A METHOD OF VALUE ASSESSMENT COMBINING QUALITY DEPLOYMENT WITH FUNCTION DEPLOYMENT

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ABSTRACT

This paper presents a new method to estimate the value of a new product during the Marketing Planning stages, which combines the merits of the QC method with those of the VE method. The Quality Function Deployment Matrix (QFD Matrix) and the Function and System Development Diagram (FSD Diagram) are merged into a QUALITY-FUNCTION-SYSTEM DEPLOYMENT Matrix (QFSD Matrix), a method of product evaluation with the determiation of the practicability of the new product is introduced in this paper.

Specific features of the QFSD Matrix are:

1) The specification of the product is detailed in the QFD Matrix.
2) Function Evaluation is equal to the System Evaluation (Relative performance evaluation of the system).
3) Values shall be determined based on Design Quality Assessment divided by the System Costs.

INTRODUCTION

Company Wide QC and VE are presently used by a large number of companies to improve their performance, however, they are often used independently of each other. Only by use of these two tools in conjunction can the full benefit of each be achieved. QC and VE are individually very good techniques to apply to the planning of a new product, but this paper introduces a much better technique to achieve the same purpose. It combines the merits of QC with those of VE. That is to say, the merits of Quality Deployment are combined with those of Function Deployment.

PROCESSES OF TARGET ACHIEVEMENT IN NEW PRODUCT DEVELOPMENT IN PRESENT USE

There are two processes of target achievement for Quality, Function, Specification Development in new product planning. One is the QC approach presenting market needs as Customer Requirements and finally as Quality of Design in the QFD Matrix, and the other is the VE approach taking Customer Requirements as the specification in the Functional Analysis System Technique (FAST). The QFD Matrix plays an important role in the QC approach, and likewise Function Analysis in the VE approach, determining Value according to the well known equation V=F/C.

The purpose of product planning is to improve the quality, function and specification of the product and further to add salability. This method conducts product planning through the following steps:

1. To establish targets.
2. To define various systems to achieve primary function.
3. To compare competitors' products using value criteria.

THE BASIS OF THE OF SD MATRIX

Figure 1. Comparison of the Merits and Shortcomings of the QFD Matrix and the FSD Diagram.

	QFD MATRIX / QUALITY DEPLOYMENT	FSD DIAGRAM / FUNCTION DEPLOYMENT
PROCEDURE	To determine Market Requirements regarding quality and priority. To determine quality level taking competitors' products and company policy into consideration. To set Quality of Design as development target, taking Product Control Characteristics (PCC) into consideration.	To define primary functions after analysis of Customer Requirements. To define secondary functions taking Customer Requirements and the relationship between purpose and method into consideration. To evaluate functions.
OUTPUT	Quality of Design (Target Parameters).	Function & System Diagram. Functional Specification. Evaluation of Functional Specification.
MERITS	1: Visual presentation of the evaluation detailing relative priority levels of market requirements, comparison with competitors' products, selling features and company policy. 2: It is easy to see the use of PCC priority ratings as development targets, as the Customer Requirements section of the matrix presents the information visually. 3: The data is equally useful to Sales and Engineering.	1: Encourages innovative thinking. 2: Clarifies the procedures to achieve the final product. 3: Prevents neglect of basic quality details. 4: Determines system selection and Value Assessment in clearly defined steps.
SHORTCOMINGS	1: Does not clearly show the steps required for new product realization. 2: Can neglect basic quality details. 3: Matrix can be too large for easy understanding (information overload). 4: Does not cover function requirements.	Difficult to understand what constitutes saleability, and how to evaluate specifications.

Note * Please refer to Figure 1. (above) for derivation of Figure 2. Basis of the QFSD Matrix.

DEVELOPMENT OF THE QFSD MATRIX

A combination of the merits of the QFD Matrix and the FSD Diagram (as shown in Figure 1.) will enhance the effectiveness of both methods (as shown in Figure 2.), the shortcomings of each being balanced by the merits of the other.'

Figure 2. Outline of the QFSD Matrix.

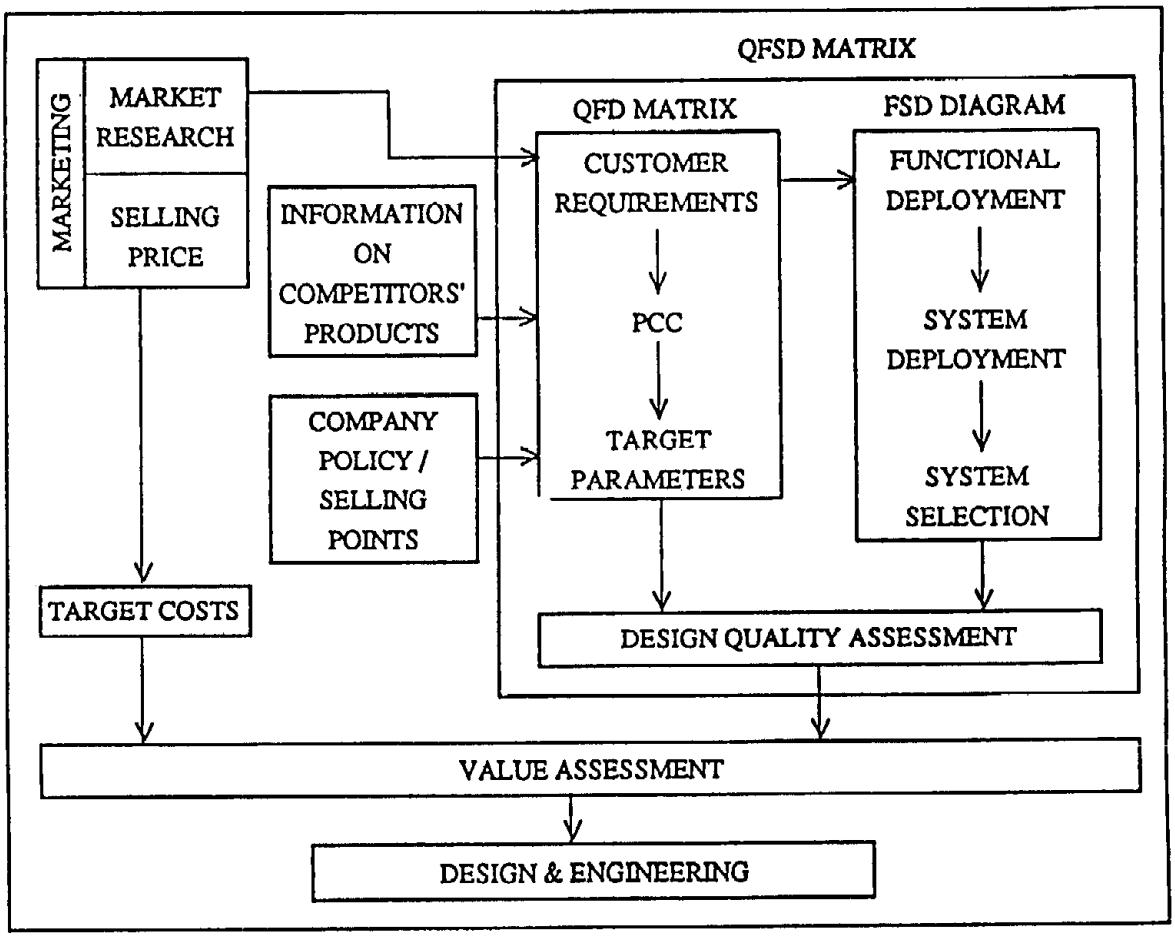
	QFD MATRIX	FSD DIAGRAM
ELEMENTS FROM QFD MATRIX AND FSD DIAGRAM TO BE SELECTED FOR QFSD MATRIX.	1: Presents customer's requiments and priority ratings. 2: Quantifies comparison with existing products. 3: Details information about Saleability / Selling points. 4: Details information about Quality of Design.	1: Functional Analysis Method. 2: Function & System Development. 3: Value Assessment. 4: Prevents neglect of basic quality details.
SHORTCOMINGS	The matrix can become very large and complicated.	
HOW TO OVERCOME SHORTCOMINGS	1: By only deploying primary quality & function levels. 2: By use of a Quality / Function Relational Matrix.	
ADVANTAGES OF THE QFSD MATRIX	1: Quality, Functions and Characteristics are all presented in a single format. 2: Target realization is simplified as each system is value-assessed. 3: Adoption of this method by a company which has already introduced CWQC / QC is simple. 4: The procedure and presentation of new product planning is improved.	

VALUE ASSESSMENT BY THE QFSD METHOD
OUTLINE OF PROCEDURE

1. Following marketing, list Customer Requirements in order as per QC method.
2. List functions based on Customer Requirements using Functional Analysis.
3. To prevent loss of saleable function elements, form a Quality Deployment / Function Deployment matrix.
4. Assess function for each PCC. The systems achieving the highest rating are selected and listed in the QFSD Matrix.
5. Value-up is determined by dividing the Composite Evaluation of Design Quality (Q up) by the Cost Variation Ratio (Ck).

Please see Figure 3. QFSD data flow chart.

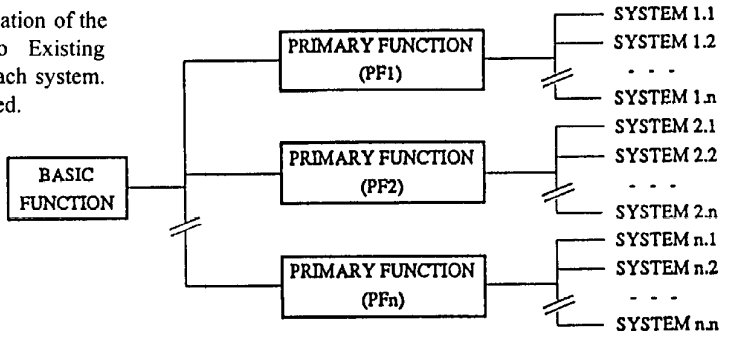
Figure 3. QFSD Dataflow Chart.



PROCEDURE IN DETAIL

Please refer to Figure 4 which shows a Quality-Function-System Deployment Matrix and Value Assessment for an Automatic Guided Vehicle.

Figure 4. The Best System is selected by calculation of the ratio of estimated system performance to Existing Parameters, then averaging all the ratios for each system. The system with the highest average is selected.



			Product Control Characteristics a	b	- - -	n	AVERAGED	SELECTED
Quality of Design	Existing Parameters		20.0	4.0		15.0		
	Target Parameters		20.0	3.0		18.0		
	Level-up Ratio (b)		1.0	1.3		1.2		
Selection of Systems	Function PF1	System 1.1		1.3		1.1	1.20	○
		System 1.2		1.2		0.9	1.05	
		System 1.n		1.1		1.2	1.15	
	Function PF2	System 2.1	1.2			1.2	1.20	○
		System 2.2	1.3			0.8	1.05	
		System 2.n	0.9			1.1	1.00	
	Function PFn	System n.1				1.2	1.20	
		System n.2				1.1	1.10	
		System n.n				1.3	1.30	○

Figure 4. The QFSD Matrix & Value Assessment.

STEP 1 [CREATING THE QFSD MATRIX]

Marketing data usually includes details of Quality, Function, Specification and Cost. This data is used as a basis for quantification of customer's primary requirements, which are further broken down into secondary requirements using the KJ Method.

Following the above, the Planned Quality ratings, PCC and Design Quality parameters are input into the matrix. We have not fully detailed this process here. Further details are available in Reference No. 1.

a) Customer Requirements, PCC and Function are usually deployed to the tertiary level, however in this method, only the primary level is taken into consideration.

b) The relationship between Customer Requirements and PCC is indicated as follows:

Double Circle	Strong (5 points)
Single circle	Medium (3 points)
Triangle	Weak (1 point)

In addition the Target Quality Rating (%) is prorated to the PCC level.

c) Each PCC ratings column is then added to obtain the Adjusted PCC Rating (%). Thus the Target Quality Rating (%) is converted to the Adjusted PCC Rating (%).

d) Each Target Parameter is decided on completion of Comparative Analysis. The Target Parameters have not yet been assessed for practicality but are used for reference purposes only.

e) Level-up Ratio (b) is the ratio of Target Parameter to existing parameter ("Ourselves" in the Comparative Analysis). Note: In some cases a smaller parameter value denotes better performance. If Level-up Ratio (b) is greater than 1, it indicates that target performance is greater than existing performance.

f) Level-up Ratio (b) multiplied by the Adjusted PCC Rating (%) gives the Target PCC Rating (%). The total Target PCC Rating shows the degree of quality improvement which adherence to the Target Parameters would give.

STEP 2 [FUNCTION ANALYSIS- FUNCTIONAL DEPLOYMENT]

Using FAST, the Function Deployment table is formed from Customer Requirements.

Note: The primary information detailed in the QFSD is developed from secondary information assessed independently.

A detailed explanation is not given in this paper but further details are available in Reference No. 2.

STEP 3 [INVESTIGATION OF THE RELATIONSHIP BETWEEN ITEMS OF FUNCTIONAL DEPLOYMENT AND QUALITY DEPLOYMENT]

The relationship between Functional Deployment and Customer Requirements is confirmed using the symbols . These symbols only indicate the degree of relationship and do not imply any numerical value. The purpose of this step is to ensure that no saleable functions are overlooked in planning for each Customer's Requirements.

STEP 4 [SELECTION OF SYSTEMS FOR EACH PRIMARY

FUNCTION]

The most suitable system is selected for each primary function as shown in Figure 4. to achieve the Target Parameters set in Step 1.

In Figure 4. the best system is selected by calculation of the ratio of estimated system per-formance to Existing Parameters, then averaging all the ratios for each system. The system with the highest average is selected.

STEP 5 [DESIGN QUALITY ASSESSMENT]

Evaluation of the extent to which the Design Quality Assessment (%) meets the Target PCC Rating (%).

a) The system improvement ratios of the selected systems (obtained from Step 4) are averaged by PCC, to obtain the System Improve-ment Ratio (Averaged).

b) The Design Quality Assessment (%) is obtained by multiplying the Adjusted Priority Rating(%) by the System Improvement Ratio (Averaged) for each PCC. The assessments for each PCC are then added together to obtain the total Design Quality Assessment (%). The Composite Evaluation of Design Quality (Q-up) is obtained by dividing the total Design Quality Assessment (%) by the total Adjusted PCC Rating (%).

c) If the total Design Quality Assessment (%) is lower than the total Target PCC Rating (%) system selection (Step 4) is repeated.

d) An assessment of potential bottlenecks for each system is carried out, and Remedies determined for each Bottleneck.

STEP 6 [VALUE ASSESSMENT]

The Cost Variation Ratio (Ck) is the ratio between the total cost of the selected system and the total cost of the existing product The Composite Evaluation of Design Quality (Q-up) is divided by the Cost Variation Ratio (Ck) to obtain the Value-up Ratio (V-up).

CONCLUSION

It is important, not only to present the development target clearly and visibly, but also to present all the data coherently during new product planning.

We hope that this paper can help you achieve this.

REFERENCES

1. Ofuji, T., Ono, K & Akao, Y., (1990) *Method of Quality Function Deployment*, Nikkagiren (In Japanese)

2. (1983) *Function Analysis System Technique*, Society of Japanese Value Engineering (In Japanese)