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Research Article

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Designing a Neighbourhood Newspaper Using QFD

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Abstract The neighbourhood newspapers in tabloid form are the trend in Chennai and other cities. They carry advertisements from the local trade for a fee and are distributed free of cost to houses and customers door to door. This promotes local trade, while providing information of use to the prospective customers of the product or service. This paper attempts to use Quality Function Deployment (QFD) for cost engineering in designing the neighbourhood newspaper, with appropriate volume of advertisements, news and other information.

Keywords Newspaper, Quality Function Deployment, House of Quality, Value, Engineering, Target Costing

1. Introduction

Marketing a newspaper is a challenge anywhere in the world. This is more challenging when that newspaper is a neighbourhood weekly in tabloid form and supplied as a free copy. This demands not only high levels of ingenuity but also very high levels of customisation. In this regard the producer and distributor of the tabloid newspaper have to develop his product into satisfying the customer needs in respect of quality in content and presentation. Therefore, the product design must be optimised with regard to cost, design requirements and value considerations of the customer and advertiser. This paper attempts to use Quality Function Deployment (QFD) for cost engineering in designing the neighbourhood newspaper.

2. Review of Literature

Quality function deployment (QFD) is a customer driven tool in implementing total quality management. Among lots of Total Quality Management (TQM) methods, QFD has been used to translate customer needs and wants into technical design requirements by integrating marketing, design engineering, manufacturing and other relevant functions of an organization (1). The concept of QFD was introduced in Japan by Yoji Akao in 1966 and used by Toyota and other companies (2). Target costing is not a costing system as such; rather it is an activity to which is aimed at reducing the life-cycle costs of new products, while ensuring quality, readability and other customer requirements, by examining all ideas of cost reduction at the product planning, research and development process (3).

Target costing is a disciplining mechanism contributes to realising the different conflicting goals by having product designers make explicit tradeoffs between them (4). Value engineering is a cost control approach which examines the relationship between the function of a product and its cost and it can be used at the design stage of a product. Quality Function Deployment (QFD) is a customer driven technique which is used for product development and it has four stage methodology to translate the needs of the customer needs into parts characteristics, process plans and production requirements associated with its production (5). The second phase of QFD gives the best option to apply value engineering approach (6). QFD methodology consists of four sets of matrices. The first matrix is product planning matrix, and this is known as House of Quality (HOQ) and it maps prioritised list of customer needs to appropriate design requirements. This gives the priority ratings of the design

requirements. The parts deployment matrix is the second matrix of QFD and it maps the prioritised design requirements obtained from HOQ to critical parts characteristics. Process planning matrix and production planning matrix are the other two matrices (7).

Value engineering (VE) is a methodology used to analyse the function of the goods and services and to meet the required functions of the user at the lowest total cost without reducing the necessary quality of performance (8). VE approach is also a functional cost analysis approach in which weightages for the functions of each part can be compared with relative costs of the corresponding parts and can be expressed as the ratio of function to cost (9). This value ratio forms the basis for levels of characteristics of parts can be established prior to production.

Target costing (TC) is an essential tool for cost management in a competitive scenario. It is a market driven strategy that involves pricing a firm's product based on the levels that gives the best competitive advantage (10). The target costing process begins by establishing a selling price based on market research for the new product. From this target selling price, the desired profit is subtracted to determine the target cost (11). The price and profit are independent variables. Prices are determined by what customers are willing to pay and profit is determined by what financial markets expect as a return from that particular industry. The dependent variable is cost, which implies that a firm has to manage its cost to meet the external constraints compelled by the product and financial markets in which it operates (12). Target cost is the permissible cost of a product that gives the required rate of return.

3. QFD for Cost Engineering

Cost Engineering is an engineering practice where engineering judgement, expertise and experience are used in the application of scientific principles and techniques to the problems of cost estimation, cost control, cost management, business planning and management techniques, profitability analysis, planning and scheduling. Cost estimation is the process of predicting the real cost of manufacturing a product. Cost management techniques are used to manage the development of a product with a view to achieve the desired cost profile. Cost estimate is an integrated component of target costing process and it helps in estimating and managing the cost of product at development stage. The fundamental principle of value engineering is minimising the cost of a product without compromising quality and value engineering supports the TC methodology for cost control (13). In order to enhance quality, value and customer satisfaction QFD is used in different industries and it is important to use cost engineering along with QFD. Cost deployment in QFD helps in achieving the target cost of the product while ensuring a balance with quality (14).

4. Research Methodology

A method of quick cost estimation based on function characteristics and the technique of quality function deployment (QFD) is presented by Yuan et al, based on the cost structure and the total costs of some well-known competitive products of the developed system. The function levels of these well-known products are identified one by one by means of the QFD technique (15). Target cost management will not be successful without the support of VE (16). This technique helps to develop a right product and VE shows the best way of performing it. Design costs are integrated into the QFD frame work, which enables designers to optimize product development resources towards customer satisfaction and conduct analytical investigations to facilitate decision making in product design and development (17).

In this paper an attempt has been made to establish a mathematical model to integrate second phase of QFD, VE and Target costing. To obtain the part characteristics at different levels, value engineering is taken up in the second phase of QFD. In order to establish the model, correlations among the parts characteristics and inter-relationship between the design requirements and the parts characteristics of parts deployment matrix are established. The HOQ is used to establish to obtain weightages of the design requirements by deploying the customer preferences in QFD matrix.

5. Cost Engineering Model

The proposed model is adopted to establish different design alternatives considering arriving at the product cost using parts deployment matrix and TC methodology in VE (18).

i = Design requirement, i = m 1, 2, ... m
j = Part characteristic, j = n 1, 2, ... n
m = Number of design requirements
n = Number of parts
Ljl = Number of level of parts
l = 1,2,3 for j = 1,2, ... n
wi = Priority rating for I th design requirement
r i jl = Inter-relationship values of parts deployment matrix
Ri jk = values in roof of parts deployment matrix
Cj l = Cost of part j in level l
Yi = Summation effects of parts characteristics for i th design requirement
TCj = Target cost of the j th part
x jl = Decision variable:
x jl = 1, part characteristic is appropriate at level l
x jl = 0, otherwise.

Objectives:

Maximize customer satisfaction (Z_1)

Max. $Z_1 = \sum_{i=1}^{m} wi\ Yi$

Minimize total cost (Z_2)

Min. (Z_2) = $\sum_{i=1}^{n} TCi$

Constraints:

$$\sum_{l=1}^{lj} Cjl\ xjl \leq Tj$$

$$\sum_{l=1}^{lj} xjl = 1$$

$Y_i = \sum_{j=1}^{j=n} \sum_{l=1}^{lj} rijl\ (xjl) + \sum_{j\ 1}^{n-1} \sum_{k\ j+1}^{n} \sum_{l=1}^{lj} \sum_{u=1}^{lk} Rijk\ (xjl)\ (xku)$

$x_{jl} \in \{0,1\}$

6. Results

House of Quality (HOQ) is generated as the first phase towards QFD. Customer expectations on a neighbourhood newspaper in southern Chennai are obtained through personal interviews with the customers and users. Through factor analysis (19) important customer needs are identified. The design requirements are obtained from those who are in designing the neighbourhood newspaper. The six, identified customer needs and the six design requirements are recorded in the table 1, below.

Table 1: Customer needs and design requirements

Customer needs	Design requirements
Less than 16 printed pages -less pages (LP)	Enhancing readability – column width & typeface (ERead)
Local news (LN)	Optimise the number of pages – Crisp reporting & editing, condensed typeface (OPage)
Local advertisements (LA)	Intense and relevant reporting – Localised news (IReport)
Crispy paper (CP)	Strengthen advertisement collection – marketing (SAdvt)
Non sticking ink (NSI)	Better quality newsprint – ink absorbing (BPaper)
Easy to read (ER)	Better ink – to dry fast and well (BInk)

The priority structure of design requirements is the product of the House of Quality. This is the input for the Parts deployment matrix (20). The priority design requirements of the newspaper are determined the using conjoint analysis and QFD-ANP methodology, which are shown in table 2, below.

Table 2: Priority ratings of design requirements

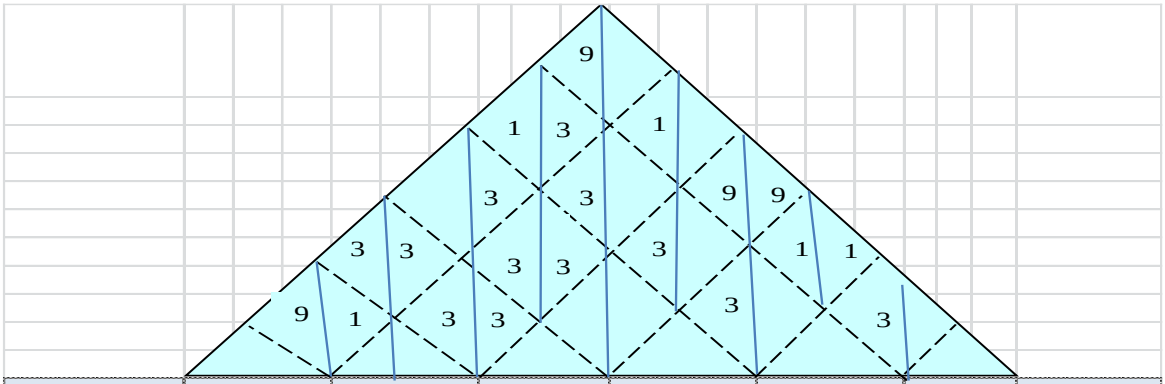
Design requirements	Priority ratings (w_i)
ERead	18.00
OPage	20.00
IReport	30.00
Sadvt	12.00
BPaper	11.00
BInk	9.00

The parts characteristics for three different levels of cost are identified to arrive at the design requirements by the graphic design team using VE technique. Costs of principal parts of the neighbourhood newspaper corresponding to different levels of cost are shown in table 3.

Table 3: Costs of various parts of the newspaper in relation to different levels

Principal Parts Characteristics	Level I (8 pages)	Cost (Rs) per copy	Level II (12 pages)	Cost (Rs) per copy	Level III (16 pages)	Cost (Rs) per copy
PC1 Reporting, Editing & Marketing (REM)	5 persons	0.30	6 persons	0.40	8 persons	0.60
PC2 Newsprint (NP)	45 GSM	2.00	42.5 GSM	3.00	42 GSM	4.00
PC3 Ink (IN)	Normal	0.40	Normal	0.60	Normal	0.80
PC4 Design (DC)	4 hours	0.15	6 hours	0.25	8 hours	0.30
PC5 Other Costs (OC)	Normal	0.15	Higher	0.25	Highest	0.30

The parts deployment matrix is generated by conducting interactions with the experts of the design team. In the matrix, relationship values are assigned using the scale of 1-3-9. The established inter relationship values (rijl) represent the relationship between design requirement (i) and part characteristic (j) for each level (l). The intensity of the correlation between the parts characteristics j and k for the ith design requirement is represented by R i jk. The parts deployment matrix is as generated is given below.



VOC Prioritized Comments	Easy to Read			Optimise Number of Pages			Intense Local News			Strengthen Advt. Collection			Better Newsprint			Better Ink			Totals "What Importance"
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
LP	3	1			1	3	1	3	9	1	3	9							60
LN	9	3	1	1	1	3	1	3	9		1	3							40
LA	1	1	1	1	3	9		1	3	1	3	9	1	1	1				110
CP	1	1	3							1	1	1	9	9	9	1	1	1	14
NSI	3	3	3										1	1	1	3	3	3	9
ER				9	9	9							3	3	3				18
Totals "How Importance"	67	29	19	28	42	90	9	32	96	11	34	98	30	30	30	5	5	5	

Figure 1: Parts Deployment matrix

Table 4 shows the results when optimizing the objectives individually as case (i) and case (ii). In the case (i), the customer satisfaction index and the total cost of the newspaper obtained are 134.66 and Rs.6.00 respectively. The customer satisfaction index and cost are reduced to 59.76 and Rs.3.00 respectively in case (ii). In view of attaining highest level of customer satisfaction, the newspaper is manufactured by assembling all the parts under level III. In order to provide the newspaper free of cost to the customer ensuring the required reach and sell to advertiser at higher prices, the design components of the newspaper such as localised news, optimise the number of pages and enhanced readability are to be selected in level I and in addition to the optimised number of pages better ink, better paper and to some extent on collection of advertisements have to be selected in level III.

Table 4: Estimated values of customer satisfaction index and decision variables

Objectives	Case (i)	Case (ii)
	Maximize customer satisfaction	Minimize total Cost
Customer satisfaction index	134.66	59.76
Total cost	6.00	3.00
Decision variables	X_{13}, X_{23}, X_{33}, X_{43}, X_{53}	X_{11}, X_{21}, X_{31}, X_{41}, X_{51}

7. Conclusion

The proposed design solution for neighbourhood newspaper in southern Chennai improves product development and intends to balance customer satisfaction, cost and functionality of the product. As parts deployment matrix of QFD is considered in the model, it is possible to change the parts characteristics in accordance with the views of the customer. Total cost can be used with value engineering is appropriate to control and manage the cost of the product during the design stage. This also can be used for optimisation of multiple objectives in addition to customer satisfaction and cost.

Limitations of the Study

This paper approaches the issues of customer in this case – the reader of the newspaper. However, it has not studied the response of the advertisers for whose needs this neighbourhood serves.

Scope for Further Study

A wholesome and comprehensive research may be carried out by solving the model covering both the advertisers and readers in order to solve the inherent uncertainty associated with the cost estimation of various components of the product.

References

[1]. Analysis of CUstomer Satisfaction Using Quality Function Deployment. Parul Gupta, R.K. Srivastava,. 6, s.l.: JIAATS, March 2014, Journal of The International Association of Advanced Technology and Science, Vol. 15. ISSN-2095-1563.

[2]. Institute of Management Services. Quality Function Deployment (QFD). The Productivity Portal. [Online] Institute of Management Services, 2023. [Cited: September 26, 2023.] https://www.ims-productivity.com/page.cfm/content/Quality-Function-Deployment-QFD/.

[3]. Target Costing Support Systems: Lessons from Leading Japanese Companies. Kato, Yukato. 4, s.l.: Acadedemic Press Limited, 1993, Management Accounting Research, pp. 33-47. 1044-5005/93/010033.

[4]. The Adoption and Use of Target Costing in Dutch Firms. Henri Decker, Peter Scmidt,. 3, Amsterdam: s.n., 2003, International Journal of Production Economiccs, Vol. 84, pp. 293-305. 10.1016/S0925-5273(02)00450-4.

[5]. A quality Cost-based Improvement Approach for Conceptual Process Planning. Alaa Hassan, Ali Siadat, J. Y. Dantan, Patrick Martin. 3, September 2008, International Journal of Management Science and Engineering Management, Vol. 4, pp. 188-197. 10.1109/ICMIT.2008.4654403.

[6]. Quality Function Deployment, Value Engineering and Target Costing an Integrated Framework in Design Cost Management: A Mathematical Programming Approach. F. Jairi, S. H. Zegordi. 3, s.l. : Sharif University of Technology, 2008, Scientia Iranica, Vol. 15, pp. 405-411.

[7]. Cost Engineering with QFD: A Mathematical Model. K. G. Durga Prasad, K Venkata Subbaiah, K. Narayana Rao. 1, 2011, International Journal for Quality Research, Vol. 5, pp. 33-37.
[8]. SAVE International Value Standard. Value Standard and Body of Knowledge. 2007, 2007, pp. 2-5.
[9]. Applying Functional Cost Analysis in a Manufaturing Environment. T. Yokoshikawa, J. Innes, F. Mitchell. 1, 1994, International Journal of Production Economics, Vol. 36, pp. 53-64.
[10]. Target Operational Excellence Through Cost Management: Some Firm Level Evidence. Manoj, P. K. 5, 2009, International Bulletin of Business Administration, pp. 6-15.
[11]. Cost Engineering with QFD: A Mathematical Model. K. G. Durga Prasad, K. Venkatasubbaiah, K. Narayana Rao. 1, 2011, International Journal for Quality Research, Vol. 5, pp. 33-37.
[12]. Target Costing: Uncharted Research Territory. Shahid Ansari, Jan Bell, Hiroshi Okano. 1, 2006, Handbooks of Management Accounting Research, Vol. 10, pp. 507-530.
[13]. Cost Engineering with QFD: A Mathematical Model. K. G. Durga Prasad, K. Venkata Subbaiah, K. Narayana Rao. 1, 2011, International Journal for Quality Research, Vol. 5, pp. 33-37.
[14]. DFX and DFSS: How QFD Integrates Them. J. C. Jiang, Shiu Ming-Li, Mao-Hsiung Tu. 10, 2007, Quality Progress, Vol. 40, pp. 45-51.
[15]. Function-based Cost Estimation Integrating Quality Function Deployment to Support System Design. Y. T. Tsai, Y. M. Chang. 7-8, 2004, International Journal of Advanced Manufacturing Technology, Vol. 23, pp. 514-522.
[16]. Target Cost Management for Profit Engineering System Based on VE in Japanese Automotive Parts Manufacturing. K. Noda, M. Tanaka. s.l.: SAVE International Conference Proceedings, 1997. pp. 211-220.
[17]. Cost Engineering with Quality Function Deployment. Jurgen Bode, Richard Y. K. Fung. 3-4, s.l.: Pergamon, 1998, Computers and Industrial Engineering, Vol. 35, pp. 587-590. 10.1016/S0360-8352(98)00165-X.
[18]. Jürgen Bode, Richard Y. K. Fung. 3, s.l.: Pergamon, December 1998, Computers & Industrial Engineering, Vol. 35, p. 589. 10.1016/S0360-8352(98)00165-X.
[19]. A Quality Function Deployment Application Using Qualitative and Quantitative Analysis in After Sales Services. Fatma Pakdila, Feride Bahar Isınc, Hande Genc. 12, s.l.: Routledge, December 2012, Total Quality Management, Vol. 23, pp. 1397–1411. ISSN 1478-3363.
[20]. Quality Function Deployment: A Literature Review. Lai-Kow Chan, Ming-Lu Wu. 3, s.l.: Elsevier, December 16, 2002, European Journal of Operational Research, Vol. 143, pp. 463-497. ISSN 0377-2217.
[21]. Function-based Cost Estimation Integrating Quality Function Deployment to Support System Design. Y. T. Tsai, Y. M. Chang, Lu Ting-jin, Cheng Yan-rong, Yuan De-guo. 7-8, November 2007, International Journal of Advanced Manufacturing Technology, Vol. 23, pp. 514-522. 10.1109/GSIS.2007.4443541.
[22]. Cost engineering with quality function deployment. J. Bode, RYK Fung. 3-4, 1998, Computers and Industrial Engineering, Vol. 35, pp. 587-590.