COST EFFICIENT PRODUCT DESIGN FOR SUSTAINABLE COMPETITIVE POWER

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ABSTRACT

Competitive power of a product in the market depends on factors such as cost, performance, aesthetics, time of submission to market, and quality. High competition conditions and change in customer expectations have shortened life span of products and time of submission to the market. This has shortened the phase of design. In an environment, where products are constantly renewed, the time of design is constantly shortened; however its importance rises. Because these factors, affecting competition power of a product, are shaped at the stage of design to a high extent. Designers act with the awareness that they affect not only current costs; but the upcoming costs as well, and should design products with high competition power in the market. To this end, in this study as techniques supporting cost management at the stage of design, the following cost management techniques have been handled: product life cycle costing, target costing, design for cost, design for manufacture, design for reliability, functional cost analysis and inter organizational cost management.

Key Words: Cost Management, Product Design, Product Life Cycle Costing

1-INTRODUCTION

The current business world faces the problem of constant change of customer preferences, which arises due to rapid technological developments. Customers constantly prefer newer and much more functional products. This gives rise to shortening of life spans of products step by step. As a result of this fact, the competition power, market advantage, attained by the products does not guarantee that the said products will carry on with competition advantage in the future. Under environment of competition, enterprises should estimate needs of their customers beforehand, and should rapidly apply the new technologies, which will ensure new product and service design, much more efficient production and service, to their systems. These changing market conditions force enterprises to rapidly reduce costs. Many enterprises handle cost reduction activity solely as a reaction against foreign competition pressure. The number of enterprises, handling cost reduction efforts as a constant business strategy or basic growth strategy is pretty limited. An efficient cost management has to be handled as a constant strategy taking into consideration all the stages of product life cycle.

Shortening product life cycle naturally increase importance of cost management at the stage of design and development. Thus cost structure is established at the stages before production to a high extent. The studies conducted indicate that 70-80 % of costs of a product is determined at the stage of design. An efficient cost management should comprise of all stages of a life cycle of a product (Özer, 2003). However the fact that life cycle costs are shaped at pre-production stages; in other words it depends on decisions taken before production at a rate of 70-80% makes it obligatory that pre-design stage should be focused on. A good product design made at the beginning will ensure reduction in costs to arise after production. For this reason by focusing on product development stage, an efficient product development cost management should be established and all aspects of product life cycle from product planning to disposal of product should be taken into consideration efficiently(Ehrlenspiel, 2007:32). In this study, design stage is focused on; thereby how a cost efficient design, aiming at cost reduction in the cycle of its life span and supporting cost management techniques have been handled and concurrent applicability of these techniques has been examined.

2-COST EFFICIENT PRODUCT DESIGN

Design as a process is a series of activities, where known and recorded information on the design product are much more detailed, information change and made definite. In other words, design process changes the situation of the current information on the designed product. In the cycle of a successful design, the level of information on the designed object increases and the product becomes much more tangible.

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Thus as a progress of design, the design increases until production and becomes sufficient and detailed. While production changes the physical state of the designed object, design is a process, changing the information we hold on the designed product(Poli,2001:1). An efficient product design requires mutual close relation of various operation functions(Yalçın,2009:290). Cost management system has to deal with not only current costs but also upcoming costs(Özer;2003). Whereas the most important stage, affecting costs of the future is pre-production stages. In other words decisions taken at the first stages of the product life cycle affect the entire product cycle(Frexio and Toledo, 2004:31). The level of the produced products' covering consumer expectations, life cycle costs, comprising of environmental expectations especially realize at the stage of design (Topayan, 2005:259). Changes coming about at the preliminary stages of design are easy to be eliminated since accumulated costs made up to that point are low (purchase etc). As the process progresses and the product is about to be finished, costs of changes increase. An efficient design system should examine as many data as possible at the preliminary stages of the design and should reduce costs(Büyüközkan,2005:280). Cost efficient product design can be defined as an approach, accepting costs as an input of the design process instead of an output, aiming at affecting not only the current costs but also the upcoming costs, including various cost management techniques to design process concurrently, aiming at design of quality, reliable products, appropriate for customer expectations.

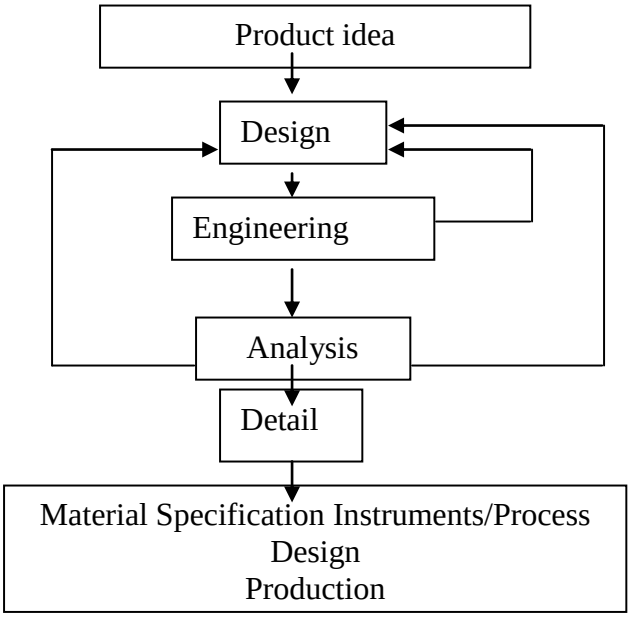

Figure 1: Design and Production Flow of Products

Source: Corrada POLI , Design for Manufacturing, Butterworth, Heinemann ,USA, 2001, p:1

The Figure 1 above, shows the design and production flow, starting with idea concept for a new product or a current product to be developed. This new product idea or the idea of development of the current product in general stems from the customer, employees or a new technology (Poli,2001:1). Flow of design data and supply chain formation in accordance with the demand obtained from the customer are seen in Figure 2. Important thing in design is design of products in line with customer expectations. Correct understanding of customer expectations is pretty important in terms of cost efficient design. Because needs for a change to arise subsequently will be costly to be eliminated. A design, established at the beginning, which is appropriate for customer expectations, will contribute to cost reduction in this respect.

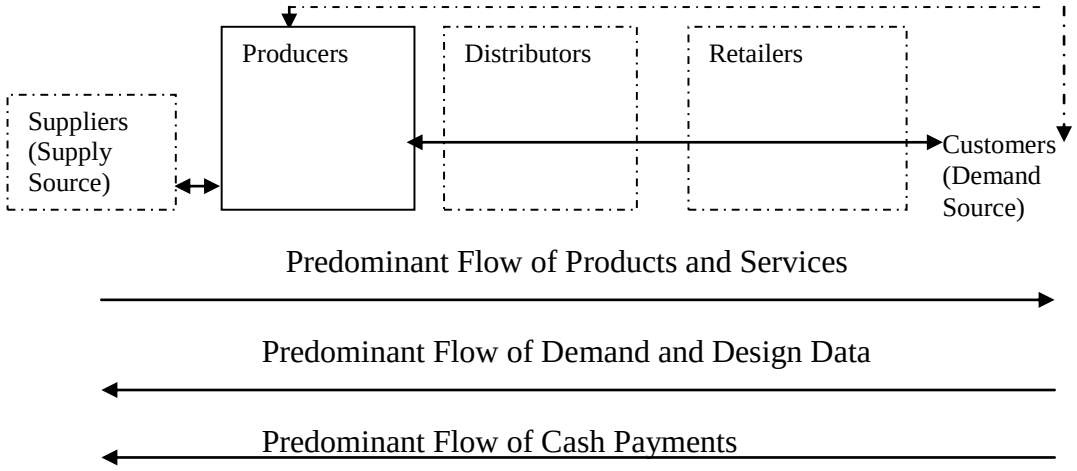

Figure 2: Design Data Flow obtained from Customers and Supply Chain Formation
Source: Archie Lockamy III, Wilbur I. Smith, " Target Costing for supply Chain Management: criteria and Selection" Industrial Management &Data Systems 2000, 100/5, p:210

As is seen in Figure 2, data for a design comes from the customer. The question "What should we do for producing products appropriate for the market?" is the point of focus of cost planning concept. It is evident that data demands from cost accounting arise as cost planning and management in the centerline of the data, obtained from the market for product life cycle(Alagöz and Ceran,2006:62).

3 COST EFFICIENT PRODUCT DESIGN AND PRODUCT LIFE CYCLE

Product life cycle in theory is an issue, handled with different point of views in terms of producer, consumer, marketing, and the product itself. Costs related to the product in the course of the life span of the product are handled as "Product Life Cycle Costs". These costs are research (within the scope of the product), development (planning, design, testing), production (transformation activities), and logistics&support (advertisement, distribution, warranty, customer service, product service etc.). It is pretty important to consider the costs in pricing of a product in terms of a sustainable competition power(Frexio and Toledo,2004:31). If enterprises, operating in the current business environment, where a fierce competition goes on, desire to take place in the market, they have to manage the costs efficiently. This struggle should begin at the first stages of the life cycle of the products, presented to the market, and should continue in the course of the entire life cycle in the market. Enterprises can reduce new product costs without making concessions of quality and functionality and can ensure sustainable competition advantage, bringing forth an economic success, and market share increase(Predić and Stefanović,1999:9).

Kotler and Amstrong (1995) have allocated the strategies, defining the price, into 3 categories(Frexio and Toledo,2004:31):

- Price definition, based on cost
- Price definition, based on value
- Price definition, based on rivals and competition

- Price Definition, Based on Costs	- This price definition is made by addition of a standard margin with regard to product cost.
- Definition, Based on Value	- Consumer perceptions are used with regard to the product value. Decisions on product projects are led by value and price.
-Price Definition, Based on Rivals	- Customers base their judgments on the value of a product on prices of similar products, produced by rivals. The price can be determined at the level of them on account of competition or with the desire of replacement of them.

As is seen above, one of the strategies, focused on Kotler and Amstrong among strategies to be used for pricing is product costs. However in other two pricing strategies, thinking of costs is pretty important in terms of profit management. This should not be ignored. Very meaningful cost management decisions for many enterprises are handled at the stage of product design and development.

The most important advantage of product life cycle costing is the fact that design and development stage is effective on the costs to arise in the course of product life cycle. However this does not mean that other stages of product life cycle are ignored (Smith, 2007:388) Product Life Cycle Costing comprises of consumer's costs in addition to producer's costs. Cost management techniques such as design for reliability, design for service are important on this account. Implementations related to reliability, bringing forth for producer can reduce the costs to be assumed by the customer. However it can be possible to increase reliability of the product in the course of its life span with the same product cost and different design. Likewise handling of sustainability (maintenance repair) and service costs at the stage of design can reduce the costs to be assumed by the customer in the future(Smith, 2007:389). However let us point out at the fact that it is pretty difficult to implement life cycle costing since different products have different life cycles(Herrmann,2004:857)

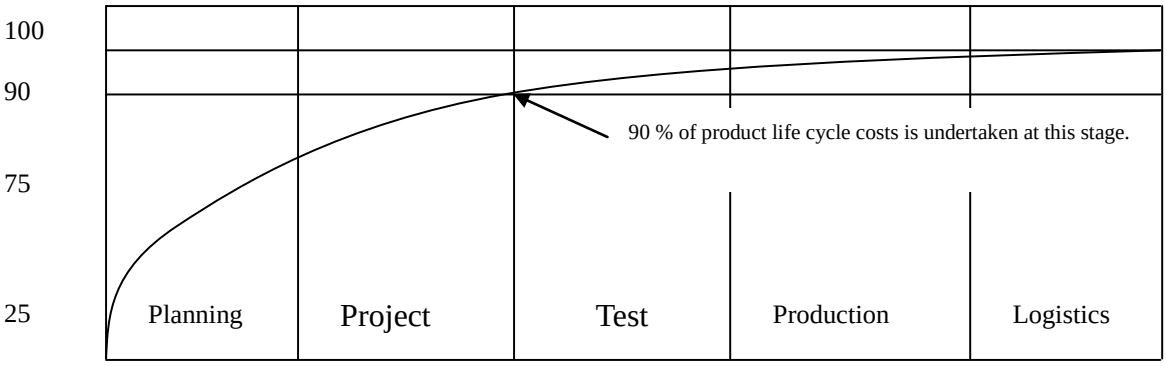

Figure 3: Formation of Life Cycle Costs
Source: Osvaldo Magno FREIXO, José Carlos de TOLEDO, (2004); "Incorporating Life Cycle Cost Management in Product Development Process" Product: Management&Development, vol 2,31

Figure 3. It indicates that decisions related to costs to arise in the course of a life s e taken at pre-production stages and cost structure is shaped at these stages in line with this fac conducted, 70-80 % of costs depend on decisions taken at these stages; whereas in some stud 0 % (See Özer,2003; Frexio and Toledo,2004: Rush and Roy, 2000) Whereas Figure 4 indicat ween costs undertaken at pre production stages (costs of the future) and incurred costs (current costs). As is evident, before production life cycle costs are undertaken. Costs undertaken are manifested at the stage of design at a rate of 70-80 %. Whereas incurred costs are a level of 10-15 % at the stages before production. At this point we want to point out the fact that costs arising after starting production are assumed to a high extent at stages before design. The point to be attached importance is the fact that costs assumed related to the product are determined at the stage of product design at a rate of 70-80 %. On this account design stage is very important in terms of life cycle costs.

Cost reduction opportunity upon production

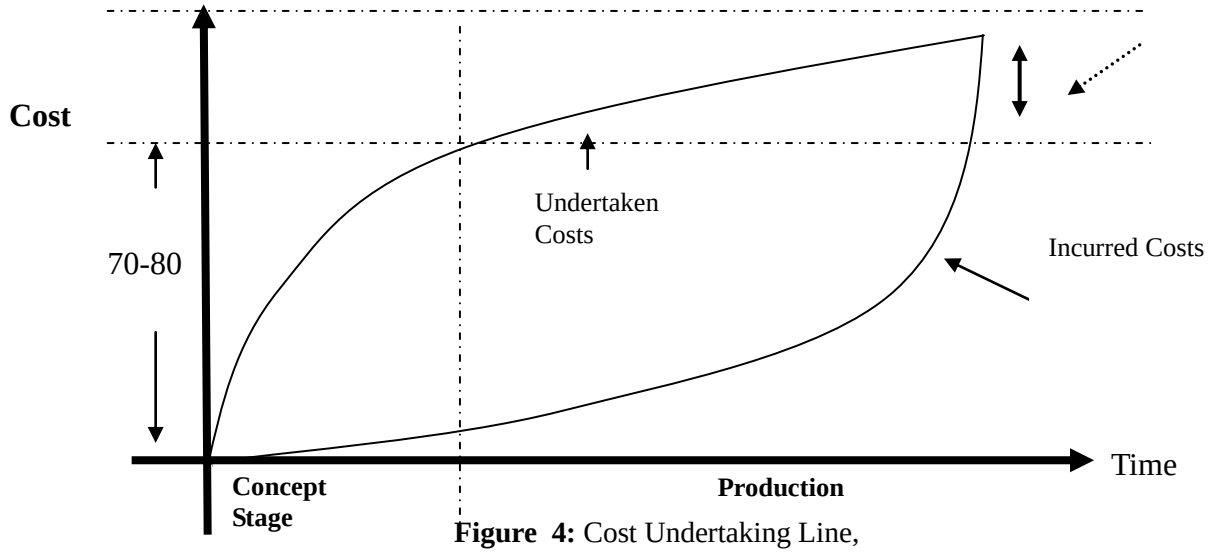

Figure 4: Cost Undertaking Line,
Resource: Rush and Roy, 2000

Production and design are in interaction with each other starting from the beginning of product development. Design team take into consideration all opportunities to reduce production cost and time, and makes effort for solution of the problems in the production line(Gerşil,2009:88). The fact that product costs at the stage of product planning and design are not taken into consideration gives rise to reduction of profitability rate. In terms of cost reduction, at the first stages of product life cycle (Planning and Design) there are more opportunities when compared with the subsequent stages(production)(Alagöz and Ceran, 2006: 62). Taking into consideration costs at the stage of design requires management of costs in the long term as in short term for both financial purposes and to obtain cost advantage. The approach, aiming at management of costs in the long term is strategic cost management. Strategic cost management aims at constant improvement of strategic positions of enterprises(Yalçın,2009:289).

4- COST MANAGEMENT TECHNIQUES, SUPPORTING COST EFFICIENT PRODUCT DESIGN

Strategic cost management requires concurrent use of cost management techniques so as to develop strategic position of an enterprise, and to ensure cost reduction(Köse,2003) Some cost management techniques are pretty beneficial especially at the stage of product design(Smith,2007:390- Slagmulder:2002,81). These are;

- Target Costing
- Functional Cost Analysis
- Design For Cost and Design to Cost
- Design to Manufacture
- Design for Reliability
- Interorganizational Cost Management

Concurrent implementation of these techniques will make contribution to development of strategic position of the enterprise and its gaining a sustainable competition power.

4.1. Target Costing

The basic principle on which target costing is based is inclusion of market data in costing system(Smith,2007:459). Target costing is instead of being a simple instrument for cost management and cost reduction, is an important part of new product design and entire profit management process (PK,2009:6-7). It is a market directing strategy, requiring the best competitive pricing. In other words it is an efficient cost management system, arising at the stages of new product design and development, comprising of profit management of the enterprise at the stage of product development(Alagöz,Ceran,2006:63). Target costing is a method, which is used at first stages without design and formation of production methods for a new product. In this method, transactions are directed according to the customer, focus on product design, and extend to the entire life cycle of the product(Coşkun,2003:25). As a result, pricing based on cost becomes a remnant in the past(Shank and Fisher,1993:73).

Supply chain management is related to optimization of the entire value creation process from suppliers to the end manager(Paksoy, Altıparmak, 2003:149). Target Costing is a strategic management instrument, ensuring active contribution of supply chain, and aiming at cost leadership with the support of all departments of the enterprise(Nicolini,2000:303). In other words, Target Costing aims at reducing the costs by inclusion of suppliers and producers in contribution of cost reduction at the stage of design(Helms *at al.*,2005:49). As a result, it can be said that Target Costing is a cost management instrument, taking into consideration the market data aiming at cost management instrument starting from the stage of design to the entire life. It was first used in Japan.

Target costing can be deemed as a process, developed for supporting strategic cost management, based on three elements of strategic cost management(Ellram,200:40).

- **Competitive Position:** Understanding the competitive position of the enterprise, and product and services is the first critical step for the target costing.
- **Cost Driver Analysis:** Cost drivers of product or process contribute a great alternative for process development to cost reduction.
- **Value Chain Analysis:** Target costing process affect current and potential value chain of the enterprise and is affected.

One of the primary targets of target cost management is subtracting target profit margins believed to be obtained by enterprises from target or expected sales price and determine how costly the products will be(Özer,2003). It can be formulated as below:

Target Sales Price – Desired Profit Level = Target Cost

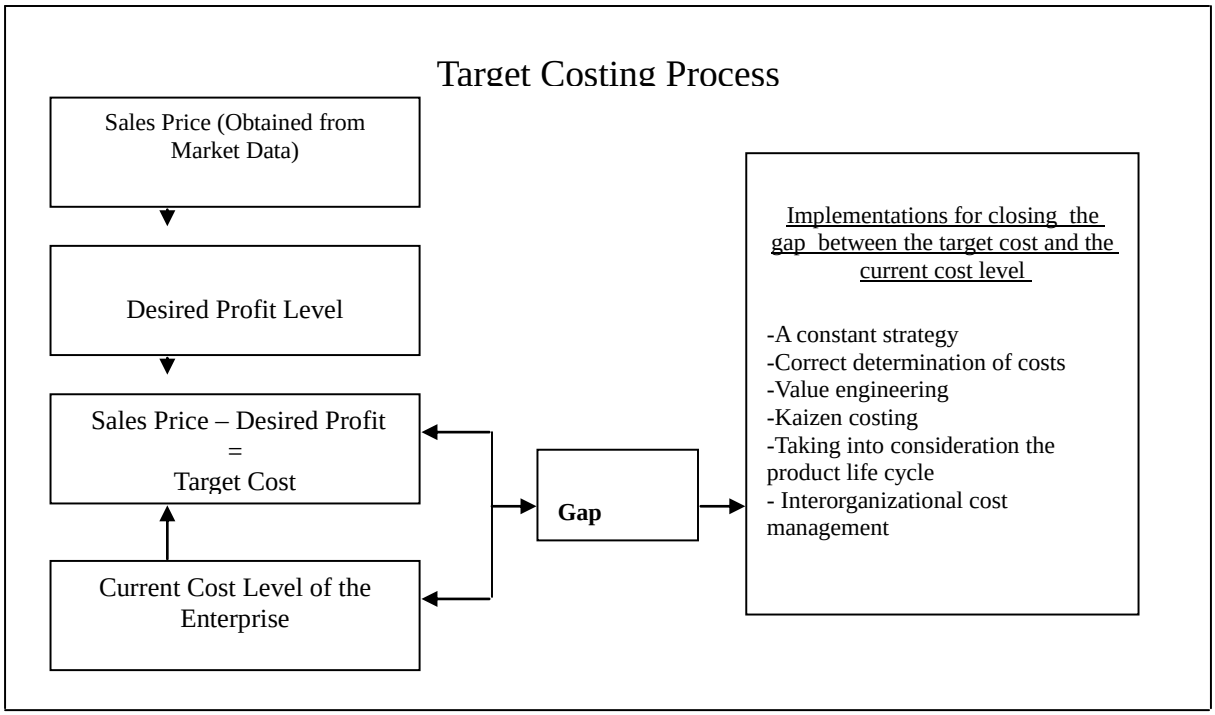

Figure 5: Target Costing Process

In the perfect competition market, the price is determined by the market. Determination of a sales price above this sales price will not form the expected returns. Because in the market, there are many rival enterprises that propose much more reasonable prices. A competitive price proposal can only be possible with the market price. Making production on the appropriate cost for the market price is the basis in terms of sustainable competition. The target cost level is determined by subtracting the determined profit level from the targeted market price. If there is a gap between the target cost which must be achieved and the current cost level which is obtained with current capabilities of the enterprise, this difference has to be closed by the enterprise. To this end, cost reduction has to be turned into a constant business strategy in the enterprise, and it should be ensured that cost data are determined accurately. By benefiting from other cost management techniques such as Value Engineering, Kaizen Costing, a cost reduction effort which taking into consideration life cycle costs, should be realized. The figure 5, indicates how target costing implementation will be done and if there is a difference between the target cost and the current cost level of the enterprise, how it will be closed as mentioned above.

4.2. Functional Cost Analysis

Functional costing is a cost management technique, developed as a support to cost management of both current and new products and services. This technique focuses on individual functions of a product instead of individual parts. For instance parts of a pen can be the circular long body, edge, ink cartridge and the top part. Nevertheless the functions of a pen is drawing a line, coloring, holding the pen, flow of ink, storage of ink, prevention of stain. Costing of functions is pretty different from costing of parts. Two products, fulfilling the same function, may be composed of different parts; however their functional costs are the same. Functional costing is pretty beneficial in the design of a new product or redesign of current products(Smith,2007:471). The primary objective of functional cost analysis is examination of technical and economical parameters of product, the function of the product and ensuring optimization. At this point in assessment of product functions demands of end customer is important(Chemega and ,Ozarina;2008:174). Functional cost analysis is a value engineering method. It aims at increasing the difference between the cost and value of the product(Yoshikawa and *at al.*, 1995,415-416). Value engineering is a method used for the purpose of increasing product design quality(Yoshikawa and *at al.*, 1994:53). It is a process, requiring a team work, organized for the purpose of analysis of functions of products and services so as to find the ways of succeeding target costs.Value engineering can be applied to design of a new product, comprehensive redesign of a current product or assessment of a product of a rival. Project activities for which functional cost analysis is beneficial can be listed as below(*Brusse-Gendre,Access 25.10. 2010:1)*:

1-Determination of product needs and requirements
2-From concept to detailed design
3-Pre-production
4-Product development after design
Implementation of functional cost analysis, comprises of the stages below:
1-Formation of the lists of the parts
2-Determination of costs of each part.
3-Determination of value of each part.
4-Thinking of functional value.
5-Formation of alternatives, which will reduce costs, and increase value.
6-Assessment of alternatives.

4.3.Design for Cost and Design to Cost

Development of successful new products requires estimate of effects of design decisions on life cycle costs at the beginning of product development process (Herrmann *at al.:2004:853*) Design or process design has the highest effect on life cycle costs and quality(Dean and Unal,1991a:3) Cost can be applied in two ways to the design stage as an assessment criterion; design for cost and design to cost. It can be used in both approaches within the context of cost(Asiedu and Gu,1998:884).

However design for cost and design to cost are not the same thing(Dean and Unal,1991b). While design to cost ensures a design for fulfillment of functional needs for a given cost target; design for cost is the conscious use of engineering process technology(Asiedu and Gu,1998:884). While design to cost is a repetitive cost process for production of the most appropriate design for covering the given budget, design for cost aims design of a product only outrightly. While design for cost increases the system performance, aims at reduction on costs. Whereas design to cost reduces performance until the budget is covered(Dean and Unal,1991:). Design for cost requires design of product and product distribution process for simplicity. Complexity is the opposite of simplicity. It increases costs. Design for cost is the internal part of engineering process. Whereas design to cost focuses on cost and management and only by chance focuses on engineering process(Dean and Unal,1991b).

The objective of design to cost is converging the design to an acceptable cost instead of converging the cost to design(Rush,Roy,2000:63). Design to cost can be defined as a cautious and repetitive step by step process(Michaels,Wood,1989:7) Design to cost is a management philosophy, emphasizing design and selection of a system, based on minimization of life cycle costs. The fact that no planning is made by the management complicates application of this important philosophy. Design to cost philosophy expresses that all purchase decisions are based on costs, disseminated to the entire life of a system. The objective is minimization of total life cycle costs(Ahmed,1995:261). Design to cost is the cautiousness of the undertakings of the management in current investments for meaningful big awards of the future. Design to cost is the most important single investment leverage within profitability within opportunities of the management(Michaels,Wood,1989:8).
The figure 6 indicates an example of ranges of necessary inputs for production of a design instrument aiming a cost.

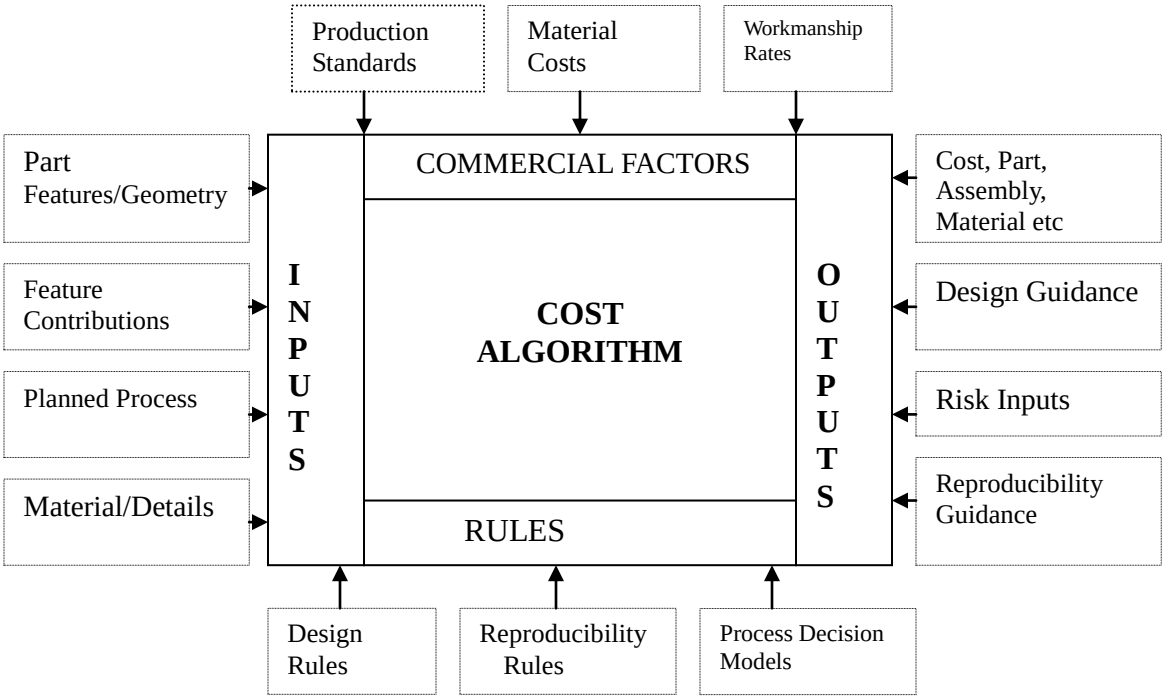

Figure 6: Design to cost model

Source: Christopher Rush, Rajkumar Roy, Analysis of Cost Estimating Processes used within a Concuurrent Engineering Environment Throughout a Product Life Cycle., 7th International Conference on Concurrent Engineering, University Lyon 1, France, July 17-20th, 2000.

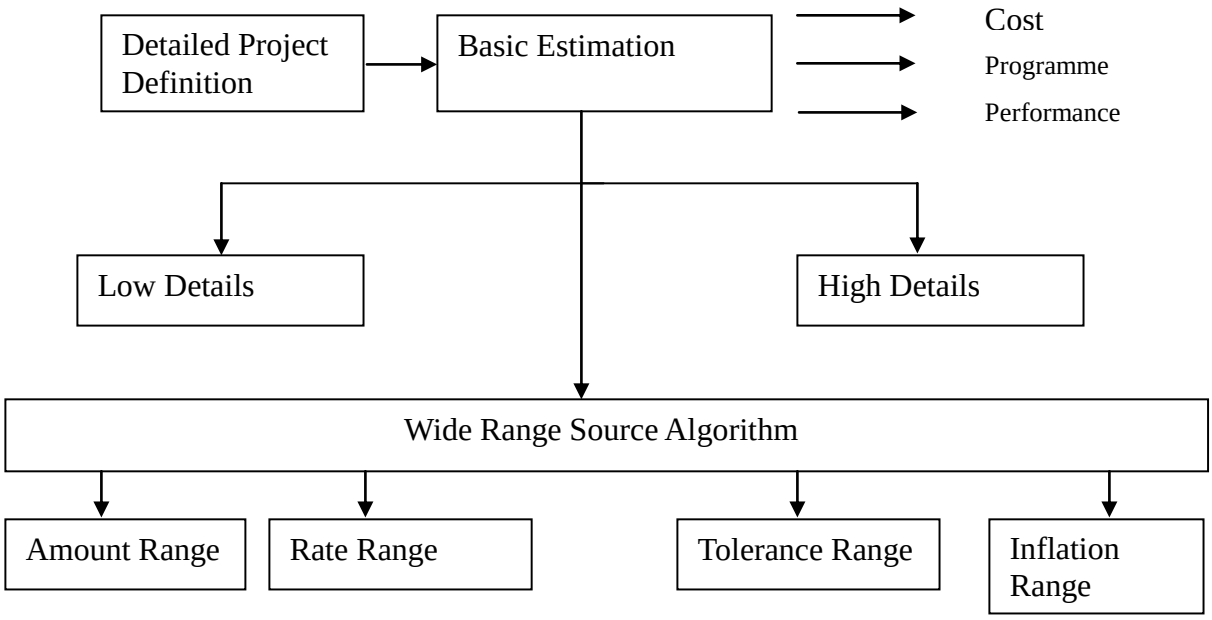

Figure 7: Functionality and Reproducibility Issues

Source: Jack V. Michaels,William P. Wood, "Design To Cost" John Wiley &Sons Inc.1989,p.7

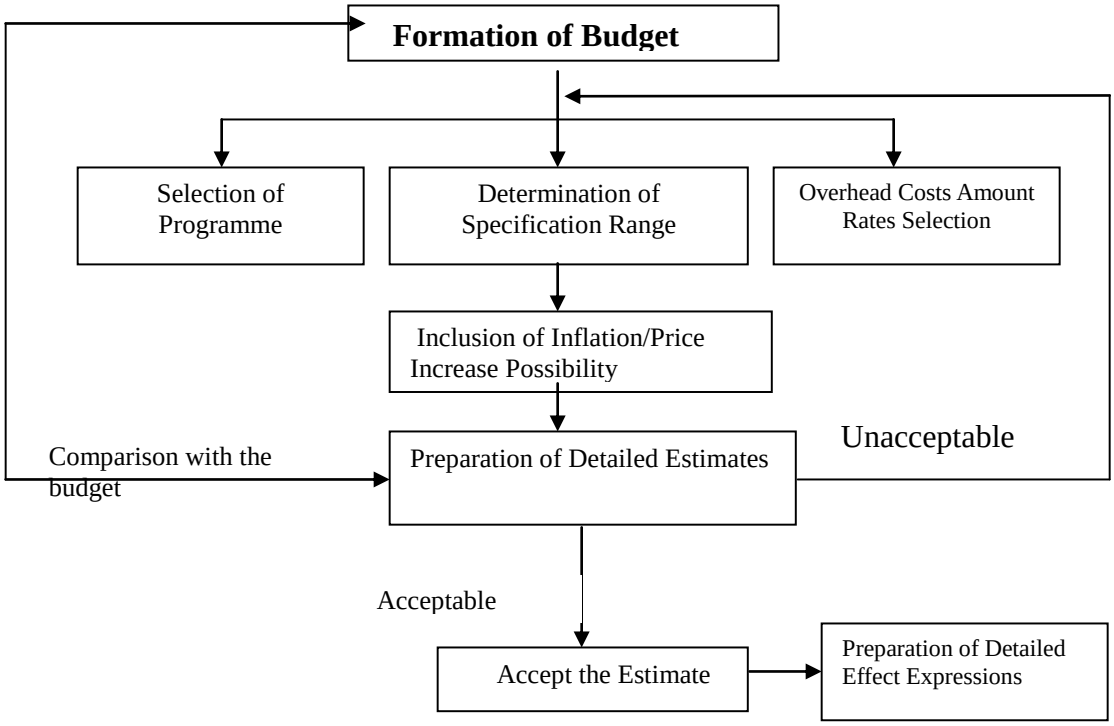

Figure 8: Functional Value and Monetary Supportability Issues
Kaynak: Jack V. Michaels,William P. Wood, "Design To Cost" John Wiley &Sons Inc.1989, p.8

The basis of the design to cost has been indicated above in figure 7 and figure 8. The figures show the process of analytical studies. Enterprises at first need to determine acceptable cost borders, time schedules, and performance borders and then procurement of production of products monetarily supportable having good functional features as programme progress in the course of development and distribution of end products. Figure 7 is basically related to functionality and reproducibility problem. Whereas Figure 8 is related to functional value and monetary supportability. Design to cost manages and controls by taking into account costs in all development processes based on the elements below(Hari et al,2008) :

1.Allocation of target cost to cost factors of the project,
2.Design for covering of cost estimate instrument, the provision of data, and target cost for designers,
3.Design for cost control and cost examinations by use of cost estimates for each cost factor,
4.Corrective activities, stemming from cost reduction requirement.

4.4. Design To Manufacture

Design to manufacture is a systematic approach which provides the opportunity to estimate production costs for engineers at the beginning of the design stage even when the produced product is a rough geometric structure(Talati, Access 14.10.2010). In other words, design to manufacture is a semi-problem solution technique for all sorts of productions at the stage of design in order to eliminate potential problems of the product to be produced(Çilsal,2005:2). However it should be adopted as a philosophy and a culture more than a management technique(Talati, Access 14.10.2010). Design to manufacture presents proposals to designers or concurrent engineering teams in a wide framework in order for the most easily produced and low costly design to be made(Çilsal,2005:2). The objective of design to manufacture is design of a product, which can be produced in a simple and economic way (Greenlee, Access 05.05.2011). Design to manufacture presents ways of solution for engineers so as to develop product quality and amount(Talati, *Access* 05.05.2011). Design to manufacture techniques currently appeal to a wide range of production and life cycle issues such as production quality, production system performance, life cycle costs and environmental problems. Design to manufacture methods assess reproducibility of and costs of the product at an operational level(Herrmann, *et al,2004:2).* In order to define objectives of design to manufacture "reproducibility" concept can be used(Trobe-Bateman and Wild,2003:109) Basic principles of design to economic production; in other words reproducibility are as below:

1-Simplicity
2-Standard materials and parts
3-Standardized design of the product
4- Free tolerance
5- Maximum processable material use
6- Team work with production personnel
7- Avoiding secondary transactions
8- Design in conformity with the expected production level
9- Benefiting from special processing features
10- Avoiding process limitations

Product and process design affect the capability of an enterprise to cover its business needs. For this reason, problems to arise in the course of production has to be taken into consideration at the product design level by use of Design to Manufacture (DTM) approach, design has to be made by prevention of problems and time, material, workmanship have to be saved.

4.5. Design for Reliability

Reliability is fulfillment of necessary functions of a system or part under conditions expressed for a specific period of time(Bauer,2010:3)
Successful new products under high competitive markets of today have to cover 3 requirements(Ireson *at al.*,1996:5.1)

-**Better**: Products should have a higher performance and reliability.
-**Faster**, They should be brought to the market faster.
-**Cheaper**, They should have lower production cost and sales price.

When the said three issues are handled, faster presentation of products to the market means shorter design, which is in contradiction with lower cost and high reliability. This is pretty hard. While previously it was possible to lower life cycle costs within time on account of effect of learning curves, current market conditions make it difficult(Ireson *at al.*,1996:5.1).

Shortening of product life cycle depending on technological developments currently give rise to shortening of product development period. However it should be emphasized in markets of today reliability ranks the first among expectations of customers about products(Crove and Feindberg,2001:11). In reliability, development of reliable products and increasing customer satisfaction are focused on, and for reliability, design realizes in 4 stages(Silverman,Fuente, Access 04.11.2010):

1-Assessment of condition of the customer
2-Development of objectives
3-Statement of programme plans
4-Implementation of programme plans

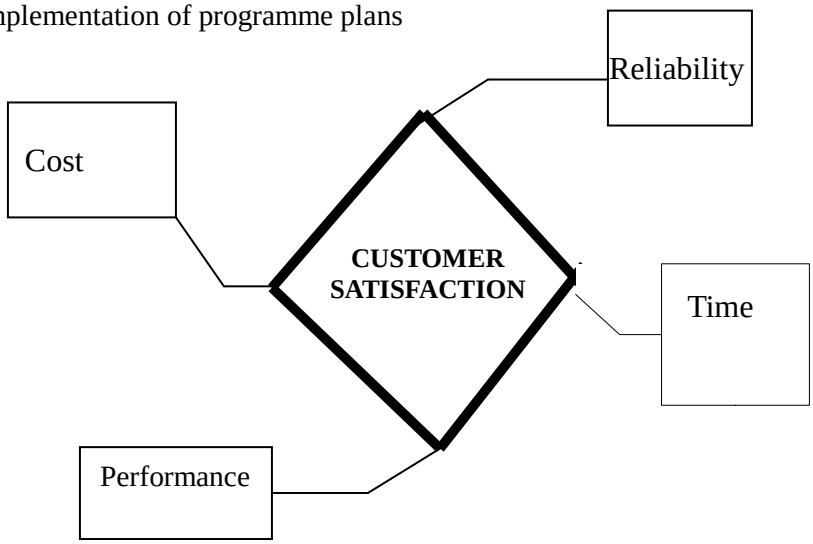

Figure 9: 4 Big Parameters to be Balanced

Source: Mike SILVERMAN, George de La FUENTE, " Software Design for Reliability", http://www.opsalacarte.com/pdfs/Tech_Papers/Software_Design_for_Reliability_-_Paper.pdf (Erişim:04.11.2010)

Engineering team should balance cost, time, performance and reliability for optimal customer satisfaction as is seen in the figure 9 above (Silverman and Fuente,Access,05.05.2011).
The difficulty of designing new products in a short time should not give rise to the fact that reliability is ignored, an optimum cost level, which is of reasonable reliability for lowering costs of the enterprise, should be determined. It is indicated in the following figure.

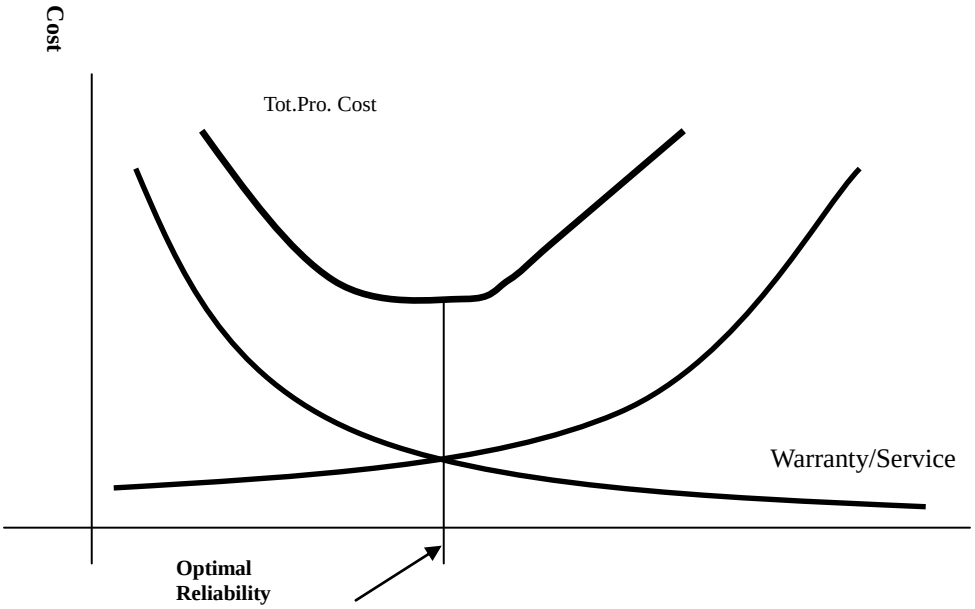

Figure 10: Product development costs curve against reliability
Source: Andre Klyner *at al.*, Minimization of Life Cycle Costs Through Optimization of The Validation Program- A Test Sample Size and Warranty Cost Approach

Reliability is no longer an activity, conducted by a separate group in the organization. Enterprises should take into consideration reliability in every decision taken in the organization(Silverman and Fuente:2006) Without ignoring reliability, products with reasonable costs have to be brought to the market fast.

4.6. Interorganizational Cost Management

Interorganizational cost management makes reference to supply chain management(Creese,2001). The basis of supply chain management expresses the need that the enterprise thinks of suppliers and relations with customers beyond its borders along the value chain(Fayard,2006). Supply chain comprises of all the activities related to transformation and flow of goods from raw material (issuance) to the end user with the relevant information flow. Material and information flows along both the top and the bottom supply chain. Supply chain management integration of these activities through developed supply chain relations for the purpose of obtainment of a sustainable competition advantage(Seuring,2002:2). Materials procured with Supply Chain Management are adjusted to respond to changes in customer demands without overstocking by production processes and distribution flow. Thereby the organization integrates cross functions within enterprise borders and national borders and conducts them concurrently. Supply chain when observed in terms of the end customer ensures a coordinated network to companies affecting each other in product or service procurement (Yalçın,2006:23).
Interorganizational cost management is used so as to succeed a cooperative management by organizations along value chain(Fayard *et al.2006:2)*. Because solely focusing on internal processes will lead to the fact that the enterprise does not benefit from cost management synergy(Slagmulder,2002: 81). Interorganizational cost management is especially important for simple organizations at the stage of design. Because these enterprises outsource at a rate of 70 % for the purpose of value addition to their products.

Since these enterprises outsource at high rates, their coordination of product development along the supply chain is important for their success(Özer,2003:). Interorganizational cost management requires close relationship of the design team and the suppliers of the enterprise at the stage of product development stage. The objective of this relationship is to find much more reasonable cost solutions(Slagmulder,2002: 81) The technique, which lies at the heart of interorganizational cost management system is Target Costing. Many enterprises use target costing and value engineering – functional analysis combination as the primary management method for the purpose of management of costs in the course of product development process. The said two techniques comprises of supply chain through interorganizational cost management systems(Özer,2003).

One of the techniques in case of non-fulfillment of the target cost is the fact that the companies look for producing and/delivering parts to be sold to suppliers at target prices of their own customers while they obtain sufficient profit. In other words to look for ways to converge the current cost structure of the enterprise to target cost. To succeed it, interorganizational cost management can be used as is seen below. When suppliers use the target costs to discipline their own product development processes, two chained companies and an integrated target cost system are obtained. As a result, an interorganizational synergy will be created. Target cost management will be an important component of interorganizational cost management systems on account of the fact that the competition pressure faced by the primary company at the top of the chain is transferred to the other companies within the supply chain(Özer,2003).

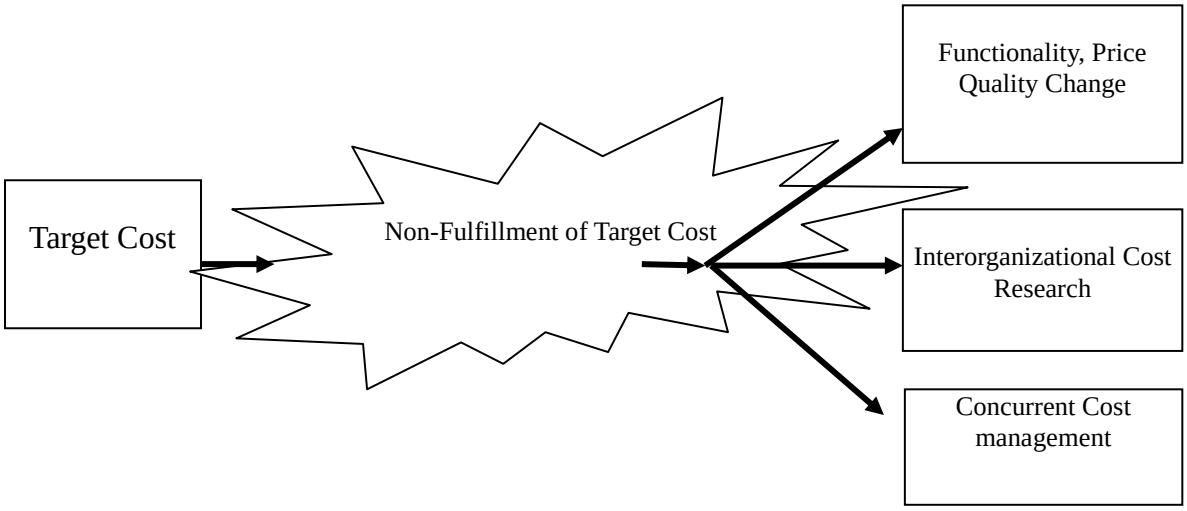

Figure 11: Activation of Interorganizational Cost Management at the Stage of Product Design.
Source: Regina Slagmulder, "Managing Costs across the supply Chain" Book part from Stefan SEURİNG, mARİA goldbach. Cost Management In Supply Chains, Phsica Verlac Pub., New York, 2002 p:81

CONCLUSION

The issue, which makes design stage of products important is that when design of a product is completed and transferred to the production line, after this point, the opportunity to affect costs is limited. Cost of design changes to be made after start of production is higher. For this reason, design should be started by accurate determination of demands obtained from the customer. In competition environment, enterprises have to make production according to the market price in order to present much more reasonable cost products. Therefore target cost has to be included as an input to design stage. An effective cost management has to take into consideration the costs of the future as well. The majority of the life cycle costs are shaped at the stage of design. Production of reliable products with reasonable costs is obligatory in order to attain customer satisfaction. The objective of reliability and cost reduction are two objectives, contradicting with each other. Enterprises have to make product design at an optimum point between the two objectives. One of the most important issues of staying competitive in terms of enterprises is cost management. Efficient implementation of cost management at the design stage will bring competition advantage to enterprises. What is stated in this study is approaches to be implemented concurrently at the stage of design such target costing, functional cost analysis, design to cost, design to manufacture, and design for reliability. Concurrent implementation of these approaches will bring many benefits to the enterprise as "cost efficient product design".

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