Integration of Quality Function Deployment and Target Costing

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ABSTRACT
Quality Function Deployment (QFD) and Target Costing (TC) are two important phases in product design cycle. This paper proposes a methodology to integrate QFD and TC. TC is a cost management method it makes the planning group focus on the customer requirements and product characteristics for which they are willing to pay for the products. QFD identifies the customer requirements in initial phase of product development. It is customer driven approach to translate the customer needs into engineering characteristics through product design phase that final product meets the customer requirements. Integration of QFD in TC process takes a greater cost competitive advantages because QFD helps to identify the customer needs which is highly rated by customer. Whereas TC helps in finding the alternatives solution to provide best features in product and providing most optimal substitute of its constituent without sacrificing product quality and features. This paper proposed an integrate approach of QFD and TC implement in initial phase of product development and also described the QFD structure and steps of QFD – TC process.

Keywords
QFD, House of Quality, Target Costing

1. INTRODUCTION
In recent times, due to increased global competition, manufacturers face ever changing condition in the market. This keen competition forces manufacturers to focus on innovation for maintaining the desired penetration in the market. New product needs to be manufactured at the most economical price to get good penetration in the market. Need of the hour is to introduce such features in the product which are highly rated by customer's that to at the most economical price. To achieve above objective QFD integrated with Target Costing (TC) which helps to identify the customer requirement and finding the optimum solution. QFD helps to identify the customer's requirements, which are highly rated by customers and helps them to reduce to engineering characteristics, whereas TC helps in finding the alternatives solution to provide best features in product and providing most optimal substitute of its constituent. TC is a cost management method it makes the planning group focus on the customer's requirement and product characteristics for which they are willing to pay for the products. It deals with customer's satisfaction, costs and quality which are the most important factors. TC helps in reducing the cost of the product by eliminating the non-value added activities and functions.

2. QUALITY FUNCTION DEPLOYMENT
QFD originally developed in Japan and introduced by Dr. Yoji Akao in early 1970. Who first realized the value of this approach in 1969 and wanted to utilize its power during the product design stage so that the product design characteristics could be converted into precise quality control points in the manufacturing quality controls points chart. Akao wrote a paper on this new approach in 1972 and called"hinshitsu tenkai" (quality deployment) [1].

The QFD is a disciplined approach for translating the customer requirements into engineering characteristics and quality assurance point to be used through the production phase. It adopts a customer driven approach and provides a structured way to ensure that the final product meets customer requirements [2]. QFD analysis identifies the relative important of each customer requirements and develops interrelationship between customer requirement and engineering characteristics to assign weights between them. Correlation matrix in QFD helps to measure the relationship of each engineering characteristics and how much they affect each other. Importance ratings for engineering characteristics, is calculated using customer requirements importance ratings and weights assigned to the relationships between customer requirements and engineering characteristics. The final relative weights of each engineering characteristics are determine and focus on it which is highly rated by customers.

QFD enables the design phase to concentrate on the customer requirements, thereby spending less time on redesign and modifications. The saved time has been estimated at one-third to one-half of the time taken for redesign and modification using traditional means. This saving means reduced development cost and also additional income because the product enters the market earlier [3].

2.1 QFD Structure
Phases of Quality Function Deployment: The QFD system consists of the following four interlinked phases [4]. As shown in Figure 1.

Phase I- The first phase of QFD system is House of Quality (HOQ). This translates customer needs (WHATs) into engineering characteristics (HOWs).

Phase II- QFD second phase is parts deployment, which translates key engineering characteristics (new WHATs) determined in the previous phase into parts characteristics (HOWs).

Phase III- Process planning, which translates key parts characteristics (new WHATs) obtained in the previous stage into process operations (HOWs). During process planning, manufacturing processes are flowcharted and process parameters (or target values) are documented.

Phase IV- Finally, the company needs the right production plan to get the processes to run effectively and efficiently. This results in the last phase, production planning, which translate key process operations (new WHATs) into day-to-day production requirements (HOWs).

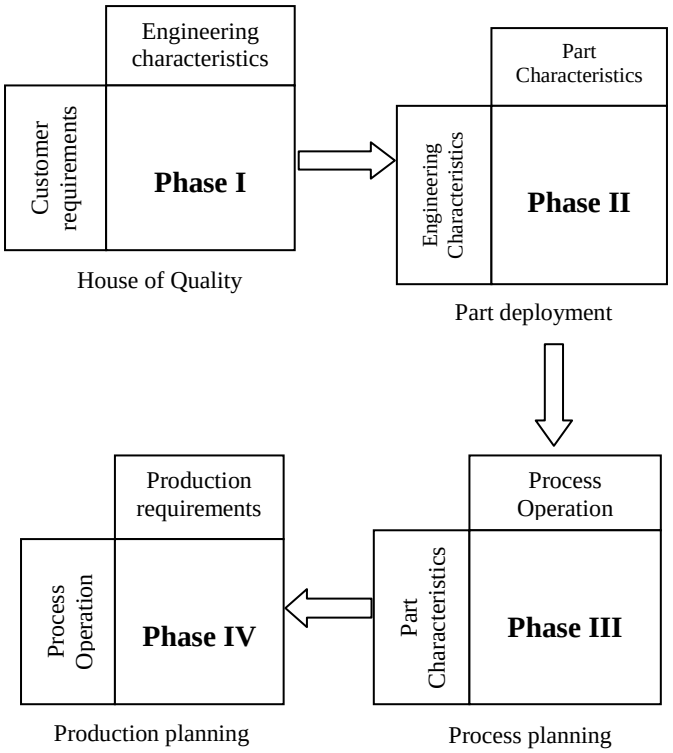

Figure 1. Quality Function Deployment: four interlinked phases [4]

2.2 Construction of House of Quality

House of quality (HOQ) is the first phase of the QFD system. The purpose of HOQ is to transform customer needs into product design specifications (referred to in QFD terms as "Engineering Characteristics"). HOQ shows what customer wants and how designer fulfils the requirements in product development phase. It provides a framework and guides the designer to set the target to improve their product quality.

QFD analysis, a matrix of HOQ is used to display the relationship between the Customer Requirement (referred to as 'WHATs') and the Engineering Characteristics (referred to as 'HOWs'). It identifies the interrelationship matrix between CRs and ECs. This matrix summarizes information about ECs and their associated customer ranking and the correlation between the ECs parameter. Six HOQ steps are following in Figure 2.

Step I has a list of customer needs and identify the degree of importance of each customer needs; **Step II** contains market data, strategic goal setting for the new product and computations for prioritizing the customer needs; **Step III** includes information to translate the customer needs into the organization's technical description or engineering characteristics; **Step IV** contains the relationship matrix between each customer need and each engineering characteristics; **Step V** the "roof" of HOQ assesses the correlation matrix between each engineering characteristics; **Step VI** contains the prioritization of the engineering characteristics, information on the competitors and technical targets.

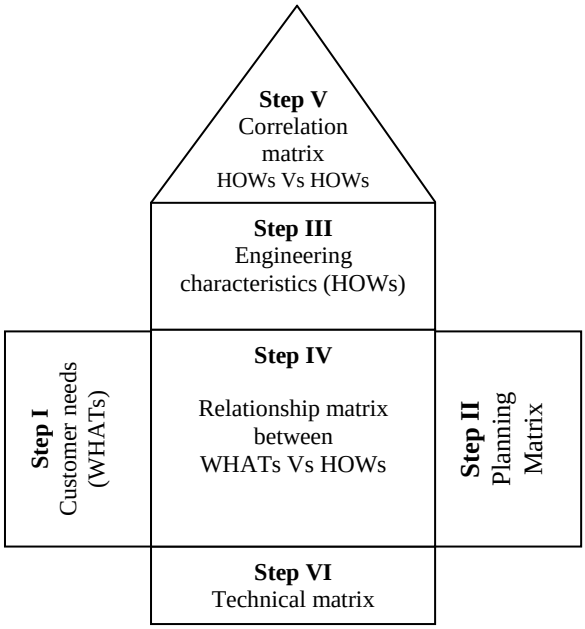

Figure 2. HOQ, description [5]

3. TARGET COSTING

TC is a costing process for determining the selling price that customers are willing to pay for a specific level of product quality. It is a reverse costing methodology, in which the selling price and required profit margin are used to determine the allowable cost for manufacturing a new/existing product [6]. It is not only cost reduction technique but also strategic planning tool because it collects information in planning phase and implement in product designing phase to reduce the cost of product and eliminate non-value function and activity. It is applies in the earlier stage of product development phase as well as throughout entire product life cycle.

Target Cost = Estimated Selling price-Desired Profit margin [7]

The use of TC forces managers to change their way of thinking concerning the relationship between cost, selling price, and profitability. The traditional costing mindset has been that a product is developed, production cost is identified and measured, a selling price is set, and either profits or losses will result. However, in TC, a product is developed, selling price and desired profit are determined, and maximum allowable costs are derived. This makes costs dependent on selling prices instead of selling prices dependent on targeted costs. As a result, the incurrence of all costs must be justified which leads to the elimination of unnecessary costs without compromising the product quality and functionality. It takes a holistic view of products and their component, and identifies the opportunities for cost reduction and product improvement [8].

TC is not just the act of setting cost targets. It is an entire value chain process (customer, market analysis, engineer, sales person etc.) to manage an enterprise goal. It begins with understanding market values in terms of what the customer wants and is willing to pay for product. TC develops a market-driven and cost-driven product. Market-driven product needs extensive market research; focus on design characteristics of product, cross functional team and supplier's evolution. During the cost-driven product development of low-cost products, product developers must constantly focus on the technical function of the product and the processes involved in its manufacturing [9].

4. INTEGRATIONOF QFD IN TARGET COSTING

Effective product design requires inter-functional and close relationship between various managerial functions. Determination of customer preferences and satisfaction levels can be achieved by QFD analysis, and target goals for quality and costs using TC method. QFD and TC must be treated as multi-functional team work bringing customers, engineers, designers, accountants and sales people together. It is best implemented by a team that aims to develop the right quality and functionality with proper pricing.

QFD analysis focus on the customer needs in product design while TC process focus on customer desires, product quality, and functionality without increasing cost of product. QFD integrated in TC process helps to manage product costs while promoting the quality specifications by meeting customer needs and helps to eliminate the non value added functions of products [10]. QFD – TC process is shown in Figure 3.The following steps are involved in QFD – TC process [11]:

- Determine the quality specification and functionality
- Target selling price
- Target costing
- Cost break down on cost drivers
- Target costing through product design
- Continuous improvement

Step 1: Determine the quality specification and functionality
The first step in the QFD–TC process is determining the desired quality specifications and functionality, where customer requirements are integrated into the process. This can be done by survey. Questionnaire for the product may be developed and sent to companies to collect data about customer requirements. The identified Customer's requirement about product and their functionality can be obtain in design phase using QFD analysis. The engineering characteristics that will meet the customer requirements in the product development phase.

Step 2: Target selling price
According to competitive market conditions and customer feedback, target selling price based on what customers are willing to pay for the product, given its functionality, quality, and price of products offered by competitive companies needs to be established. The expected market conditions must be taken into account while determining the target selling price [12].

Step 3: Target cost
Target cost is also called allowable cost. It is determined by the difference between the target selling price and desire profit or profit margin.

Target costing = Target selling price – Desired profit margin

Profit could be reasonable and cover planned costs, additional required investment, and decommissioning or disposal costs over the product's life cycle. Similarly, the profit margin should be sufficient to support continuous product research and development. Some companies, for example, Sony Corporation, build in more flexibility in establishing the desired profit or target profit margin. There, they allowed for tradeoffs between different products, i.e., within the product group some products will have some profit margins higher and some lower [12].

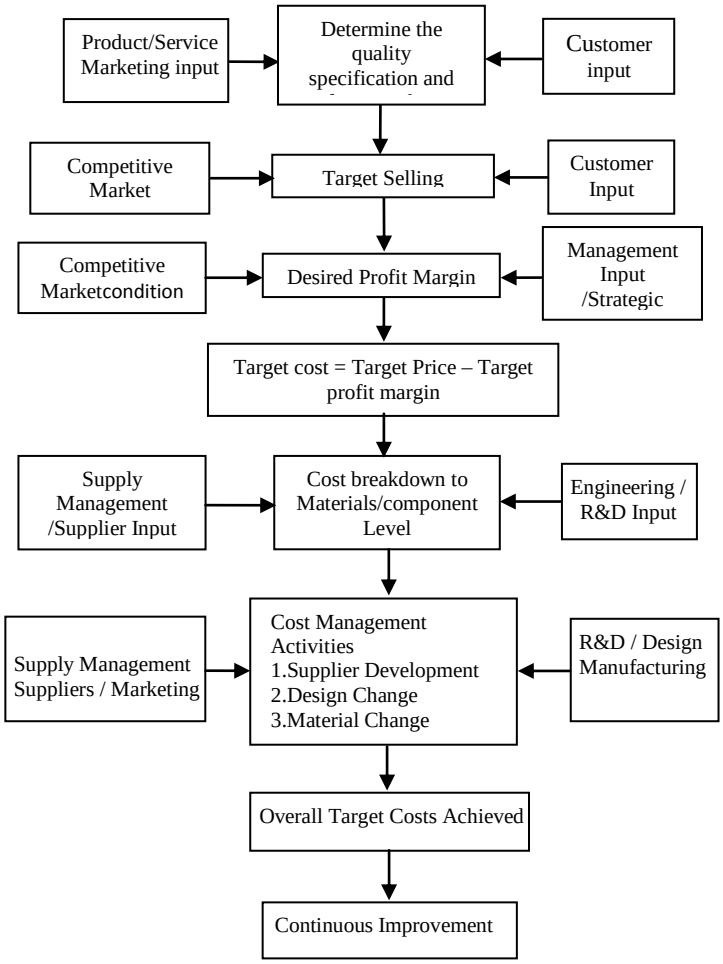

Figure 3. QFD – TC process [11]

Step 4: Cost break down on cost drivers
After determining the product target cost, this total cost is allocated to the product components in line with the data obtained from QFD analysis. Analysis of product's functions is required during the allocation of product component costs. Engineering and accounting information is needed for this analysis.

The allowable cost is determined, after the product components or part cost is identified. The design team uses Value Engineering (VE) to drive down the cost of the product until it meets its overall target cost.

Step 5: Target costing through product design
TC integrated with management tools and technique to identify the opportunity of cost reduction. VE is an operation management tool which supports the TC process. VE is used to design a product at a lower cost by reviewing the functions desired by customers since a large portion of costs are incurred in the design stage. VE supports target costing by re-designing the product to reduce costs without changing quality or functionality. Other management tool used at this stage is Design for Manufacturing and Assembly (DFMA). It refers to engineering process designed to optimize the relationship between materials, parts and the manufacturing process. The main purpose of DFMA is to increase quality and reduce the time it takes to market [13].

Step 6: Continuous Improving
Continuous cost reduction can be done through kaizen costing. Kaizen costing focuses on continual small incremental product cost improvements in the manufacturing phase, as opposed to improvements in the design and development phase [14].

5. CONCLUSION

In today's highly competitive market, the success of company depends upon its capability to meet the customers' requirement and expectations and that too at the most competitive price. In the proposed integrated approach of QFD and TC aims is to improve the existing product design. Implementing QFD - TC process basically deals with identifying customer requirements and modifying the product to meet those requirements at the identified target cost. TC is a cost management tool usually used to provide cost advantages to the firm in the competitive market. TC integrated with QFD helps to identify the customer expectation in initial phase of product design which helps the TC to choose best alternative of engineering characteristics to reduce the cost of product and improve quality. Managing product costs during product design is not enough, continuous cost reduction activities could continue in the production stage to achieve the overall product target cost. Further scope of study is to the implementation of QFD-TC process in different industries, especially service industry.

6. REFERENCES

[1] Akao Y. and Mazur G.H. 2003. The Leading Edge in QFD: Past, Present and Future. *International Journal of Quality & Reliability Management* 20 (1), 20-35.

[2] Gonzalez M. F., Quesada H. and Bahill A.T. 2003. Improving Product Design Using Quality Function Deployment: The School Furniture Case in Developing Countries, *Quality Engineering*, 16(1), 47-58.

[3] Besterfield D.H., Michna C.B., Besterfield G.H., and Sacre, M.B. 2006. Total Quality Management, *Prentice Hall of India*, 3rd edition.

[4] Chan L.K., and Wu M.L. 1998. Prioritizing the technical measures in quality function deployment, *Quality Engineering*, 10(3), 467-479

[5] Chan L.K., and Wu M.L. 2004. A Systematic Approach to Quality Function Deployment with a Full Illustrative Example, *The International Journal of Management Science*, 33, 119-139

[6] Dekker H., and Smidt, P., 2003. A survey of the adoption and use of Target costing in Dutch firms, *International Journal of Production Economics*, 84(3), 293–305

[7] Ellram L. M. 1999. The role of supply management in Target costing, [online] CAPS Research, A Global Research Center for Strategic Supply Management, Available from:http:// www.capsresearch.org/publications/pdfs-protected/ellram1999.pdf [Accessed 15 sept 2013].

[8] Sharma J. 2012. A cross disciplinary approach to product development and design through QFD, TC and value engineering, *international journal of productivity and quality management*, 9(3), 309-331

[9] Sani A.A., and Allahverdizadeh M., 2012. Target and Kaizen costing, *World academy of science, engineering and Technology*, 62

[10] Hertenstein J., and Platt M. 1999. A Cost/Time Trade-off Framework for New Product Development, *International Journal of Strategic Cost Management*, 2(2), 31-47

[11] Ellram, L.M., 2006. The Implementation of Target Costing in The United States: Theory versus Practice. *Journal of Supply Chain Management*, 42 (1), 13–26.

[12] Ansari S., Bell J., Cypher J., Dears P., Dutton J., Ferguson M., Hallin K., Marx C., Ross C., and Zampino P., 1997b. Target costing: The Next Frontier in Strategic Cost Management, *McGraw-Hill*, New York

[13] Zengin Y., and Ada E., 2010. Cost management through product design: target costing approach. *International journal of production research*, 48 (19), 5593-5611.

[14] Modarress B., Ansari A., and Lockwood D.L. 2005. Kaizen costing for lean manufacturing: a case study, *International Journal of Production Research*, 43(9), 1751-1760