The Use of Target Costing in Developing the Mercedes-Benz M-Class

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EXECUTIVE SUMMARY

- Target costing techniques are important tools for controlling costs in the early stages of product development.
- This article describes how Mercedes-Benz used target costing in the design and production of the M-class, a new sports utility vehicle.
- Mercedes' marketing research showed that customers in this market segment hold established expectations about product characteristics and price levels.
- This marketing information was used to design a vehicle with the characteristics that customers wanted, at a selling price that customers would pay, and that would produce an acceptable level of profitability for investors.

Target costing systems have three major characteristics (Cooper, 1995):

- Targets for price, quality, and function are set in advance.
- Major costs are identified in the design phase.
- The approach is multifunctional.

To develop the M-class, Mercedes used multifunctional teams that included product and process engineers, marketing professionals, and suppliers. The company held focus groups to help define features that potential customers expected to see in a sports utility vehicle from Mercedes.

Target costing was a logical cost management technique for Mercedes to use because the company was designing a completely new vehicle and concurrently constructing a new production facility. As a result, Mercedes could define a significant portion of the produc-

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tion costs that would be incurred before the costs were actually committed.

SUCCESS AT TARGET COSTING

Successful implementation of target costing principles requires managing many interrelated components, including the following (Ansari and Bell, 1997):

- Price-led costing.
- Customer orientation.
- Focus on product and process design.
- Cross-functional teams.
- Life-cycle cost reduction.
- Value chain involvement .

Price-Led Costing

In many industries, pricing has traditionally been a function of cost. Markups, or profit margins, are simply added to the estimated cost of a product to set an initial market price. If customers reject a price determined in this manner, producers have little recourse other than to reduce their margin, though they can also attempt to trim production costs.

Target costing practices treat selling prices and margins as uncontrollable variables, because the markets determine selling prices, and companies must earn adequate margins to remain in business over the long term. Thus, cost is the only variable that can be influenced by management.

Customer Orientation

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Delivering products customers want at a price they are willing to pay is a fundamental premise "of target" costing. Lean enterprises survive by gaining a series of short- term advantages over their competitors in one of three customer-oriented variables (the *survival triplet*) (Cooper, 1995):

- Price.
- Quality.
- Functionality.

Ultimately, consumers determine minimum acceptable standards for quality and functionality, and they define a maximum acceptable market price.

Short-term competitive advantage can be gained by managing the elements of the survival triplet more effectively than does the competition. For example, competitive advantage can be gained if a company can deliver comparable quality and functionality at a price significantly below that of its competitors. Similarly, a company can also gain a competitive advantage by providing greater functionality, higher quality, or both at comparable prices.

Focus on Product and Process Design

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Many production costs derive from decisions made during the design phase. Consequently, cost-reduction efforts should focus on phases before production begins. Mercedes, for example, made decisions early in the product-development process to reduce the level of value-added (or conversion) activities and costs within its planned facility.

Traditionally, purchased components have made up from 55 percent to 60 percent of unit production costs at Mercedes, which means that value-added percentages have ranged from 40 percent to 45 percent. During the product- and process-design phase for the M-class, Mercedes made the strategic decision to rely heavily on systems suppliers. As a result, the value-added percentage in the new plant where the M-class is made is only 20 percent to 25 percent of manufacturing cost.

Cross-Functional Teams

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Life-Cycle Cost Reduction

Because target costing principles are customer-oriented, design decisions should seek to minimize both manufacturing costs and the ownership costs that customers will incur.

Target costing also encourages designers to consider costs that extend beyond the manufacturing stage. Because target costing principles are customer-oriented, design decisions should seek to minimize both manufacturing costs and the ownership costs that customers will incur.

For example, although the Mercedes E300 diesel has a relatively high sticker price, it is the choice of many European cab companies because its maintenance costs are low, and its life commonly exceeds 300,000 miles. Lower operating costs during the a vehicle's useful life and higher resale values are examples of life cycle cost-reduction strategies affected by engineering design choices.

Value Chain Involvement

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BACKGROUND OF THE MERCEDES M-CLASS PROJECT

To explain how Mercedes used target costing techniques in developing the M- class, the following sections discuss each of the ma-

jor target costing characteristics mentioned previously. Also discussed are innovations Mercedes developed, which include various indexes that explicitly link engineering and financial concepts.

Background

In the early 1990s, Mercedes struggled with problems in product development, cost efficiency, material purchasing, and adapting to changing markets. By 1993 Mercedes had experienced its worst sales slump in decades, and it lost money for the first time in its history.

Since that time, Mercedes has streamlined its core business, reduced parts and system complexity, and established simultaneous engineering programs with suppliers.

New Products

In a search for additional market share, new segments, and new niches, Mercedes started developing a range of new products. The new C-class debuted in 1993, the E-class in 1995, the new sportster SLK in 1996, and both the A-class and the M-class All Activity Vehicle in 1997. Perhaps the largest and most radical of all the new projects was the M-class.

In April 1993, Mercedes announced it would build its first passenger vehicle manufacturing facility in the United States. The decision emphasized the company's globalization strategy and desire to move closer to customers and markets. After an intensive, six-month effort to evaluate locations suitable for a new plant costing $300 million, Mercedes chose Tuscaloosa County, Alabama. Annual production at the plant is now about 65,000 vehicles, with North American and export volumes approximately equal.

The M-class project can justifiably be called a radical, high-stake experiment (Woodruff and Miller, 1995). Mercedes had to build a new factory in a new country and also develop a new product for a new market segment. While Japanese manufacturing plants built outside Japan typically copy Japanese factories and models (at least at first), Mercedes simultaneously had to debug a new product, a new manufacturing process, and a new work force. During the early stages of product and process development, the popular press described the Mercedes venture as a prescription for disaster because of the many variables and unknowns involved.

THE M-CLASS PROJECT PHASES

The M-class moved from concept to production relatively quickly. The *concept phase* began in 1992, which led to a feasibility study that the board of directors approved. The project *realization phase* began in 1993. Finally, *production* began in 1997. Key elements of these various phases are described next.

Concept Phase (1992–1993)

The cross-functional team at Mercedes compared the company's existing product line with various market segments in order to find

opportunities to introduce new types of vehicles. The analysis revealed opportunities in the rapidly expanding market for sports utility vehicles, dominated by Jeep, Ford, and GM.

The team conducted market research to estimate potential sales opportunities worldwide for a high-end sports utility vehicle having the characteristics of a Mercedes-Benz. A rough cost estimate was developed that included materials, labor, overhead, and one-time development and project costs. Then cash flows were projected and analyzed over a 10-year period. Net present value (NPV) analysis was used to acquire approval of the project from the board of directors. Because of the capital-intensive nature of the automobile manufacturing industry, estimates of production volume are critical factors in the NPV calculation.

Risks and Opportunities

The sensitivity of the NPV calculation was analyzed by simulating various "what- if" scenarios involving different risks and opportunities. The risk factors that were tested included fluctuations in monetary exchange rate, different sales levels due to consumer substitution of M-class vehicles for other Mercedes products, and product and manufacturing costs that differed from projections.

Based on the economic feasibility study of the concept phase, the board approved the project. The search for manufacturing locations included sites in Germany, other European countries, and the United States. Partly because of Mercedes' globalization strategy, the decisive factor in placing the plant in the United States was the desire to be close to the biggest market for sports utility vehicles.

Project Realization Phase (1993–1996)

The target costing process requires broad, cross-functional activities to acquire market information necessary to develop a new vehicle. Mercedes used customer focus groups to obtain this information. The company held regular customer clinics to explain the new vehicle concept and to view the prototype. These clinics elicited important information about how the proposed vehicle would be received by potential customers and the press. Customers were asked to rank the importance of various characteristics including safety, comfort, economy, and styling. Engineers organized in function groups designed systems to deliver these essential characteristics.

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Furthermore, Mercedes would not lower its internal standards for components, even if initial customer expectations were lower than the Mercedes standard. For example, many automotive experts believe the handling of Mercedes products results from manufacturing a world-class chassis. Thus, each new class within the Mercedes line must meet strict standards for handling, even though these standards may actually exceed customer expectations for some classes.

Mercedes did not use target costing to produce the lowest-priced vehicle in an automotive class. Rather, the company's strategic objective was to deliver products that were slightly more expensive

than competitive models but with a greater perceived value on the part of the customer.

Goal-Oriented Approach

Another difference between Mercedes' and other companies' use of target costing lies in the goal-oriented approach to achieving target cost. Cooper cites examples of Japanese companies that strive in a single-minded effort to achieve a static target cost. In contrast, the M-class (and M-class target cost) remained alive throughout the product realization phase because of changing dynamics.

Mercedes found it beneficial to place the design and testing team members in close physical proximity to other functions within the project to promote fast communication and decision making. In this way the company was able to respond quickly to changing conditions. For example, while the vehicle was under development, the market moved toward the luxury end of the spectrum. Crash test results were also incorporated into the evolving M-class design. In addition, Mercedes developed new technical features such as side air bags. (The decision to include this new feature on all Mercedes lines was made at the corporate level because experience has shown that customers' reactions to a vehicle class can affect the entire brand.)

As demonstrated above, Mercedes recognized the importance of flexibility in setting and achieving target costs.

Production Phase 1997–Present

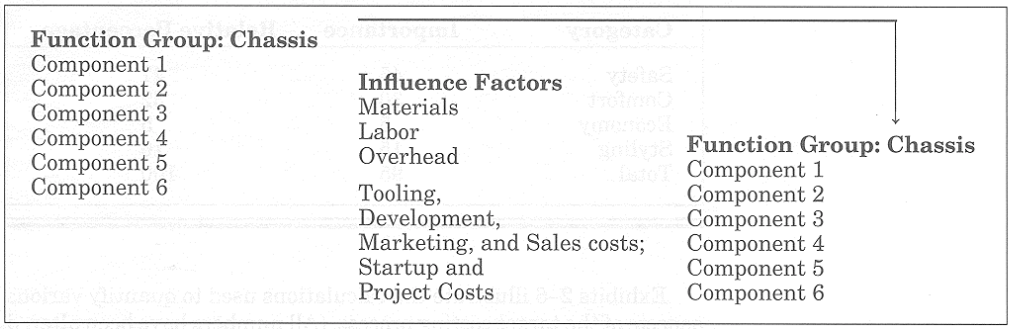
The M-class project was monitored by annual updates of the net present value (NPV) analysis. In addition, a three-year plan (including income statements) was prepared annually and reported to the headquarters in Germany. Monthly departmental meetings were held to discuss actual cost performance compared with standards developed during the cost estimation process. Thus, the accounting system served as a control mechanism to ensure actual production costs conformed to target (or standard) costs.

TARGET COSTING AND THE M-CLASS

The target costing process was led by cost planners who were engineers, not accountants. Because the cost planners were engineers with manufacturing and design experience, they could make reasonable estimates of costs that suppliers would incur in providing various systems. Also, Mercedes already owned much of the tooling, such as dies to form sheet metal, used by suppliers to produce components. Tooling costs are a substantial part of the one-time costs in the project phase.

Mercedes divided the vehicle into function groups that included doors, sidewall and roof, electrical system, bumpers, powertrain, seats, heating system, cockpit, and front end. As shown in Exhibit 1, the process of achieving target cost for the M-class began with an estimate of the existing cost for each function group. Next, components of each function group were identified with their associated

Exhibit 1. Function Groups of the Mercedes-Benz M-Class Sport Utility Vehicle



costs. Team members set cost reduction targets by comparing the estimated existing cost with the target cost for each function group. Finally, cost reduction targets were established for each component. As part of the competitive benchmarking process, Mercedes purchased and disassembled competitors' vehicles to help understand costs and manufacturing processes within the competitor's manufacturing plant.

A modular construction process that relied on high-value-added systems suppliers was used to produce the M-class. Advantages of this process include higher quality, shorter development time, and greater cost efficiency. First-tier suppliers provide entire systems rather than individual parts or components. For example, the entire cockpit was purchased as a unit from an external vendor.

Systems suppliers were part of the development process from the beginning of the project. Approximately 70 suppliers worked with teams from finance and controlling, engineering, purchasing, marketing, sales, logistics, and quality control to ensure the delivery of systems that meet expectations. Mercedes expected suppliers to meet established cost targets. To enhance function group effectiveness, suppliers were brought into the discussion at an early stage in the process.

In the final stage of analysis, the value of each function group is compared with its cost. Thus, engineers can assess cost/benefit relationships during the design phase.

Index Development to Support Target Costing

During the concept development phase, Mercedes team members used various indexes to help determine critical performance, design, and cost relationships for the M-class. The purpose of the indexes is to ensure that resources are applied in the most effective manner. An importance index is created by conceptually linking the contribution of each major function group to an attribute desired by a customer. In the final stage of analysis, the value of each function group is compared with its cost. Thus, engineers can assess cost/benefit relationships during the design phase.

Exhibit 2. Relative Importance Ranking by Category

Category	Importance	Relative Percentage
Safety	45	47
Comfort	30	32
Economy	5	5
Styling	15	16
Total	95	100

Exhibits 2–6 illustrate the calculations used to quantify various aspects of the target costing process. (All numbers have been altered for proprietary reasons; however, the tables illustrate the actual process used in the development of the M-class.) To construct the indexes, various forms of information were gathered from customers, suppliers, and the M-class design team. Though the actual number of categories used by Mercedes was much greater, Exhibit 2 illustrates the calculations used to quantify customer responses to the M-class concept. For example, values shown in the importance column of Exhibit 2 resulted from asking a sample of potential customers whether they consider each category important when contemplating the purchase of a new Mercedes product. Individuals could respond affirmatively to all categories that applied.

Target Costs for Functions

To gain a better understanding of the various sources of costs, function groups were identified together with their target cost estimates. Exhibit 3 shows the function groups, the target cost for each, and what percentage of the total cost each represents. The target cost percentage is used in the calculation of a target cost index.

Exhibit 4 summarizes how each function group contributes to the consumer requirements identified in Exhibit 2. The rows explain the relative importance of each function group to satisfying each category defined by customers. An interesting aspect of this table is that it makes explicit the link between consumer preferences and engineering components. For example, a large proportion of potential customers identified safety as the most important characteristic of the M-class; some function groups contributed more to safety than others. Mercedes engineers determined that chassis quality was an important element of safety (60 percent of the total function group contribution in this example).

Exhibit 5 combines the category weighting percentages from Exhibit 2 with the function group contribution from Exhibit 4. The key point is to understand which function groups contribute the most (least) to important (less important) consumer categories. The result is an importance index that measures the relative importance of

Exhibit 3. Target Cost and Percentage by Function Group

Function Group	Target Cost	Percentage of Total
Chassis	$x,xxx	25
Transmission	$x,xxx	20
Air conditioner	$x,xxx	8
Electrical system	$x,xxx	15
Other function groups	$x,xxx	32
Total	$xx,xxx	100

each function group across all categories. For example, potential customers weighted the categories of safety, comfort, economy, and styling as .47, .32, .05, and .16, respectively. The rows in Exhibit 5 represent the contribution of each function group to the various categories. The importance index for the chassis is calculated by multiplying each row value by its corresponding category value and summing the results: (.47 × .60) + (.32 × .20) + (.05 × .05) + (.16 × .05) = .36.

As shown in Exhibit 6, the target cost index is calculated by dividing the importance index by the target cost percentage by function group. Managers at Mercedes used indexes such as these during the concept design phase to understand the relationship of the *importance* of a function group to the *target cost* of a function group. Indexes less than one may indicate a cost in excess of the perceived value of the function group. Choices made during the project realization phase were largely irreversible during the production phase because approximately 80 percent of the production cost of the M-class represented materials and systems provided by external suppliers. Thus, opportunities for cost reduction, known as value engineering, are best identified and managed during the early stages of product development.

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VALUE ENGINEERING

Having established a target cost index, value engineering techniques may be applied to align target cost and perceived value. As defined by Cooper (1995), value engineering is the systematic, interdisciplinary examination of factors affecting cost to devise a means of achieving cost, quality, and functionality at the target cost.

Opportunities for cost reduction, known as value engineering, are best identified and managed during the early stages of product development.

Many value engineering techniques are available. For example, purchasing, disassembling, and analyzing competitors' products provide insights into manufacturing processes and costs. This technique often is used as part of a competitive benchmarking program. Redesigning production processes and key components involves the cross-functional analysis of each component within a function group. Cooper describes how camera manufacturers may substitute a plastic lens for a glass lens to reduce costs when designing a new product. Supplier involvement early in the design phase can create oppor-

Exhibit 4. Function Group Contribution to Customer Requirements

Category– Function Group	Safety	Comfort	Economy	Styling
Chassis	60%	20%	5%	5%
Transmission	20	30	30	
Air conditioner		20		5
Electrical system	5	5	25	
Other systems	15	25	40	90
Total	100%	100%	100%	100%

Exhibit 5. Importance Index of Various Function Groups

Category–Function Group	Safety .47	Comfort .32	Economy .05	Styling .16	Importance Index
Chassis	.60	.20	.05	.05	.36
Transmission	.20	.30	.30		.21
Air conditioner		.20		.05	.07
Electrical system	.05	.05	.25		.05
Other systems	.15	. 25	.40	.90	.31
Total	1.00	1.00	1.00	1.00	

Exhibit 6. Target Cost Index

Index–Function Group	(A) Importance Index	(B) % of Target Cost	(C) A/B Target Cost Index
Chassis	.36	.25	1.44
Transmission	.21	.20	1.05
Air conditioner	.07	.08	.87
Electrical system	.05	.15	.33
Other systems	.31	.32	.97
Total		1.00	

tunities for cost reduction, such as recycling reusable materials or adjusting tolerances where feasible.

SUMMARY

The Mercedes organization produced an entirely new vehicle from concept to production in four years, on time, and within budget. Mercedes launched the M-class in September 1997 in the United States market; the export market launch occurred in March 1998. The production facility originally constructed to produce 65,000 M-

class vehicles annually is currently being expanded to permit annual production of 80,000 vehicles.

The M-class project used a streamlined management structure in order to facilitate efficient and rapid development. Target costing proved to be a key management element in the success of this venture.

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