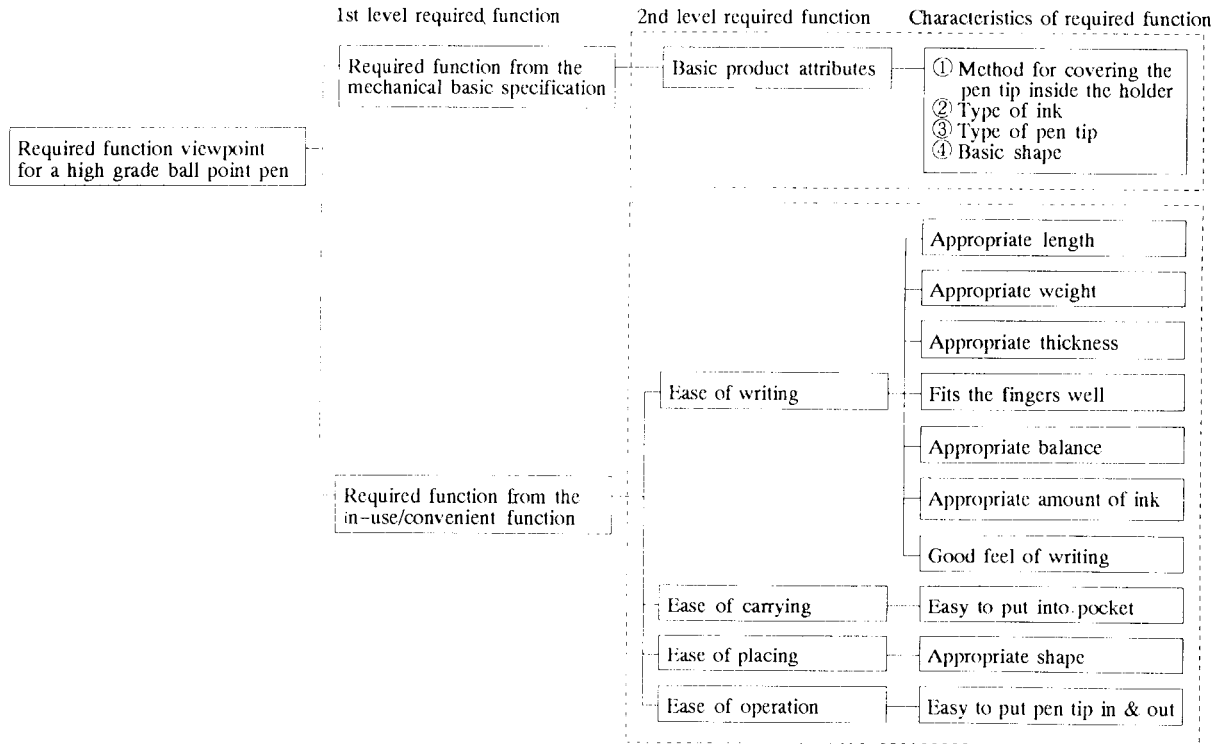


Figure 2 Functional Block Diagram for the Required Use Function of a High Grade Ball Point Pen

side, and to use a model which handles the consumers' choice probably.

Step 1 Decide the attributes and methods and make out the profile

The important attributes and their methods for the mechanical function which the consumers decide (select) when buying are decided here. Here, attributes mean the major shapes, structures, performances, and characteristics, etc. and are, for an automobile example, attribute 1 (engine), attribute 2 (drive), As for the example here, they are the 4 attributes, ① method for covering the pen's tip inside the holder, ② type of ink, ③ type of pen tip, and ④ basic shape. Furthermore, methods mean the means for actualizing the individual attributes. In the case of an automobile, there are the 3 methods of reciprocating-type, rotary-type, and diesel-type engines for attribute 1, and the 2 methods of 2-wheel drive and 4-wheel drive for attribute 2. For our case, 4 methods for attribute ①, and 2 methods for attributes ②, ③, and ④. Also, profile means the product alternatives ($32 = 4 \times 2 \times 2 \times 2$) conceivable by

combining the individual attributes with the individual methods. The number of profiles differs according to the number of attributes and their methods, but it will be possible to easily obtain the necessary and sufficient number of profiles needed to be studied for the mechanical structure of the new product if they are made by using orthogonal arrays, etc., used in the design of experiments.

Step 2 Collect data for ordering the choice

The individual profiles are ordered according to the degree of choice (they are numbered 1, 2, ..., 8 according to the order of choice) for each sub-market based on the "required items study 2" from the consumers' side, etc.

Step 3 Estimate the weights for individual methods

There are many methods for deciding the degree of importance of the individual methods, but the method of making a likelihood function assuming a Logit Model and using the maximum likelihood estimate (the method for estimating the weights for the individual methods within the

ANALYSIS CONCERNING THE IN-USE/
CONVENIENT FUNCTION (ANALYSIS 2)

It is necessary for analyzing the in-use/convenient function by comparing them with competing products. It was assumed in this study that a product alternative 1 was going to be newly introduced into a market with competing products A, B, C, and D, and will propose a series of methods for evaluating the individual function of the product alternative 1. In this case example, the method of deciding the individual function levels of product alternative 1 is done by improving its function and/or values based on the in-use/convenient function of a specific competing product (e.g. product A) considered from the characteristics of the competing product group in mind.

The method of carrying out the following series of 3 analyses is proposed here for the present competing product group.

① Analyze the degrees of require and satisfaction

To analyze the degrees of require and satisfaction means to obtain the extent of the desires (degree of require) of the consumers towards the individual function of the present competing product group and the extent of the individual achievement of the function (degree of satisfaction) of the object product (e.g. product A), and to clarify the function needed to be improved and its extent by studying their balance. The outline of the procedure is as follows.

Step 1 Collect data on the degrees of require and satisfaction to be quantified

A "study on the degrees of require and satisfaction" is carried out for each function in the competing product group (characteristics of required function in Figure 2). The study on the degree of require is that made on how much consumers etc. evaluate the importance of each function when buying (selecting) the product, and the study on the degree of satisfaction is that made on how much the product (e.g. product A) gives satisfaction regarding that function.

Step 2 Quantify the degrees of require and satisfaction

The collected data are normalized so as to be statistically treatable, the degrees of require and

satisfaction for individual function are quantified, their percentages are obtained, and these become the degrees of require and satisfaction for the individual function.

Step 3 Make a value control chart

A value index ($V=N/S$) is calculated from the quantified degrees of require (N) and satisfaction (S) and a value control chart is made. It is considered here that higher valued function are adopted for product alternative 1 based on the individual function of product A, so the balance among the achievement levels of the individual function are analyzed.

Step 4 Prefer the function needed to be improved

Those functions plotted in the low valued region (outside the oblique lines) from the value indices and value control chart are performed as function needed to be improved. In the case of product A, the following functions can be chosen by making a value control chart by considering the function needed to be improved as $q=6$.

Function needed to be improved

- ├ F5 (Fits the fingers well)
- ├ F3 (Appropriate thickness)
- ├ F7 (Good feel of writing)
- └ F1 (Appropriate length)

② Analyze the high priority function

Analyzing the high priority function means to study the effect of the achievement of the individual function of the product (e.g. product A) in question on the order of choice of consumers in buying (selecting) the competing product group in question, and to analyze those functions which give a large effect as the high priority function. The procedure is as follows.

Step 1 Collect data on the ordering of choice, etc.

"Data on the ordering of choice and the degree of satisfaction" for the competing product group in question are collected and normalized.

Step 2 Calculate the partial correlation coefficient

Calculate the partial correlation coefficient by considering the normalized choice-ordered data as the objective, explanation variable and carrying out multiple regression analysis.

Step 3 Prefer the high priority function

Prefer the function with a high order of choice and a large correlation as the high priority function (not necessarily singular). The preferred high priority function from the result of the partial correlation coefficient and t-test becomes F6.

- ③ Prefer the high priority function needed to be improved and set up the improvement target

Here, the high priority function needed to be improved means those functions needed to be improved and also the high priority function. These are function necessary to be improved with the highest priority, and their direction of improvement is toward putting them within the appropriate value region of the value control chart.

MAKE AND UTILIZE THE PRODUCT CONCEPT TABLE

MAKE THE PRODUCT CONCEPT TABLE

Those information obtained through the above two analyses are summarized into one table and will be called the "Product Concept Table". This Product Concept Table is an arrangement of information essential for clarifying and detailing the product concept from the use function aspect so makes up an important part of the designer support system.

This Product Concept Table will contribute to a much more integrated product

conceptualization by combining Product Concept Tables for use and esteem function into a pair so as to compensate each other. Therefore, the Product Concept Table in this study only looks from one side. The form is as shown in Table 2, and the contents are those of the drawing no., function needed to be improved, high priority function, and the high priority function needed to be improved.

UTILIZE THE PRODUCT CONCEPT TABLE

On information A

Information A is the quantified degree of the choice of the consumers regarding the individual methods for individual attributes. For the case taken up, when the cap type (β_1) for attribute 1 (method for covering the pen tip) is evaluated as 0.00, it shows what the degrees of choice are for the other methods ($\beta_2, \beta_3, \beta_4$). As a result, it can be seen that the cap type is liked overwhelmingly as the method for covering the pen tip. The water soluble type (5) is liked better than the oil soluble type (6) for attribute 2 (type of ink) when comparing the two, but the table shows that the difference is small. The remainder can be interpreted similarly. Thus, the method most liked by the consumers is the combination $\beta_1, \beta_5, \beta_7, \beta_9$.

On information B

Information B shows the quantified degree of consumer choice for individual attributes for the

Table 2 Outline of Form for a Product Concept Table

*** Product Concept Table ***		
Object product	Object segment	Object sub-market
< Weights for individual methods (information A) > β_1 : β_2 : β_3 : ⋮ β_n :		< Importance ratio for individual attributes (information B) >
< Value control chart (information C) >		< Function needed to be improved (information D) > 1. 2. ⋮
		< High priority function (information E) > 1. 2. ⋮
		< High priority function needed to be improved (information F) > 1. 2. ⋮

competing product group taken up. For the case taken up here, the proportions of the effects on the consumer decision on buying can be seen to be about 66% for attribute 1, about 5% for attributes 2 & 3, and about 24% for attribute 4. Thus, the degree of consumer choice is overwhelmingly the majority for the cap type of covering the pen tip, and so, together with information A, the mechanical/structural combination to be studied can be said to be, from the consumers' degree of choice, a new product with a combination of β_1 , β_5 or β_6 , β_7 or β_8 , and β_9 .

On information C

Information C is the application of the technique proposed by one of the authors, Masayasu Tanaka, at the 5th VE National Conference, and the function needed to be improved is/are determined from how the value of q is set. Here, q was set as 6, so the function needed to be improved became F5, F3, F7, and F1. The value of q depends on how much allowance can be made for the balance among the degree of achievement of the individual function, and is decided by corporate policy on product development. For the case taken up here, the value control chart for product A for personal use is shown below.

On information D

Information D is information C in itemized form, and clarifies those functions needed to be improved and their priority.

On information E

Information E is a list of functions which have a large effect on the consumers in buying(selecting) from among the competing product group in mind, which means that these function should be seriously considered in conceptualizing new products. In the case taken up here (personal use), it is F6 (in most cases, there exist plural function). To be more concrete, the same function as that/those shown at Step 3 of analyze the high priority function is/are shown.

On information F

Information F shows the high-priority function needed to be improved, and the level of its/their achievement must be by all means made to be within the appropriate region of the value control chart. There existed none in the case taken up here.

CONCLUSIONS

Two new analytical methods from the use function viewpoint have been proposed in this study for supporting the conceptualization of new products using existing or improved technology to be introduced into an existing market. In analysis 1, Conjoint Analysis has been applied to calculate the overall utility value of the alternative plan from the "mechanical/structural function" standpoint. The merits of adopting the Conjoint Analysis can be summarized into the following.

First of all, the large number of existing combinations of attributes and methods (those product alternatives which can be considered) can be reduced to a necessary and sufficient number of combinations by using orthogonal arrays of the design of experiments.

Secondly, the consumer choice structure can be quantified by ordering the combination of attributes/methods. As a result, there are merits of not only the best choice structure and the degree of potential demand able to be shown but the second/third best choice can be known.

Thirdly, the relative degrees of importance among the attributes constituting the product alternatives and the weights of the individual methods can be calculated so it is useful in clarifying the potential demand structure of the product group taken up.

In analysis 2, a value control chart has been made for the "in-use/convenient function" and those functions needing improvement were preferred by using the concept of an appropriate value region. Next, the high priority function were clarified by using regression analysis, and it was further possible to prefer high priority function needed to be improved and to clarify their directions.

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