

Major Criteria of Target Costing Implementing and Lurching

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Abstract: Target costing system is one approach which its lurching and implementing in practice will bring advantages for the users. The present study tried to point out criteria affecting launching and implementing target costing system among Iranian companies; Fuzzy AHP was employed as one of the important items regarding multi-criteria decision making. Finally, these criteria were ranked according to their importance. To this end, first of all, major criteria were classified and ranked into five main groups such as organizational, managerial, environmental, technical and project team criterion. Regarding results of Fuzzy AHP organizational criterion is the most important ones and then are managerial, environmental, technical and project team criterion. These criteria primarily determine the magnitude of the benefits that the firm will generate from the application of target costing. As the benefits increase, the amount of energy the firm is willing to expend on the target costing process is expected to increase concomitantly. Therefore, firms that gain significant benefits from target costing are likely to have more extensive target costing processes than those that gain only minor benefits.

Key words: Target costing • Fuzzy AHP • Criterion • Organization • Implementing • Iran

INTRODUCTION

The accurate costing of objects and the reduction of those costs is one area that can influence success in organizations. Target costing is of pioneer systems in this field and have made organizations and companies use them [1]. According to the CIMA Official Terminology [2] a target cost is "a product cost estimate derived by subtracting a desired profit margin from a competitive market price." Sakurai defines target costing as a "cost management tool for reducing the overall cost of a product over its entire life cycle with the help of the production, engineering, R&D, marketing and accounting departments" [3]. Management utilizes this pricing technique to meet both the demands of its customers as well as company profit goals.

Target costing is not seen as a technique for cost control but a management process which involves all disciplines and brings a focus on the customer from the beginning of the design process. Cooper and Chew describe the value of target costing as its "ability to bring the challenge of the marketplace back through the chain of production to product designers" [4]. Most cost reduction and cost control efforts have focused on the production stage of the product life cycle. However, almost all production capabilities and costs are set during production planning and design. Value engineering is used in target costing to reduce

Table 1: Ranking major criteria implementing and launching target costing System by fuzzy AHP

Weight of Criterion	Criterion
0.268	Organizational criterion (I1)
0.233	Managerial criterion (I2)
0.204	Environmental criterion (I3)
0.167	Technical criterion (I4)
0.128	Project Team criterion (I5)

product cost by analyzing the tradeoffs between different types and levels of product functionality and total product cost. Effective cost management and cost control must be emphasized and start at the design stage of a product's life, accordingly, research and developments and any engineering changes must occur before production begins, resulting in lower costs and reduced "time-to-market" for new products. The use of cost information and cost management during product design has received increasing attention in the literature [5].

Iranian companies don't apply Target Costing in an effective way, so they can not interest of its advantages. Thus regarding former researches, criteria affecting implementing and running target costing system in Iranian companies are classified into five groups such as: organizational, managerial, environmental, technical, project team criterion are shown in Table 1. Organizational criterion considers formal and informal relationships between employees, departments and managers.

Managerial criterion considers the management characteristic. On the other hand, environmental criterion is related to conditions which are outside the enterprise and managers can not control them. Technical criterion contains items which are derived from the nature of target costing System. Finally, Project team criterion includes characteristics and attribute of the planning and implementing (project) team. The purpose of this research is to prioritize and rank the criteria that influence the target costing implementation and launching process. From such an analysis, conditions that appear to favor target costing can be identified. So the question of this research is:

- What is the priority of the major criteria of Target Costing implementing and launching in case of Iranian companies?

Review of the Literature: The strategic pricing approach changes over the sales life cycle of the product. In the first phase, pricing is set relatively high to recover development costs and to take advantage of product differentiation and the new demand for the product. In the second phase, pricing is likely to stay relatively high as the firm attempts to build profitability in the growing market. Alternatively, to maintain or increase market share at this time, relatively low prices ("penetration pricing") might be used. In the latter phases, pricing becomes more competitive and target costing and life-cycle costing methods are used, as the firm becomes more of a price taker rather than a price setter and efforts are made to reduce upstream (for product enhancements) and downstream costs.

A desired, or target, cost is set before creating or even designing the product. Management bases the target cost on the product's predicted price and the company's desired profit. In order to achieve the target cost, concentration on the cost reduction opportunities in the design stage rather than production, constantly reduction of costs during the product life cycle, participation of all departments of the company and all members of the value chain (research & development, design, production, marketing, distribution, customers and suppliers) to the process of determination and reduction of costs are required. According to the CIMA discussion paper key characteristics of successful target costing are to focus on the customer, emphasizing on cost reduction at early stages in product development, consideration of the whole product life-cycle, having a multidisciplinary process, good team members who understand their role and how it impacts cost,

involvement of the whole value/supply chain, an iterative process and specific and real targets for improvement [6]. In order to ensure that total costs are minimized for both the producer and the customer, successful target costing examines the full life-cycle cost of the product. This includes consideration of the purchase price, operating costs, maintenance and distribution costs [7].

In a study of Toyota Australia's target costing system, the International Federation of Accountants' (IFAC) Financial and Management Accounting Committee (now Professional Accountants in Business) highlighted the multi-disciplinary involvement in the cost management process and the vital roles played by different functions [8]. According to Gagne and Discenza, the target costing teams which are the most successful are those whose members have a basic understanding of how their work is translated into numbers which represent the firm's performance, using indicators which are meaningful to them [9].

In addition, the best team members are those who have rotated through several departments, including design, purchasing and marketing before being assigned to a cost-planning project, as broad backgrounds give team members a unique ability to spot and implement ways to improve costs. Working with the company's supply chain to identify opportunities for cost savings is very important. This is particularly important where a high proportion of the total cost of a product is in purchased raw materials and components and target costing goals would be impossible to achieve without supplier involvement. Some companies view their supply chains as part of an "extended enterprise" where design and cost information is shared and inter-company teams are established to meet cost reduction goals [7]. Banham identifies getting suppliers to buy in to target costing as probably the most difficult aspect of target costing as experienced by US companies implementing the process [10]. Amongst the methods used to achieve this are joint classes and team-building and promises of shared savings.

Research Methodology: In this research, first of all, criteria affecting implementing and launching target costing System were recognized then using Fuzzy Analytical Hierarchy Process (FAHP) they were ranked. Analytic Hierarchy Process (AHP) is one of the well-known Multi-criteria decision making techniques that was first proposed by Saaty [11]. Although the classical AHP includes the opinions of experts and makes a multiple criteria evaluation, it is not capable of reflecting

human's vague thoughts. Different methods for the fuzzification of AHP have been proposed in the literature. Experts may prefer intermediate judgments rather than certain judgments. Thus the fuzzy set theory makes the comparison process more flexible and capable to explain experts' preferences [12].

Fuzzy set theory. If uncertainty (fuzziness) of human decision-making is not taken into account, the results can be misleading. A commonality among terms of expression, such as "very likely", "probably so", "not very clear", "rather dangerous" that are often heard in daily life, is that they all contain some degree of uncertainty. Fuzzy theory thus is used to solve such kind of problems and it has been applied in a variety of fields in the last four decades. Theory of fuzzy sets has evolved in various directions and two distinct directions are: treating fuzzy sets as precisely defined mathematical objects subject to the rules of classical logic and the linguistic approach. The underlying logic of linguistic approach is that the truth-values are fuzzy sets and the rules of inference are approximate rather than exact [13]. A triangular fuzzy number, a special case of a trapezoidal fuzzy number, is very popular in fuzzy applications. The triangular fuzzy number \tilde{M} is represented by (a,b,c) and the membership function is defined as:

$$\mu_{\tilde{M}}(x) = \begin{cases} \frac{x-a}{b-a}, & a \leq x \leq b \\ \frac{c-x}{c-b}, & b \leq x \leq c \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

The strongest grade of membership is parameter b, that is, $f_M(b) = 1$, while a and c are the lower and upper bounds. An important concept of fuzzy sets is the α -cut. For a fuzzy number \tilde{M} and any number $\alpha \in [0,1]$, the α -cut, C_α , is the crisp set [14]:

$$C_\alpha = \{x | C(x) \geq \alpha\} \quad (2)$$

The α -cut of a fuzzy number \tilde{M} is the crisp set \tilde{M}^α that contains all the elements of the universal set U whose membership grades in \tilde{M} are greater than or equal to the specified value of α , as:

By defining the interval of confidence at level α , the triangular fuzzy number can be characterized as [15, 16]:

$$\tilde{M}^\alpha = [a^\alpha, C^\alpha] = [(b-a)\alpha + a, -(c-b)\alpha + c], \quad \forall \alpha \in [0,1] \quad (3)$$

The distance between two triangular fuzzy numbers can be defined by the vertex method [17]. Let $\tilde{M}_1 = (a_1, b_1, c_1)$ and $\tilde{M}_2 = (a_2, b_2, c_2)$ be two triangular fuzzy numbers, the distance between them is:

$$d(\tilde{M}_1, \tilde{M}_2) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]} \quad (4)$$

Fuzzy Analytic Hierarchy Process (FAHP): FAHP is used to generate the weighting of the four factors of the launching and implementing target costing system. There are six essential steps:

- Construct the hierarchical structure with decision elements (e.g., criteria and detailed criteria). Each decision maker is asked to express relative importance of two decision elements in the same level (e.g. two criteria) by a nine-point scale. Collect the scores of pair wise comparison and form pair wise comparison matrices for each of the K decision makers.
- Analyze consistency. The priority of the elements can be compared by the computation of eigenvalues and eigenvectors:

$$A \cdot w = \lambda_{\max} \cdot w \quad (5)$$

Where w is the eigenvector, the weight vector, of matrix R and λ_{\max} is the largest eigenvalue of R. The consistency property of the matrix is then checked to ensure the consistency of judgments in the pairwise comparison. The consistency index (CI) and consistency ratio (CR) are defined as [11]:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (6)$$

$$CR = \frac{CI}{RI} \quad (7)$$

Where n is the number of items being compared in the matrix and RI is random index, the average consistency index of randomly generated pairwise comparison matrix of similar size, the upper threshold CR values are 0.05 for a 3*3 matrix, 0.08 for a 4*4 matrix and 0.10 for larger matrices. If the consistency test is not passed, the original values in the pairwise comparison matrix must be revised by the decision maker.

- Construct fuzzy positive matrices. The scores of pairwise comparison are transformed into linguistic variables.

According to Buckley [18], the fuzzy positive reciprocal matrix can be defined as:

$$\tilde{R}^k = [\tilde{r}_{ij}]^k \quad (8)$$

Where \tilde{R}^k : a positive reciprocal matrix of decision maker k;

\tilde{r}_{ij} : relative importance between decision elements i and j;

$$\tilde{r}_{ij} = 1, \forall i = j \text{ and } \tilde{r}_{ij} = \frac{1}{\tilde{r}_{ji}}, \forall i, j = 1, 2, \dots, n$$

- Calculate fuzzy weights. Based on the Lambda–Max method proposed by Csutora and Buckley [19], calculate the fuzzy weights of decision elements. The procedures are:
- Apply α - cut Let $\alpha = 1$ to obtain the positive matrix of decision maker k, $\tilde{r}_b^k = (\tilde{r}_{ij})_b^k$ and let $\alpha = 0$ to obtain

the lower bound and upper bound positive matrices of decision maker k, $\tilde{r}_a^k = (\tilde{r}_{ij})_a^k$ and $\tilde{r}_c^k = (\tilde{r}_{ij})_c^k$. Based

on the weight calculation procedure proposed in AHP, calculate weight matrix,

$$W_b^k = (w_i)_b^k, W_a^k = (w_i)_a^k \text{ and } W_c^k = (w_i)_c^k, i = 1, 2, 3, \dots, n$$

- In order to minimize the fuzziness of the weight, two constants, M_a^k, M_c^k and, are chosen as follows:

$$M_a^k = \min \left\{ \frac{W_{ib}^k}{W_{ia}^k} \mid 1 \leq i \leq n \right\} \quad (9)$$

$$M_c^k = \max \left\{ \frac{W_{ib}^k}{W_{ic}^k} \mid 1 \leq i \leq n \right\} \quad (10)$$

The upper bound and lower bound of the weight are defined as:

$$w_{ia}^{*k} = M_a^k \cdot w_{ia}^k \quad (11)$$

$$w_{ic}^{*k} = M_c^k \cdot w_{ic}^k \quad (12)$$

The upper bound and lower bound weight matrices are:

$$W_a^{*k} = (w_i^*)^k \quad i = 1, 2, \dots, n \quad (13)$$

$$W_c^{*k} = (w_i^*)^k \quad i = 1, 2, \dots, n \quad (14)$$

- By combining w_a^{*k} , w_b^k and w_c^{*k} , the fuzzy weight matrix for decision maker k can be obtained and is defined as $\tilde{w}_i^k = (w_{ia}^{*k}, w_{ib}^k, w_{ic}^{*k})$, $i = 1, 2, \dots, n$
- Integrate the opinions of decision makers. Geometric average is applied to combine the fuzzy weights of decision makers

$$\bar{w}_i = \left(\prod_{k=1}^K \tilde{w}_i^k \right)^{\frac{1}{K}}, \quad \forall k = 1, 2, \dots, K \quad (15)$$

Where \bar{w}_i : combined fuzzy weight of decision element i of K decision makers. \tilde{w}_i^k : Fuzzy weight of decision element i of decision maker k. K: number of decision makers.

- Obtain final ranking. Based on the equation proposed by Chen [17], a closeness coefficient is defined to obtain the ranking order of the decision elements. The closeness coefficient is defined as follows:

$$CC_i = \frac{d^-(\bar{w}_i, 0)}{d^*(\bar{w}_i, 1) + d^-(\bar{w}_i, 0)}, \quad i = 1, 2, \dots, n \quad (16)$$

Where CC_i is the weight for decision element i and

$$d^-(\bar{w}_i, 0) = \sqrt{\frac{1}{3}[(\bar{w}_{ia} - 0)^2 + (\bar{w}_{ib} - 0)^2 + (\bar{w}_{ic} - 0)^2]} \quad (17)$$

$$d^*(\bar{w}_i, 1) = \sqrt{\frac{1}{3}[(\bar{w}_{ic} - 1)^2 + (\bar{w}_{ib} - 1)^2 + (\bar{w}_{ia} - 1)^2]} \quad (18)$$

$d^-(\bar{w}_i, 0)$ and $d^*(\bar{w}_i, 1)$ are the distance measurement between two fuzzy numbers.

The respondent of this research were managers, financial managers, researchers, university professors and experts of target costing system. For gathering data needed for FAHP tables, the researchers used interviews, questionnaire and making expert work groups. After recording the answers, combining pair wise comparison matrix for each participant would be started.

Data Input and Analysis: Computer software packages, such as the Expert Choice Expert Choice, have been applied abundantly in solving AHP problems. The responses collected from questionnaires are input to the FAHP system and the results are analyzed by the FAHP.

The pairwise comparison results of decision makers filled on the questionnaires are then input by selecting the number on the nine-point scale. Maximum eigenvalue of the matrix is calculated by Eq. 5 and the consistency property of the matrix is checked by Eqs. 6 and 7. If the consistency test is not passed, the questionnaire can either be revised by the decision maker or be disregarded. In this research the consistency rate is 0.0347 that is acceptable. Fuzzy positive matrices based on the input questionnaire results are generated next by Eq. 8 and Eqs. 9–14, are adopted next to calculate the comparison weights of decision elements. The fuzzy weights from different decision makers are finally combined by Eq. 15, to generate the overall fuzzy matrix, as shown in table 1. The final priority weights and ranking are obtained by Eq. 16.

RESULT

In this study, 5 major groups on implementing and launching target costing System among listed companies in Tehran Stock Exchange were examined. To answer the question and as Table 1 illustrates, regarding findings of the research, the importance of organizational criterion (0.268) is more than other criterion; then are other criterion such as: managerial criterion (0.233), environmental criterion (0.204), technical criterion (0.167) and project team criterion (0.128).

CONCLUSION AND DISCUSSION

Target costing is most appropriate for firms that are in a very competitive industry, so that the firms in the industry compete simultaneously on price, quality and product functionality. In very competitive markets such as this, target costing is used to determine the desired level of functionality the firm can offer for the product while maintaining high quality and meeting the competitive price. So to implement new cost management systems like target costing in organization is inevitable.

The criteria to have an effective Target Costing system are classified in the five following groups including organizational criterion, managerial criterion, environmental criterion, technical criterion and project team criterion. Target costing programs require proper planning and a commitment from upper management. It is essentially to incorporate all department and segments in implementing and launching the system. The organization should have an agile designing department to make new product and move to continuous improvement rapidly.

Target costing is more effective for companies which are active in a competition in market. Companies always should seek for new customers and markets and their expectation and then adopt the production with them as soon as possible. This process has a close relationship by management strategy. In the other hand management need some tools to be success in competition environments such as suitable management and cost accounting system that provide all information necessary for making timely and accurate decision. When we are aware of the reasons of the failures, we can easily solve the problems and predict the probable problems and find solution for them. As results, we will experience more success and can enjoy benefits of target costing system more than ever and finally value of the organization would be added.

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