CHAPTER – 1
INTRODUCTION

If Toyota does one thing better than the other Automakers, it is Cost Management”
- 1992 Annual Report of Toyota Motor Corporation

In this introductory chapter, the background and motivation for the PhD work described and discussed in this thesis is presented. This discussion provides the background for the establishment of the problem approached in this thesis, which relates to the studies on Cost and Quality Engineering during New Product Development (NPD) with specific reference to Target Costing. Further, the structure of the thesis is outlined at the end of the chapter.

1.1 BACKGROUND AND MOTIVATION

During the past two decades, much has been written about Japanese manufacturing practices and Management Accounting methods. Western industry has also gained from the introduction or in some cases reintroduction of Manufacturing and Management techniques developed in Japan. (Williamson, 1997)

1.1.1 Japanese Practices and the Impending Competition

In the 1970’s, an American Automobile manufacturer took a group of Japanese industrialists around his automated warehouse, of which he was very proud. When he wanted to know what they thought about it, the reaction was “Why do you store what you cannot sell?”. During the same time, in Japan, a supplier’s truck was halted at the gates of Toyota for no other reason but that they were earlier than the delivery schedule, which was against the concept of Just in Time (JIT) (Mahidhar, 2002).

This is just a glimpse of the impending competition that was waiting to happen. The New Economic policies, revolutionary Liberalization and Globalization have made competition reach heights that were never seen before. Globalization has opened up wide ranging opportunities for the industries together with a stringent barrier on cost control.
The companies which were submerged in the traditional beliefs, doctrines and principles now stand exposed to the onslaught of fierce competition that was never witnessed before. To be competitive in this emerging global scenario, the ability to develop new products faster and cheaper is vital. Presently, intense competitive pressure makes it difficult to survive-let alone prosper by focusing on technical differentiation alone.

### 1.1.2 Competing by Cost Management

With competition becoming tighter than ever before, the manufacturers have realized that cost will be a major factor in acquisition of a product. For organizations that face serious competition, the product’s price will be under constant pressure from the market and a competitive price today may not be competitive tomorrow (Williamson, 1997). In this market oriented economy, organizations are striving to offer customers maximum value at minimum possible price. Since they have more control over cost than price, the obvious option is to turn towards Cost Management to address the seemingly paradoxical situation of offering more value at lesser price and still maintaining profitability.

### 1.1.3 Global Manufacturing Sector

Ever since the World Trade Organization’s (WTO) Globalization initiative, the manufacturing sector has undergone a paradigm shift in its attitude towards cost management. The global manufacturing sector has seen a complex and bewildering scene with mergers and acquisitions threatening the survival of the very organization. In developed and developing countries, like India, a traditional “Cost Plus” approach used to exist in the market, wherein a component supplier gets a price increase from the Original Equipment Manufacturer every year based on the increase in the input costs (Raw material, Labour, etc.). However, during the past decade, most of the OEMs (Toyota, Suzuki and Ford to quote a few) have insisted price reductions from their global suppliers and hence the component manufacturers have realized that the market determines the price, and that their cost determines their profitability. Cost Management during New Product Development hence becomes critical and one question which arises is the question of managing the costs effectively without affecting quality.
The background of prevailing conservative approaches towards Cost Management and the emerging cost pressures from the global market in developing countries has been the prime motivation behind this research study.

1.2 NEW PRODUCT DEVELOPMENT AND TARGET COSTING

The background of Target Cost Management during New Product Development process which forms the basis for this research is detailed below. The forthcoming discussions on background of Target Costing are primarily based on the studies conducted by Cooper & Slagmulder (1997, 1999) and Monden (1992, 1995) at various Japanese organizations.

1.2.1 Challenges ahead of New Product Development Process

A major source of successful competitive advantage for companies in the future will be the consistent and successful development of new and modified products. However, batch sizes, repeat orders and product life cycles are all reducing as product variety increases (because of niche market penetration). Thus the ability to produce steady flow of successful new products consistently is one of the key factors in corporate success. Three fundamental principles emerge from the past research evidence on New Product Development (Barclay, 2001):

(i) *Company-specific issues:* there is no universally applicable panacea or solution to New Product Development problems that exist

(ii) *‘Tailoring’ the process:* a company’s development environment (both internal and external) is unique to that company. Improvement processes have to be ‘tailored’ to suit the specific circumstances.

(iii) *Things change:* especially in product development terms, what is correct today may not be correct for the future. What has been discarded today may be a key to the future.

The term New Product Development is all embracing the ranges from products that are totally new to the world to minor modifications. *Booze, Allen and Hamilton* defined six categories of ‘new products’ (Barclay, 2001) as shown in Table 1.1
Table 1.1 - Booze, Allen and Hamilton’s newness

<table>
<thead>
<tr>
<th>Definition</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>New to the world</td>
<td>Entirely new</td>
</tr>
<tr>
<td>New product lines</td>
<td>New market entry</td>
</tr>
<tr>
<td>Additional lines</td>
<td>Supplements</td>
</tr>
<tr>
<td>Improvements</td>
<td>Additional ‘value’</td>
</tr>
<tr>
<td>Re-positioning</td>
<td>Into new markets</td>
</tr>
<tr>
<td>Cost reductions</td>
<td>For same performance</td>
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</tbody>
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As markets emerge, the actual products that are developed by competing companies using common technologies tend to become undifferentiated and of similar performance. Hence a major competitive advantage in the future will be the ability to create and exploit the ‘emotive’ in the product; that is the intangible aspects that make the product ‘the one for me’. In summary, the key trends include the following:

- **Competitive advantage**: product development being a key determinant of competitive advantage for both companies and nations.

- **A strategic issue**: product development becoming a major strategic issue for companies.

- **Increasing activity**: the rate of introduction of new products to double every five years.

- **Reducing development time**: to reduce in line with the increasing introduction rate.

- **Company-specific approaches**: each company will need to address the issues that are specific to their own internal and external environments and to develop appropriate New Product Development practices.

- **Continuous improvement**: in New Product Development performance.

With ever increasing demand on lower prices, the New Product Development process is under constant pressure always to deliver products at lowest possible cost. In the present competitive environment, firms must manage costs aggressively if they are to survive. Cost management must be applied across the entire life of the product by everyone in the firm. It must start at the earliest stages of a product’s life because the ability to change the design of the product significantly increases the degree to
which costs can be reduced. Products must be designed so that they deliver the quality and functionality that are demanded by customers while generating the desired level of profits for the firm.

1.2.2 Cost Management during New Product Development

One way to ensure that products are sufficiently profitable when launched is to design them to a Target Cost determined by subtracting the product’s desired profit margin from its expected selling price. Under this approach cost is viewed as an input to the design process, not as an outcome of it. Forcing the product to achieve its Target Cost creates an intense cost discipline in the product design process. The cost management technique that is used to discipline the product design process in this manner is called Target Costing (Cooper & Slagmulder, 1997).

By setting Target Costs based on market-driven selling prices, Target Costing transmits the cost pressure that is placed on the firm by the marketplace to everyone involved in the product design process. Through this pressure, Target Costing focuses the creativity of the firm’s product designers for developing products that satisfy customers and that can be manufactured at their Target Costs.

To follow the steps of Total Cost Management (Monden, 1992), a corporation must:

(i) plan a product that meets the customer’s demand for quality
(ii) determine a Target Cost under which the customer’s demand for quality is attainable by using a blueprint
(iii) determine which processes achieve the Target Cost in production performance

Many Japanese manufacturers have implemented this approach and broken down their cost management departments as follows (Monden, 1992):

- **Cost control section**: profit planning, budget control, cost accounting
- **Cost planning section**: general advocate of cost planning, cost estimation by blueprints, cost reduction by Value Engineering
- **Cost improvement section**: general promotion of cost improvement activities at the factory

The cost management department supervises the general progress of the total cost management processes mentioned above. Many other departments, however, play
a definitive role in the process. These include the corporate planning, product planning, exporting, technology planning, design, purchasing, and production technology departments. As a result, the relative significance of conventional accounting cost decreases. From a profit stand point, a focus on cost as an economic measure of value unites the entire corporation under the coordination of cost management in creating innovative approaches to cost reduction and cost control.

1.2.2.1 The Survival Triplet and the Survival Zone

The survival triplet (Cooper & Slagmulder, 1997) consists of the three dimensions that define a product, which are cost/price, quality and functionality. Only products with values along each of these three dimensions that are acceptable to the customer stand a chance of being successful. The survival range is defined by determining the minimum and maximum values that each characteristic can have for a product to be successful. The survival zone is the volume created by connecting the three minimum values and three maximum values, as shown in Fig 1.1.

Fig 1.1 Survival Triplet (Cooper & Slagmulder, 1997)

In the survival triplet, Price is defined as the amount at which the product is sold in the marketplace in arm’s-length transactions. In the highly competitive markets, the market sets selling prices, and cost is the value of the resources consumed to get the product into the hands of the customer. Cost includes all investment costs, all production costs, and all marketing and selling costs. Unlike
price, it is not set externally but, like quality and functionality, has to be managed internally.

Quality is defined as conformance to specifications. This definition of quality is narrower than the definition often used in literature on quality, in which quality is defined to include the ability to design a product that meets customer requirements (quality of design). This narrower definition allows quality and functionality to be treated as two separate characteristics.

Functionality is defined by the specification of the product. It is not a single dimension but rather multidimensional. When managers model competition using the survival triplet, they may find it beneficial to decompose functionality into a number of characteristics.

Each product a firm sells has distinct values for each of these three dimensions. Only products with values acceptable to the customer stand a chance of being successful. The price characteristic is slightly different from the other two, in that the customer determines the maximum allowable price and the firm determines the minimum feasible price. The maximum allowable price is the highest price the customer is willing to pay regardless of the values of the other two characteristics. The minimum feasible price is the lowest price the firm is willing to accept for the product if it is at its minimum allowable quality and functionality levels. While the customer views the critical characteristic as price, the firm views it as cost. The minimum acceptable profit at any price level transforms cost to price. The survival zone of a product can be identified by connecting maximum and minimum values.

1.2.2.2 Cost Management in a Confrontation Strategy

With the emergence of the lean enterprise and global competition, firms face ever increasing levels of competition. As competition becomes more intense, firms are forced to learn to be more proactive in the way they manage costs. For many of these firms, survival depends on their ability to develop and practice sophisticated cost management systems that create intense pressure to reduce costs over the entire life of the product and across the entire value chain.

The following are three generic strategies of competition (Cooper and Slagmulder, 1997).

1. Cost leadership – apply when firms compete on the price characteristics
2. Differentiation – apply while firms compete on functionality and quality characteristics
3. Confrontation – apply when, multiple firms compete for the same customers by developing equivalent products

Firms that adopt a confrontation strategy must become experts at developing low cost, high quality products that have the functionality customers demand. A firm that fails to reduce costs as rapidly as its competitors will find its profit margins squeezed and its existence threatened. Cost management, like quality, has to become a discipline of concern, virtually to everyone in the firm. Therefore, overlapping systems that create intense downward pressures on all elements of costs are required.

The survival triplet has an internal form that reflects the perspective of the producer and an external form that reflects the perspective of the customer. Internally, the three characteristics are the product’s cost, quality, and functionality. Externally, the characteristics are selling price, perceived quality, and perceived functionality. While the selling prices of products can be disconnected from costs temporarily, if the firm is to remain profitable in the long run costs must be brought into line with selling prices. Therefore, the survival triplet can be represented as cost/price, quality, and functionality. Here, cost/price is used to acknowledge that a long term relationship exists between cost and price (Cooper & Slagmulder, 1999).

1.2.3 Target Costing

Target costing is primarily a technique for profit management. Its objective is to ensure that future products generate the profits identified in the firm’s long-term profit plan. The objective can be achieved only if products satisfy the demands of the firm’s customers and can be manufactured at their costs. Firms use Target Costing to ensure that new products are profitable when launched.

Cooper & Slagmulder (1997) define Target Costing as a structured approach to determine the life-cycle cost at which a proposed product with specified functionality and quality must be produced to generate the desired level of profitability over its life cycle when sold at its anticipated selling price.

The product’s Target Cost is not always simply the target selling price minus the target profit margin. Sometimes adjustments have to be made for the capital intensity of products and the ability to reduce manufacturing costs during the product’s life.

To be effective, Target Costing must take into account the constraints of product quality and functionality. Target Costing systems rely heavily on the cardinal
rule: "The Target Cost of a product can never be exceeded" (Cooper & Slagmulder, 1999).

1.2.3.1 The Structure of Target Costing Process

Target Costing process can be broken into three major sections (as shown in Fig 1.2). The first section identifies the allowable cost of each product. This is the cost at which the product must be manufactured if it is to earn its target profit margin at its expected target selling price. Once the appropriate price, functionality, and quality targets have been set, then the allowable cost can be determined by subtracting the target profit margin from the target selling price.

The second section identifies the product-level Target Cost, which is set to be achievable, but only if the product designers expend considerable effort and creativity. The third section identifies the component-level Target Costs. The firm’s suppliers are then expected to find ways to deliver the components at their Target Costs while still making adequate returns themselves. Target profit margins have to
reflect the economics of the product’s life cycle.

1.2.3.2 Market Level Target Costing

It promotes the necessary level of aggressive cost management. Subtracting the target profit margin from the target selling price set by the market identifies the cost at which the product must be manufactured.

1.2.3.3 Product-level Target Costing

Product-level Target Costing creates intense pressure on the product designers to reduce costs; it focuses designer creativity on reducing the costs of future products to their target levels. Value Engineering is the primary technique used to find ways to decrease product costs while maintaining the functionality and quality the customer demands.

1.2.3.4 Component-level Target Costing

Component-level Target Costing creates an equivalent pressure on their suppliers. Firms use component-level Target Costing to focus supplier creativity on reducing the costs of the components they supply.

1.2.3.5 Factors influencing Target Costing

At least five major factors influence the Target Costing process. The factors that influence primarily the market-driven Target Costing portion are (i) the intensity of competition and (ii) the nature of the customer (shown in Fig 1.3). The factors that influence the product-level Target Costing process are, (i) the firm’s product strategy and (ii) the characteristics of the product (shown in Fig 1.4). Finally, the last factor that influence component-level Target Costing is the firm’s supplier-base strategy (shown in Fig 1.5).

1.2.3.6 The Seven Key Questions of Target Costing

The essence of Target Costing can be captured in the following seven questions,

- What are the firm’s long-term sales and profit objectives?
- Where will the new product’s survival zone be when it is launched?
- What is the target profit margin?
- What level of cost reduction is realistic?
- How can we achieve this cost reduction objective?
- Are there extraneous circumstances that allow the target cost to be relaxed?
- How can we distribute the cost reduction among the components?
Fig 1.3 - Factors that influence Market-driven Target Costing

Intensity of competition

Nature of the customer

Degree of customer sophistication
Rate of change of requirements
Knowledge of future requirements

Market-driven costing

Fig 1.4 - Factors that influence Product-level Target Costing

Product strategy

Number of products in line
Frequency of redesign
Degree of innovation

Product complexity
Magnitude of up-front investments
Duration of product development

Product-level Target costing

Fig 1.5 - Factors that influence Component-level Target Costing

Supplier base strategy

Degree of horizontal integration
Power over suppliers
Nature of supplier relations

Component-level Target costing
Fig 1.6 shows the method of decomposing the Target Costs of major functions into component level.

1.2.3.7 Achieving the Target Cost

As the design process proceeds and costs are removed from the major functions, the estimated manufacturing cost gradually falls toward the Target Cost. Many firms call the updated estimate the *drifting cost* (as shown in Fig. 1.7). Thus the product design process starts with a current cost that is higher than the Target Cost and that the product development process reduces the expected or drifting cost until it finally reaches the Target Cost. At most firms, if the drifting cost equals the Target Cost, cost-reduction activities will cease. There is no reward for achieving greater savings than those required to achieve the Target Cost. The Engineers’ time would be better spent on getting the drifting cost of other products to equal their Target Costs.
The background of Target Costing during New Product Development was discussed in the above sections. The structure of the thesis is outlined in the next section.

1.3 STRUCTURE OF THE THESIS

The outcome of the Research study has been compiled into a thesis as detailed below.

Chapter 2 describes the literature review wherein past works in this area are discussed. The research objectives and research questions were framed based on the literature survey and are given in the end of the chapter.

Chapter 3 gives an outline of the proposed work and the theoretical model developed. The methodology involved and the overall Target Costing model suggested during NPD are outlined in this chapter.

Chapter 4 details the role of Quality function Deployment (QFD) and Value Engineering (VE) in a Target Costing process with cases from industries. A novel Cost – QFD (C-QFD) approach for incorporating financial constraints into QFD and a combined QFD-Taguchi methodology for Target Costing is also discussed in this chapter. The chapter also explains how Fuzzy logic helps in handling uncertainty in cost models.

Chapter 5 explores the role of Supply Management in a Target Costing process. It also explains how Supply Chain Management (SCM) and Quality Function Deployment (QFD) can be combined effectively to synergize the benefits in a Target Costing process.

Chapter 6 analyzes and discusses the Reliability issues in a Target Costing process and explains how tools like Failure Modes and Effects Analysis (FMEA) help improving product reliability during a Target Costing process. The chapter also explains role of Kaizen Costing in Target Cost Maintenance and handling of drifting costs. A case study on Target Cost maintenance conducted at a supplier of an Indian auto manufacturer is discussed in this chapter.

Chapter 7 summarizes the major conclusions of the research and suggests scope for further research.

Various references are listed in the References and additional supporting data for the thesis are given in the appendices.