Target Analysis: Cost, Quality or Both?

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In the increasingly competitive environment of the nineties, considerable attention has been paid to cost and quality issues. Though, traditionally, improvement in quality meant increased costs and was associated with reduced productivity, more recent research treats them as complementary characteristics.

In this article, K R Balachandran and Bin Srinidhi argue that the target analysis approach which combines cost and quality issues in a complementary manner can help achieve the strategic objectives of the firm. Data from NMMC, a subsidiary of Nissan Motor Corporation located in the US, have been used to describe the process of implementation of this approach.

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Growing competition from foreign companies, notably from Japan, has resulted in increased attention being paid to cost and quality issues in the US. The traditional view is that improvements in quality entail increased costs and are generally associated with reduced productivity. However, the more recent thought on the matter, espoused by Deming [1982] among others, treats quality and cost as complementary characteristics. We discuss here the target analysis approach which brings together cost and quality issues in a complementary manner. Target analysis consists of target cost and target quality components which are efficiently put together to achieve the overall strategic objectives of the firm. In contrast, traditional standard costing approach, while emphasizing cost control, fails to explicitly incorporate quality issues. Most of the manufacturing costs are committed during the design stage which occurs early in the life cycle of the product. This early commitment considerably constrains the ability to attain cost reductions during the manufacturing stage. On the other hand, if cost reduction objective is given sufficient emphasis during the conceptual development and design stages, significant cost efficiencies can be realized. The life cycle cost concept has been documented in Berliner and Brimson [1988] and some target costing ideas are given in Kaplan and Atkinson [1989].

An explicit cost minimization objective would seemingly sacrifice quality objectives. A quality maximization objective would apparently sacrifice cost containment. The traditional operations research response to this dilemma would be to approach it as a constrained optimization programme. One could minimize the cost subject to a pre-specified minimum quality level or alternatively, one could maximize quality subject to a maximum cost level. Target analysis views the problem very differently. The assumption of consistent trade-off between cost and quality is questioned. An example would clarify this aspect. Consider a pre-specified quality criterion at the body welding stage of automobile manufacturing. Any pre-specified quality

The authors are grateful to Mr Charles Morello and Mr Norman Bennett of Nissan Motor Manufacturing Corporation, USA, for helping them understand the philosophy and procedures followed at Nissan.
level other than zero would allow some defective parts to enter the subsequent painting and assembly processes. The defective part would be worked on in all the subsequent stages and finally be rejected (or returned by the customer). In this case, relaxing the quality criterion at the welding stage results in unnecessary work and cost at subsequent processes and therefore increases the total cost. In other words, a tougher quality criterion would result in a smaller cost and a lax quality criterion would increase the costs. This is the essential complementary nature of cost and quality which gets exploited in target analysis. In some ways, this is akin to the "satisficing" idea propounded by Simon. At one extreme, the cost and quality criteria are balanced because they conflict with each other. They are balanced initially till the useful complementarity between the two becomes relevant. Once the complementarity becomes relevant, this property is exploited to achieve results in both cost and quality aspects.

This complementarity between cost and quality can also be viewed with a somewhat different perspective. The total long term cost of a product not only includes the manufacturing cost but also the costs of design, development, inspection, rework and the opportunity cost of customer loss due to quality problems. Lower quality increases the future cost to the customer and in the long term, the customer shifts this cost back to the producer by choosing the competitor's products. The total cost including the opportunity cost of customer loss decreases with better quality initially but then enters a stage when it starts increasing. However, as the quality improvement nears zero defect, the total cost starts, falling. This type of cost curve is shown in Figure 1. Given the shape of the curve, the traditional systems choose the point A as the optimal or "acceptable" quality. Target quality systems, on the other hand, strive towards zero defects and achieve point B which, in the long term, result in a reduced total cost.

Target Analysis Procedure

The procedure of target analysis is shown in Figure 2. Target analysis requires the marketing strategists to determine at the conceptual product development stage the performance characteristics of the product as well as the price that the market would bear at that time to achieve the desired market share. From this and the desired mark up, a target cost for the product is computed. An objective in the design of the product is to achieve this overall target cost. The overall design stage also facilitates breaking up the total cost to target costs for the parts and for labour and overhead. The target costing process continues through the parts design by the suppliers all the way back to raw materials.

Target and Standard Costing Approaches: A Comparison

In the traditional standard costing approach, we identify several problems. To illustrate, the mix of resources used, the technology of manufacturing and the design of the product are treated as exogenous.

There have been a number of studies in productivity literature which treat the resource mix as endogenous. These studies examine the issue of the
Figure 2: Target Analysis for a New Product

1. Determine customer requirements and price
   Mark up

2. Target cost
   Target quality

3. Preliminary design - parts list including elimination & substitution
   Accountants and designers involved

4. Parts characteristics

5. Aggregate quality
   > target quality

6. Yes
   Estimated cost for each part

7. Total estimated cost < Target cost

8. Yes
   Target cost for each part

9. Identify suppliers; Discuss and design parts in coordination with suppliers - purchase, designers and suppliers involved

10. No
   Satisfactory?

11. Yes
    Make production plans

relationship between the resource prices and the optimal quantities of the resources. For example, if the price of one of the resources increases relative to others, it may be possible to achieve an overall cost reduction by using less of that resource and more of the others. Standard costing, however, treats the resource quantities and resource prices independently and does not recognize the interdependence. Consequently, the use of standard costing curtails a dynamic movement towards an efficient mix of resources.

Secondly, the technology of manufacturing is assumed to be exogenous in standard costing systems. Standards are set independently for each component. This inhibits transfer of allowable costs among components and in turn, reduces incentives to substitute components that might be more efficient. For example, a longer lasting and maintenance-free battery may entail higher battery costs and yet reduce total costs because it might reduce the cost of connectors. Setting separate standards for the battery and connectors would have prevented such a possibility. In addition, an exogenous treatment of technology eliminates the incentive to continually explore new technological possibilities including the substitution of standard parts for non-standard parts and elimination of parts.

Standard costing also acts as a barrier between the pull effect of customers' desires and the internal design and production processes. If the tastes and expectations of customers change, the standard costing system inhibits a prompt adaptive response.

On the other hand, target analysis does not assume the technology to be exogenous or efficient. In fact, it assumes that there must be some inefficiencies in the technology which need to be eliminated. It is possible to incorporate these concepts in standard costing if the targets can be treated as standards. The targets could be updated (target costs are reduced and target quality is increased) on a continuing basis. It is possible to view target costing system as a refined standard setting process which takes into account the changing market, technology and mix.

Another problem of a traditional standard costing system is that the variances are identified with individuals who have to provide the explanations. This results in an attitude of non-cooperation. For example, the purchase manager can reduce unfavourable price variances by buying inferior quality parts or by changing the supplier at the last moment. Target costing, on the other hand, fosters long term relationships with suppliers and a commitment to quality because the differences between target and actual is not identified with any particular individual, but with the whole team.

**Target Costing and Strategic Considerations**

Target costing has developed as a concept mainly because of the pressure for survival, market share and quality in Japanese corporations. The traditional approach has been to develop products first and then market them at prices which provide enough mark up to help the manufacturer survive. Target costing reverses that approach. Market considerations and price come first. Design of the product and costing are sub-servient to the primary market goals. The same market goals dictate that the maintenance of market share depends to a great extent on quality. Improving the quality of the product involves improving the quality of all the parts used, improving the quality of labour, service and other inputs and having a high quality perspective from the very start. A necessary condition for this to occur is a long term relationship with suppliers, subcontractors and employees. Target costing also requires the same commitment to long term relationships. In this way, the strategic quality considerations and target costing are consistent with each other.

Implementation of a target costing system necessitates good communication among organizational units such as marketing, manufacturing, distribution, purchasing and product design. For example, the product designer needs to incorporate consumer preferences on quality and price. He should also consider in his design the effect of the design on the defect rate in manufacturing. (For example, it may be possible to design the product very well from an engineering viewpoint but at the same time, this design may introduce complexities in manufacturing which will result in more defects and, therefore, increased cost and/or reduced quality.) This increased communication and coordination between departments entails additional cost. It is usually necessary to form teams comprising of employees from different functional specializations to implement target analysis procedures. This teamwork requires members to understand and appreciate other functional areas in the business. In effect, a new management style and philosophy are needed to introduce target analysis in an existing business that is entrenched in standard costing. However, the benefits from implementing a target analysis system generally outweighs these additional costs.
Application of Target Costing in NMMC

NMMC is a manufacturing subsidiary of Nissan Motor Corporation located in Smyrna, Tennessee. Eighty per cent of the subsidiary is owned by Nissan of USA and 20 per cent directly by Nissan in Japan. Nissan of USA is the sole distributor of the vehicles produced in NMMC. Currently, NMMC produces a compact car and a pick up truck in its plants. There are plans for introducing a new product in the future.

NMMC has an employee strength of about 3,100 and has a capacity to produce about 265,000 vehicles annually. It has been operating from 1981 and has been manufacturing both the products from 1985. The vehicles manufactured in NMMC are sold at a transfer price to Nissan of USA. As such NMMC has no marketing or sales decisions to make. The facility has three plants. The Body, Frame and Stamping plant is a highly automated plant which produces the bodies for both the cars and the trucks. The bodies are then moved to a paint shop which is also highly automated. After chemical wash, the case and truck bodies are spray painted by robots. The Trim and Chassis plant where the chassis and the fixtures are assembled is mostly manually operated. In addition, there is a vehicle test track and a training centre.

Organizational Aspects

There is awareness in NMMC that target costing is an important function which requires considerable interaction between accounting personnel, designers, suppliers and operating personnel. In order to accommodate this, a separate coordinating department under accounting is charged with target costing responsibility. This team coordinates with the designers at Nissan Design International at Detroit in the preliminary design stage. They also coordinate with a team of five purchase engineers in the Purchase department. The purchase engineers are in constant contact with the suppliers and are aware of the possible problems which might be faced in the supply stage. These engineers, in turn, coordinate with the suppliers and the designers at the supplier's firms. In effect, there is a matrix organization with a coordinating body for target costing.

Process of Target Costing for New Products

In NMMC, the process of target costing for a new product starts about four years before the scheduled launch date for the product. The target costing process takes place in three phases. Each of these phases is explained in detail below.

Phase 1: Concept based Market Penetration Analysis.
This is the pre design stage in which the marketing team determines the nature of the product to be offered, identifies the market segment and proposes the desired market share. Based on this, they also estimate the approximate price at which the product should sell. In making these estimates, the main inputs used include the known plans of competitors, projected inflation rate as well as the current and projected productivity data. The estimates and projections are made available to the target costing team. The purchase engineers use this data to identify the possible set of suppliers who might be able to supply the parts. Suppliers are selected based on their commitment to quality and JIT philosophy, their ability to design and develop parts for given specifications and their location.

Phase 2: Design. In the design stage, the target costing group works closely with the product designers. For NMMC, the design work is mainly coordinated by Nissan Design International in Detroit. Cost and quality considerations are paramount in designing the product. Efficient use of space and staff are also relevant considerations at the design stage. For instance, if it is possible to achieve the same characteristics required in phase 1 by reducing the number of parts, this would reduce cost, improve quality because of greater simplicity, reduce space because of lower inventory and less handling and reduce staff because of reduced part planning and control work. Substitution of a standardized part for a non-standard one also results in reduced cost, improved quality, lower inventory and reduced staff. The term "target cost" is perceived in NMMC to be a composite of an explicit cost target, a quality target, staff reduction target and space utilization target. Part reduction and standardization, process automation and standardization of the monitoring procedure are the principal tools of target costing at this stage.

The preliminary design also serves to set targets for individual parts, labour and overheads. Decisions are made in consultation with the target costing group on whether to make the part internally, source it from local suppliers or source it from Japan. The suppliers are provided with the relevant aspects of the preliminary design and are given the cost and quality targets. NMMC also helps the suppliers design the parts to meet these targets. The procedure is one of continuous interaction with the supplier rather than giving a purchase order and expecting the supplier to deliver the part.

This procedure is relatively novel for American suppliers and we were told that this phase involves extensive supplier education. Generally, the initial reaction of suppliers to the proposed targets is one of shock and impossibility. However, in most cases, careful ex-
amination of all the alternatives jointly by the suppliers and NMMC generally results in the targets being met.

**Phase 3: Final Coordination and Related Aspects**

Most of the target costing work for the new product would be completed at the design stage. What remains to be done is the consolidation of all the target costs and implementation of a production plan. As the plan is implemented, the costs are compared with the target costs and differences are investigated. In addition, quality targets are also controlled. Vehicles which are manufactured are given quality scores called Vehicle Evaluation Scores (VES). VES represents the number of defects weighted by the severity of the defects. It is displayed on TV monitors installed throughout the manufacturing facility. This serves as a constant reminder of the quality consciousness of the firm. The bonuses of all the personnel in NMMC are dependent on the VES. Individual incentives are discouraged but team incentives based on both the profits and VES are used to promote team effort.

Target costing as practised in NMMC is also closely linked with other systems such as JIT, inter company materials logistics planning (IMLP), cross dock operations, etc. For the inventory, the current target is one day's inventory and for Japanese suppliers, the target is 3.5 days. For most local suppliers, a direct computer link is established for JIT monitoring purposes. A final production schedule is given three months in advance and an estimate of production requirements is given five months in advance. NMMC also coordinates movement with trucks. There have been attempts to move one step further and have lineside feeding by the suppliers. Lineside feeding means that the part is delivered directly to the person using the part at the right time. This saves material handling at the time of receipt and labour involved in moving the item to the proper position for manufacturing. In some cases where the supplier is not equipped to do this, there are truckers who collect the parts from the supplier, maintain some inventory but do lineside feeding to the firm. Some suppliers are also provided with returnable containers. The amount of inventory with the supplier can be at least partially controlled by controlling the number of returnable containers. Needless to say, JIT concept results in reduction of inventory and corresponding reduction in capital tie-up costs. Even more importantly, it frees up space within the facility. As a result, though it is planned to expand capacity in the future, the planned expansion in space is much less. This not only reduces space costs but also improves the working atmosphere by removing the clutter.

At the staff level, direct payment without invoices is being attempted on a pilot basis. Based on the purchase order and receipt, payment can be automatically made obviating the need for invoices, invoice processing and approvals. The internal control aspects of this system are being studied at this time. If implemented, this could result in substantial saving in accounting and related staff costs.

**Differences between Target Costing in Japan and US**

As we have seen, target costing is conceptually related to the philosophy of JIT, zero defect, etc. To the extent that this philosophy is not fully imbibed by the suppliers and other agencies linked with NMMC, the efficiency with which target costing is implemented will be lower than in Japan. To take an illustration, cost targets are based on estimated fully absorbed costs. Fully absorbed costs in NMMC's suppliers are estimated in the traditional way by allocating overheads based on direct labour. The overheads are not logically related to direct labour in most cases. For example, the material handling costs are related to the number of set ups in the schedule more than the direct labour. The costs in support departments such as purchase are related more to the number of parts ordered than on direct labour. The estimated target costs are distorted to the extent that overhead allocation is not properly done. This requires an activity system which is commonly used in Japan but is not as common here.

In a similar vein, the suppliers have to be educated much more on the concept of zero defect here than in Japan where it is the norm. Such education is time consuming and may not be fully effective. This could also affect the efficiency of the target system implemented here vis-a-vis the system under implementation in Japan.

**Conclusion**

In this study, we have presented an introduction to the target costing system and related it to corporate strategy, the standard costing system and other supporting systems and examined the process of implementation of target costing system in NMMC which is an American subsidiary of a Japanese corporation. In the end, we compared the differences between implementing the system in USA and implementing the system in Japan.

We find that even though all the efficiencies realized by Japanese companies in Japan may not be realized, it is still worthwhile to experiment with a target costing system in the interests of enhancing quality in
an increasingly competitive environment. It has to be implemented as part of an overall framework; not as an independent stand alone system. The target costing concept not only requires sustained management support but also a fierce commitment to reducing cost as a strategic response to competitive pressures.

References
