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Design to Cost-Imperatives to Industry Today

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Abstract
Product design decides the product cost. While the world markets have opened ways of development of modern manufacturing technologies at a rapid rate like flexible, agile, intelligent, etc, the cost remains the common denominator in all the efforts. The paper discusses the key areas of design to cost and touches on product cost optimization through exploration of content, design optimization manufacturing and purchasing costs. The paper discusses, bench marking needs and highlights why DTC is imperative for industry. The paper also coves cost saving ideas, enterprise networking for costs, life cycle costing and future research areas that will become more significant in future.
Keywords: Competition, operations, Design, Cost, Technical, Functional, Standard, Life Cycle Cost, Customer, Ideas, Systematic, Feedback

Introduction

With growing competition it has become necessary not only to improve overall operation of a company but also do it with focus on cost because this is the single most important factor to combat onslaught of competition.

Design to cost rigorously identifies and captures step change cost improvements through cross functional application of data driven tools to achieve cost transparency. This is done by analyzing the cost structure, product content, review and functional bench marking, design optimization of technical solutions for chosen functionally and product specific purchasing optimization.

The paper discusses the key procedural contents for DTC and identifies the processes of cost built up into the product with special reference to a large Public Service Enterprise.

Why DTC:

In companies where the profitability considerably declines even though sales may go up, offers a great potential for DTC. The figure 1 shows net sales of 3 years moving average which shows a significant rise. With reference to figure 2 which show gross profits as 3 years moving average to decline from year 2000 onwards.

Figure 3 shows technique of prioritization of products. For a given company the steam turbine is placed with high impact whereas its ease of capture of cost for the same is difficult. Similarly fossil boilers are placed with high impact and high ease of cost capture. Thus the approach chosen is through prioritization on the basis of impact, saving potential, business impact, ease of cost capture, design complexity, direct material cost, standardization, organizational support etc.

A company has to select the factors depending on its business profile and may choose impact factors accordingly.

Product cost optimization:

In the first step of a team of personnel connected with the design, manufacturing, technology, purchasing, quality, dispatch etc. is built up and the team set out clear agenda of product cost optimization. In this process it is desired to challenge the content where customer will not notice will not care or will not pay for additional functionality.

In the next step the team should sit together and draw out a plan for design optimization through internal and external competitor product bench marking. The team should also work on complexity reduction through standardization and using standard platforms for design and construction.

Through purchasing the team should fix target for A categories of items for value maximization, revisit to product specifications for cutting down the non required features, adding to cost and challenging the design specification, tolerance and other requirements that might have come in the design of purchased items. The above process has been diagrammatically depicted in figure 4.

It is noteworthy in a typically job order type of products viz turbines generator, transformer etc, the purchasing cost and design cost has a potential saving of 5-10%, which gives ample opportunity to bring down the cost. The objectives here is to rigorously benchmark and challenge all content choices namely designs, shapes, sizes, materials, specifications and prices paid to identify the potential cost saving that can be accrued through DTC process. In fact design to cost principle itself means that after winning the order the cost structure is fragmented into constituent costs and each of the operations has to accomplish the objectives within the defined cost.

On the customer side it is important to identify the functionality and value derivatives and other features

which act as a driver of customer purchase and the customer behaviour to selectivity over and under for understanding process of creating a distinguished brand. The various stages could be initial base product cost, cost optimized through non differentiated competitive products and cost optimized differentiated and distinguished products. The details of such a product become bench marks which are to be further murmured by a company.

Cost Saving Idea:

The key tools in reducing the content where customer will not pay, not notice, not care would be bench marking through customer interviews, customer service analysis and joint analysis of data.

For identifying cost reduction design ideas for in house design and manufactured and purchased products, the key tools would be cost driver analysis, brain storming session, product tear down, simplification, integration and redesign of parts, use of different materials their forms and process, standardization of parts and specification optimization. We all know that radial test piece and longitudinal test piece in a forging give identical test results. It is also know that the longitudinal test piece is quite expensive in terms of extra length to be provided in forging, but companies still continue to specify both. All such areas causing wastages and unnecessary costs need to be identified and addressed.

Working with supplier to reduce price based on improved understanding of cost structure can be achieved by using tools like linear performing pricing, clean sheet cost built up, best of best benchmarking, plant visits and value chain mapping. Suppliers should be exposed for improved solutions for reducing the costs and the purchaser should also pool their knowledge to bring down the costs.

Lean manufacturing and lean assembly process can be used to identify cost saving and improved performance through reduction of waste.

Figure 5 shows DTC saving which have been realized across a variety of industries.

Enterprise Networks

Systemic approach to designing enterprise networks have demonstrated several benefits [1], however it's possible easily in green field projects. In the existing enterprises, the focus as redesigning opens up complexity leading to changes in existing decisions. Frame works should be designed to systematically determine how the design should be changed so that the defined objectives of cost reduction are met with least reconfiguration changes. Whenever a company focuses problems of profitability, they undertake cost reduction programs and reduce research and development expenditures, which is too little or too late, since most of the cost structure in the company is already built and expenditure network has locked in costs which is quite difficult to even visualize.

Even though concurrent engineering have made great strides in integrating design with other functional areas, there are still major gaps in accurate and timely costing information available to designers. This is due to three reasons: (1) the traditional isolation of product designer from the actual cost information located in the accounting database, (2) the lack of suitable tools to provide designer with rapid cost feedback on proposed new parts and products. (3) Theinability to integrate the existing but diverse and heterogeneous data of various functions.

DESIGN TO COST AND ITS RESEARCH AREAS:

Design to Cost (DTC) is a design method which analyses and evaluates the product's life cycle cost (including the manufacturing cost, sales cost, use cost, maintenance cost, recycle cost, etc.) , then modify the design to reduce the life cycle cost. Its characters can be concluded as followed:

1) In tradition, designers attached importance to the other parameters, but not cost. In product design process of DTC, the LCC must bean equivalent parameter as performance, schedule and reliability.
2) Product designers consider reducing product cost in the whole life cycle.
3) DTC need confirming parameters of manufacturing usage, maintenance phases. For example, assembly cost percent unit, usage cost percent unit etc. Designer should balance performance schedule, reliability, LCC and so on.
4) It makes sure that designers and their related personnel communicate and give feedback on cost information in time to each other and to those where it serves useful purpose. The objective is to use some effective methods to control product LCC. The research areas in DTC proposed are the following:

1) Cost features are extracted using LCC analysis. Then LCC database and LCC estimation methods base to be established.
2) In order to provide design information in cost estimation, one must analyze design stages and models and then extract some design features that are related with LCC in different design models.
3) The research and development of software tools in DTC lead to improved design efficiency and design quality. It is important to use DTC software tools in product design process.

4) According to market states, the balance between design and LCC must be found. Under increasingly furious market competition, the lowest product cost is not enough to defeat other competitors. Product must be the best performance/price, namely provide the best functions in the suitable price that can be accepted by the users. Because the price mostly depends on the product cost and product functions are decided by designers, it is essential to balance between design and cost.
5) DTC must be integrated with the other DTC tools, because DTC is based on the whole life cycle. It requires that DTC must harmonize the other DTX (DFM, DFA, etc.) tools to work. Therefore, we should establish an evaluation criterion to do it.

CONCLUSIONS

In the competitive market, manufacturing companies must be able to quickly design, manufacture and deliver products that meet changing consumer demands, and to make a profit on those products. Meeting this challenge must begin at the design stage, when decisions most affects a product's cost. Unfortunately, traditional product development is isolated from cost information at the time of design, so the focus is on a product's features and performance. Introducing accurate cost information into the design process for the use of designing to cost could improve the methods of product design and enhance overall profitability.

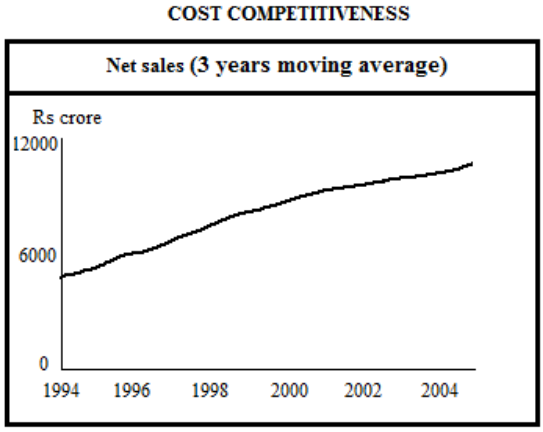

Fig-1 Cost Competitiveness

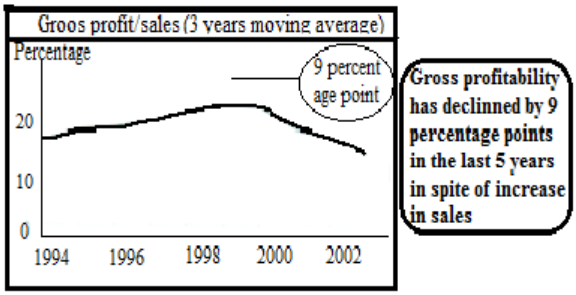

Fig-2 Cost Competitiveness

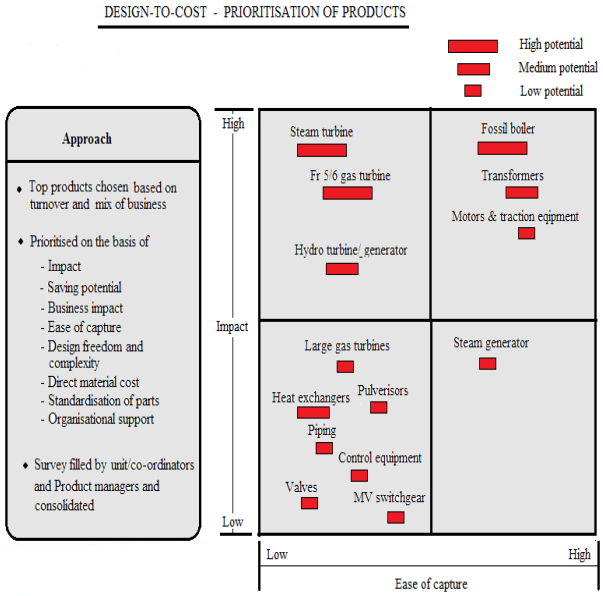

Fig-3 Design to cost- prioritization of products

IDEA SOURCE	DESCRIPTION	KEY TOOL
Content	Reduce product content as customer will not notice and care or will not pay for functionality	• Benchmarking • Customer interviews • Customer surveys
Design	Identify cost-reduction ideas for both designed and purchased parts	• Cost driver identification • Brainstroming sessions • Product cost tear-downs • Simplication/integration/redesign of parts and assemblies • Use of different materials,shapes, functionality and processes • Standardiztion of parts • Specification optimization
Purchasing	Work with vendors to reduce prices based on improved understanding of cost tree	• Linear performance oriented pricing • Clean sheet approach for cost build up • Best-of-Best Benchmarking • Plant visits/verification • Batching/scaling of parts • Value chain mapping
Own Operation	Identify activities/ideas to upgrade manufacturing performance.	• Lean manufacturing/assembly • Plants visits/verifications

Fig-4 Source of cost saving ideas

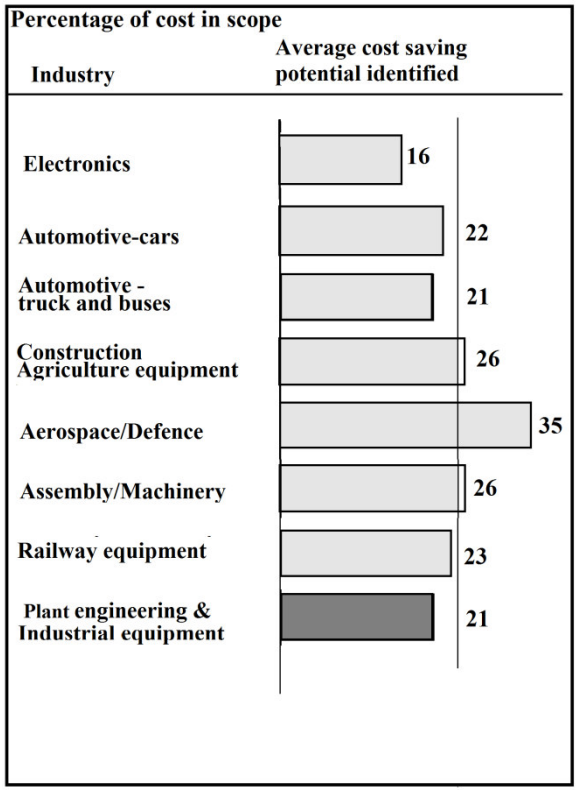

Fig-5 Average cost savings potential identified

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