

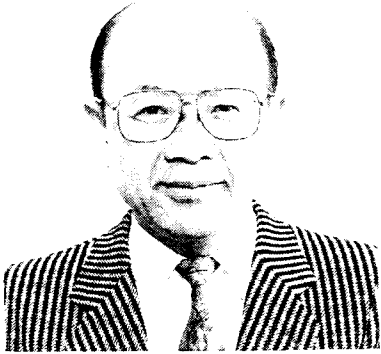
## **An Evaluation Method for New Product Specifications Based on the Evaluation of the Required Functions from the Viewpoint of Pilot Users**

~Using Interactive Information of Pilot Users by Internet~

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**ABSTRACT**

Products will not become hits unless the customers' unique and readily changing latent needs and wants are caught timely in markets with very shortened product life cycles. Manufacturers must carefully grasp the trend of the needs and wants of pilot users who prefer new things in order to respond to such needs and wants which are difficult to catch. This is because such pilot users are opinion leaders for the individual product groups and largely influence general users.

A useful tool for concept making for products with very short life cycles is proposed by the author through this study in which new products are sent into the market one after another (a mobile information terminal was taken up as an example), and the special characteristic of this tool is to make out specifications for such new products reflecting the functional evaluations of the pilot users.

**KEYWORDS**

Internet, customer satisfaction, required function, pilot user

**1. INTRODUCTION**

The interrelationship between the manufacturer and the customer has changed with the rapid spread of Internet. Formerly, information between the manufacturer and the customer was mainly that manufacturers offered products and the users informed the degree of their satisfaction or dissatisfaction and complaints as customers. That is, they were individually one-way flows. However, when the product life cycles become short as at present, and products are sent into the market frequently, the opinions of pilot users who show immediate interest in such products will largely influence those customers

who will follow them, and will seriously influence the increase in the amount of sales of such products. Therefore, product concept making reflecting their opinions will become important for such new products. Fortunately, a large number of such people are enthusiastic Internet users, so manufacturers can obtain their opinion and information from the network timely as frequently as necessary.

Thus, it was first investigated using Internet in this study as to which functional characteristics of a product sold in the market recently were considered important by the pilot users. As a result, the major required functional characteristics considered important in common by the pilot users were clarified. Next, they were asked to evaluate the functional characteristics, and an overall evaluation was made for competitive products including the product being taken up. Then, it will become possible to develop new products with a higher possibility of satisfying the degree of customer satisfaction by deciding the new product specifications according to such evaluation values.

**2. THE EVALUATION METHOD FOR THE SPECIFICATIONS OF NEW PRODUCT PLANS****2.1 The Defect of the Conventional Evaluation Method**

Conventionally, the evaluations of whether new product specifications were appropriate or not were carried out at major points between individual key development and design stages at new product development meetings or by design review. These evaluations were mainly carried out based on information from the manufacturers' point of view, but this is insufficient. They must be evaluated by adding information as seen from the customers' points of view. However, it is not easy to collect the many true customers' information timely. Therefore, in reality, the new product specifications are evaluated under

insufficient situations regarding such information.

Even when the methodology for deciding new product specifications are rationally established, there are many cases in which the information to be input are not appropriate. Therefore, the results are clear as to what will happen even when quality function deployment, conjoint analysis, zero-phase VE are employed if the information used in them lack appropriateness.

### **2.2 The Features of the Method in this Paper and Products to be Applied**

So, investigations were carried out by using Internet as the method for collecting the frank opinions of pilot users timely regarding which functions they really are searching for. This investigation method has the following advantages compared with the conventional method for collecting information.

- ① Additional investigations can be carried out as many times as necessary without infringing the privacy of pilot users.
- ② It is not necessary to answer many questions at one time, so partitioned answers are possible.
- ③ Internet is used so the opportunity is given to all users using Internet to answer the questionnaires.
- ④ The difference in the degree of cognition of the person answering the questionnaire toward the product is comparatively small, so more reliable data can be obtained.
- ⑤ The answers are directly given to the personal computer, so the burden on the person summarizing the result is lightened and the cost can be reduced.

These advantages can be especially utilized in evaluating the product specifications whose life cycles are short in the order of several months and the speed of technical development is fast. As examples of such products, cellular phones, car navigation, mobile information terminals, personal computers, digital video disks, can be given. In the case of such products,

latent customers purchase them by making use of the opinions of pilot users as reference other than direct advertisement from the manufacturers.

### **3. THE SUMMARY OF THIS METHOD**

Pilot users have been investigated by several Internet communications in this study to grasp their knowledge level and the state of usage of the new product group in mind to find out whether they were users capable of carrying out the role of pilot users for the new product group and thus, pilot users were defined.

Based on this investigation, first, the convenient, use functions which have especially high degrees of requirement among existing similar product group usage are investigated and are systematically arranged to decide the required functional characteristics. The pilot users are asked to give the degrees of importance (0~5 points) to the individual required functional characteristics. Secondly, the degrees of importance obtained above are converted to the degrees of importance for the major structural characteristics composing the product in mind. For this purpose, the pilot users are asked to answer the degrees of causal relationships between the individual required functional characteristics and the structural characteristics. The degrees of importance of the required functional characteristics are converted to the degrees of importance of the structural characteristics by completing a matrix table for the required functional characteristics and the structural characteristics by using the results of the answers.

Thirdly, the pilot users are asked to give points (0~5 points) to the degrees of satisfaction regarding the required functional characteristics previously decided at the stage of usage after purchasing. Then, the points for the degrees of satisfaction of the structural characteristics are obtained by completing the matrix mentioned before.

Fourthly, the degrees of importance of the individual structural characteristics obtained at the second step and the degrees of satisfaction of the individual structural characteristics obtained at the third step are shown in graphic forms. These are called customer satisfaction (C/S) maps.

Fifthly, those structural characteristics which should be improved and their degrees of improvement are made clear by these C/S maps, and the results are reflected in new products for the next period, and product specifications with higher degrees of satisfaction are made. The steps for this method are as shown in Fig. 1.

#### 4. THE INVESTIGATION OF THE REQUIRED FUNCTION LEVEL OF THE PILOT USER (AN APPLICATION EXAMPLE OF THIS METHOD)

An investigation of the actual situation of pilot users regarding the evaluations of the new product specifications of a mobile information terminal was carried out (from April, 1997 to January, 1998) as follows to apply the method proposed in this study, and 531 valid answers were obtained.

##### 4.1 Deciding the Required Characteristics for Convenient, Use Functions and Structural Characteristics

First of all, an investigation of the actual situation was made to decide the required convenient, use functional characteristics and structural characteristics of the pilot users. Using the results of this investigation and specialists' opinions, 28 items ( $S_1, \dots, S_{28}$ ) for major required functional characteristics and 20 items ( $H_1, \dots, H_{20}$ ) for structural characteristics considered to be necessary by the pilot users were selected (See the required functional characteristics of Tables 1 and 3). Those points devised in carrying out

the investigation by the questionnaires were as follows. First, electronic mails with contents requesting cooperation were transmitted to the home pages published in magazines, the Internet bulletin board, mailing lists, etc., to increase the number of answers. Next, keywords related to the product in mind were registered in the most frequently searched word list opened by search engines.

##### 4.2 The Calculation of the Convenient, Use Required Functional Evaluation Values

After deciding the required functional characteristics, an investigation using questionnaires was carried out for pilot users planning to buy the product in mind in the near future by asking them to answer their degrees of expectation on the 28 previously selected items on the required functional characteristics before purchasing by a 0~+5 Likert scale. Then, e-mails were sent to the same pilot users after one to three months later to carry out a similar investigation by questionnaires to grasp their degrees of satisfaction after the purchase.

If these data are used, it will be possible to analyze how the evaluation points for the required convenient, use functional characteristics have changed from before to after the purchase, and the expectations and dissatisfactions of the pilot users toward the required convenient, use functional characteristics of the product group in mind can be quantitatively grasped. In general, it is not considered desirable to send out plural similar questionnaires to the same person because the burden on the persons will be heavy. However, the burden can be reduced if we make use of the special characteristics of investigations by Internet. The results of the above are shown in Table 1.

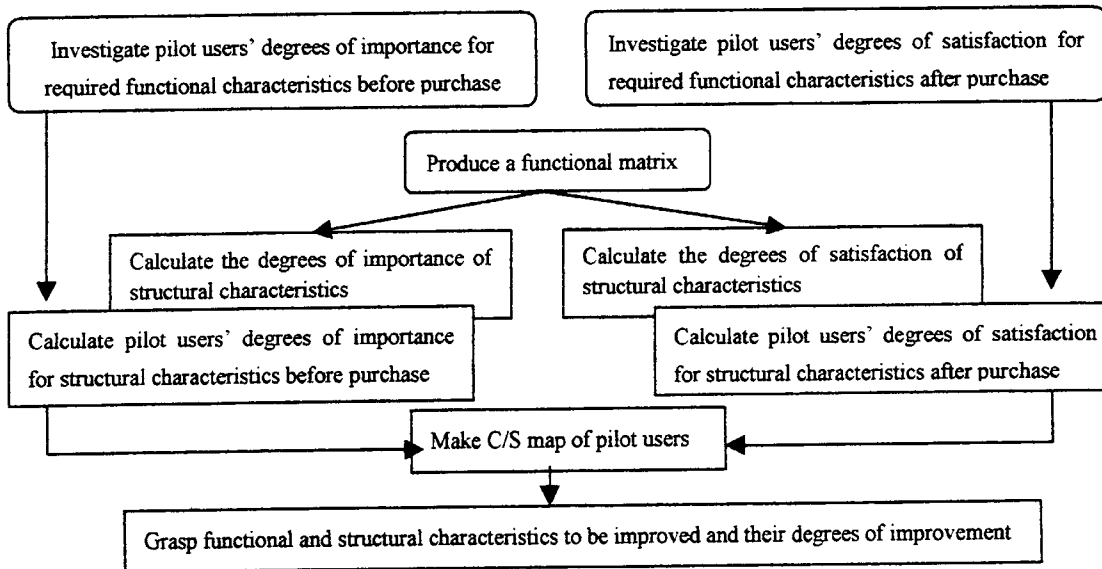


Figure 1 Flowchart of this Study

	Required Functional Characteristics	Before Purchase	After Purchase		Required Functional Characteristics	Before Purchase	After Purchase
S <sub>1</sub>	Can use continually for a long time	72	108	S <sub>15</sub>	The input of handwriting is possible	24	180
S <sub>2</sub>	The volume of the body is small	276	186	S <sub>16</sub>	The word processor function is satisfactory	51	87
S <sub>3</sub>	The body is light	180	30	S <sub>17</sub>	The color quality is good	120	216
S <sub>4</sub>	The body is easy to be cleaned	15	15	S <sub>18</sub>	The variety of the display color is abundant	60	90
S <sub>5</sub>	The body is not likely to break down	24	15	S <sub>19</sub>	The display speed is quick	93	18
S <sub>6</sub>	The body is not likely to become heated	18	6	S <sub>20</sub>	It can be connected to a personal computer	30	140
S <sub>7</sub>	One does not get tired while using it	36	15	S <sub>21</sub>	Wireless transmission is possible	60	15
S <sub>8</sub>	The processing time is fast	210	112	S <sub>22</sub>	Can send and receive e-mails	36	94
S <sub>9</sub>	The memory capacity is large	120	90	S <sub>23</sub>	Can send and receive facsimiles	3	24
S <sub>10</sub>	It is easy to rebuild the body	45	15	S <sub>24</sub>	Can use telephone functions	24	48
S <sub>11</sub>	Its functions can be expanded	105	93	S <sub>25</sub>	Can be used with intranets	57	24
S <sub>12</sub>	Customization is possible	57	45	S <sub>26</sub>	Has a WWW browser	72	58
S <sub>13</sub>	External memory device can be connected attached	54	85	S <sub>27</sub>	The variety of software is abundant	30	72
S <sub>14</sub>	Japanese language usage environment is satisfactory	105	60	S <sub>28</sub>	Its software is easy to use	30	18

(Remarks) The numbers in the table are the totals of the evaluated (degrees of) importance for the individual functional characteristics by the 531 persons who answered.

Table 1 The Required Functional Characteristics and Their Evaluation Points

**4.3 The Calculation of the Evaluation of Required Structural Functional Characteristics**

An investigation using questionnaires was carried out on the same pilot users as above to relate the required convenient, use functional characteristics and the structural characteristics. Its contents were to consider the evaluation values of the individual

required convenient, use functional characteristics as 1 point each and to distribute it to the individual structural characteristics according to their degrees of influence on the evaluation values (of the required convenient, use functional characteristics). Their averaged values to calculate the degrees of relationship are the values shown in the matrix of Table 2.

			Display			CPU		Memory	Input-Output	
			Size	Variety	Number of colors	Variety	Speed	Size	Variety	Number
	Before	After	165	137	79	68	161	88	118	65
	Before	After	189	194	119	33	83	51	119	63
Can use continuously for a long time	72	108	0.2				0.1			
The volume of the body is small	276	186	0.2							
The body is light	180	30								
The body is easy to be cleaned	15	15	0.3	0.1	0.1		0.1			
The body is not likely to break down	24	15		0.2		0.3				
The body is not likely to become heated	18	6				0.3	0.4	0.1		
One does not get tired while using it	36	15	0.3	0.4	0.2			0.1		
The processing time is fast	210	112				0.2	0.5	0.1		
The memory capacity is large	120	90						0.3	0.1	0.1
It is easy to rebuild the body	45	15				0.3		0.1	0.2	
Its functions can be expanded	105	93							0.2	0.4
Customization is possible	57	45								
External memory device can be connected attached	54	85							0.2	0.2

**Table 2 Function Matrix (Part)**

Table 2 shows the valid answers in matrix form, and shows the relationships between individual required convenient, use functional characteristics and the structural characteristics. Here, the required functional evaluation values of the structural characteristics were calculated as the sum of products of the evaluation values of the required convenient, use functional characteristics and the degrees of relationships. Table 3 shows the total values of the evaluation values of the structural characteristics obtained by the above-mentioned calculation method divided into those before and after purchase. (Table 3

corresponds to the half-tone dot meshed portion of Table 2.)

Next, the utilization of the differences between the points for the degrees of importance and the degrees of satisfaction toward the structural characteristics shown by the pilot users before and after purchase in evaluating the specifications for new product development will be tried out. It can be considered that the degree of customer satisfaction will be high when the evaluation after purchase is close to or higher than the evaluation before purchase, so a C/S map was made out to express this in an easily understandable

form by taking the evaluation values of specific functions before purchase on the horizontal axis and

the evaluation values of specific functions after on the vertical axis.

			Before	After				Before	After
Display	H <sub>1</sub>	Size	165	189	Input Device	H <sub>11</sub>	Keyboard	80	77
	H <sub>2</sub>	Variety	137	194		H <sub>12</sub>	Pen	13	58
	H <sub>3</sub>	Number of Colors	79	119	Battery	H <sub>13</sub>	Duration	54	77
CPU	H <sub>4</sub>	Kinds	68	33	Modem	H <sub>14</sub>	Speed	73	112
	H <sub>5</sub>	Speed	161	83	Body	H <sub>15</sub>	Size	172	115
Memory	H <sub>6</sub>	Size	88	51		H <sub>16</sub>	Weight	192	38
Input-Output	H <sub>7</sub>	Variety	118	119	Phone	H <sub>17</sub>	Phone	19	38
	H <sub>8</sub>	Number	65	63	OS	H <sub>18</sub>	Variety	247	198
PC Card Slot	H <sub>9</sub>	Variety	88	132	Application	H <sub>19</sub>	Number	119	175
	H <sub>10</sub>	Number	40	36		H <sub>20</sub>	Variety	30	52

**Table 3 Evaluation Values of the Structural Characteristics**

To make the degrees of change in the evaluation values between before and after purchase visible, the data of Table 3 were normalized by taking their average as 0 and their variance as 1 as shown additionally in Fig. 2. Not only how much of what structural characteristics is being desired by the pilot users can be known but it will become possible to be able to propose improvements for the individual structural characteristics quantitatively. Those structural characteristics above the 45 degree line in the figure satisfy the pilot users and those below the line will dissatisfy them. The ideal specifications for the manufacturers will be for the evaluation values of all the structural characteristics before and after purchase to be close to each other and that they fall close to the 45 degree line.

Those structural characteristics desiring

improvement by the pilot users are “OS”, “body weight”, and “CPU speed”. There is dissatisfaction especially toward the “body weight”, so reducing the weight of the product is demanded in the future.

Some time will be necessary from the time of deciding the product specifications tentatively till the time of actually developing and selling it. If the preferences of the pilot users toward the required functional characteristics of the product change rapidly the engineer developing and designing the product must face such situations flexibly. So, the investigation using questionnaires was partitioned into the two periods of from August to October and from November to January, and the investigated results were summed up for the individual periods to analyze the transitions of the pilot users’ evaluation values for the required functional characteristics.

**<Examples of the calculations by the sum of products>**

H1 :before purchase 165 = 0.2×72 +0.2×276 +0.3×15 +0.3×36 +...  
 H1 :after purchase 189 = 0.2×108 +0.2×186 +0.3×15 +0.3×15 +...  
 H2 :before purchase 137 = 0.1×15 +0.2×24 +0.4×36 +...

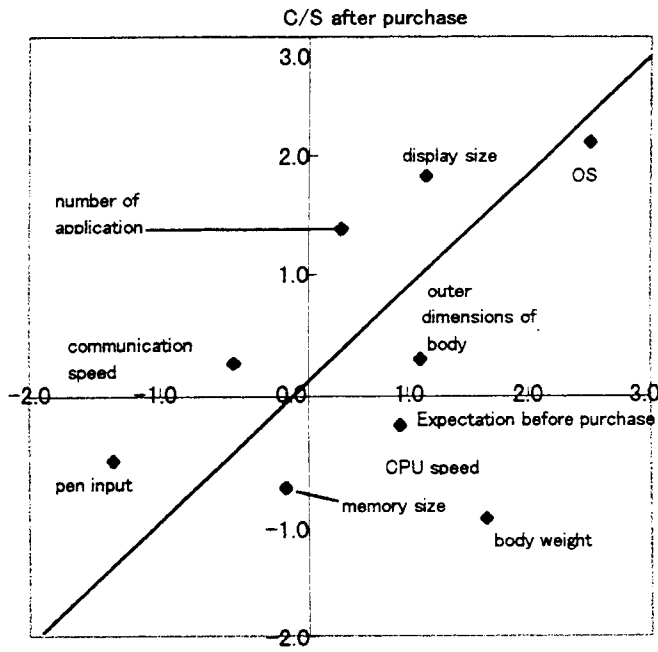


Figure 2 C/S Map of Structural Characteristics (Being Normalized)

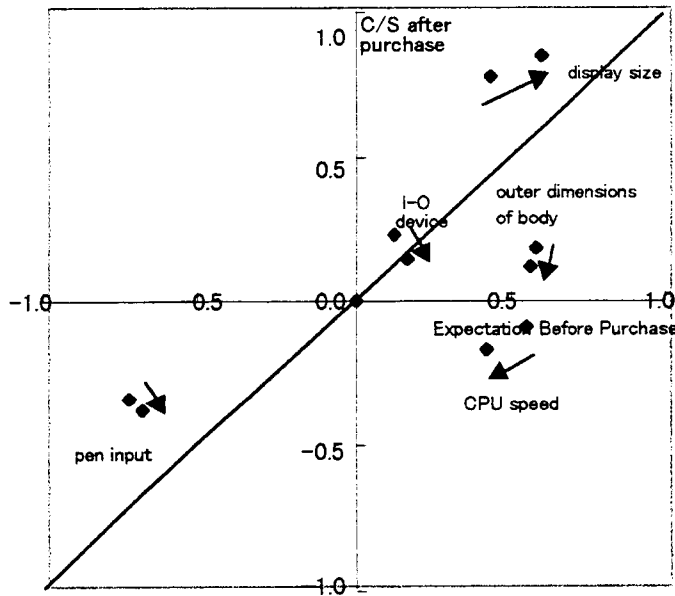


Figure 3 Time Series Analysis of C/S Map

Fig. 3 shows the C/S map for the pilot users. Information concerning the degrees of importance of the required functional characteristics not obtainable from Fig. 2 showing only the result for one period can be obtained from Fig. 3, and is very useful in finding out the expectations of the pilot users toward the mechanical characteristics and their trends. That is, "the display size" was better than expected, but it can be seen that pilot users are expecting further improvement, while "pen input" and "the variety of input/output methods" were better than expected, but the pilot users already grasped their technical aspects upon purchase and did not expect so much more so their evaluation values before and after purchase are close to each other. As for the "outer dimensions of the body" and the "CPU speed", the degrees of importance before their purchase were low while the evaluation values after their purchase also decreased. Therefore, the evaluation values before and after purchase did not become close to each other, so the improvements of these functions which have continued to fail to satisfy the customers is necessary. It is necessary to grasp such useful information timely in developing next stage new products.

### 5. THE CALCULATION OF THE PRODUCT EVALUATION VALUE

The overall evaluation of popular product lines among pilot users sold in 1997 was carried out using the required functional characteristic evaluation points in Table 3. The relative features among competing products can thus be clarified. The design characteristic values were collected for individual competing products. Quantitative data for which larger values were better were adopted as they were, while those for which smaller values were better were multiplied by -1. Those difficult to quantify like OS were valued by referring to the opinion of experts. The product evaluation values for products can be calculated to grasp the expected evaluation values of products before purchasing by taking the sum of

products of normalized design characteristic values and their evaluation characteristic points (after normalizing them) for individual products. The evaluation values of products after purchasing are also similarly calculated. And the values of individual products for pilot users are calculated by dividing the product evaluation values by their list price. As a result, the 5 highest ranking product models before purchase were "Bungou" ARDATA CA-1000T, CASSIOPEIA A-51, Mobile Gear MC-MK11, Apple Message Pad 130, and Color Zaurus MI-10. The first place "Bungou" ARDATA CA-1000T had high point evaluations for the display size, external size, and weight, and also miniaturization and weight reduction led to high values. On the other hand, the 5 highest ranking models after purchase were HP200LX, CASSIOPEIA A-51, Bungou" ARDATA CA-1000T, Brain Pad TiPO, and Power Zaurus, and the first place HP200LX was highly valued for the number of usable, installed applications. It is thought that the reason for this product to maintain such a high rank for 3 years in this period of short life cycles is that it has a high evaluation value for after purchase.

### 6. CONCLUSIONS

A new method has been proposed in this paper to develop concepts for very short life-cycled new products which are continuously sent into the market, and its contents can be summarized as follows.

1. It becomes possible by investigating the needs and wants of pilot users many times through Internet to grasp the continuously changing trends timely.
2. It shows the direction for improvement at an early stage of development and design by making out a C/S (customer satisfaction) map for functions by these evaluation information.
3. A C/S map is similarly made out for structural characteristics in the latter stage of development and design which shows the direction for improvement.
4. It will become possible by these information to

evaluate hit products including competing products, it will become known as to which structural characteristics of hit products are highly evaluated.

5. This study has shown a method for utilizing such information in total to next period new products and a concrete example has been shown by applying it to mobile information terminals.

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