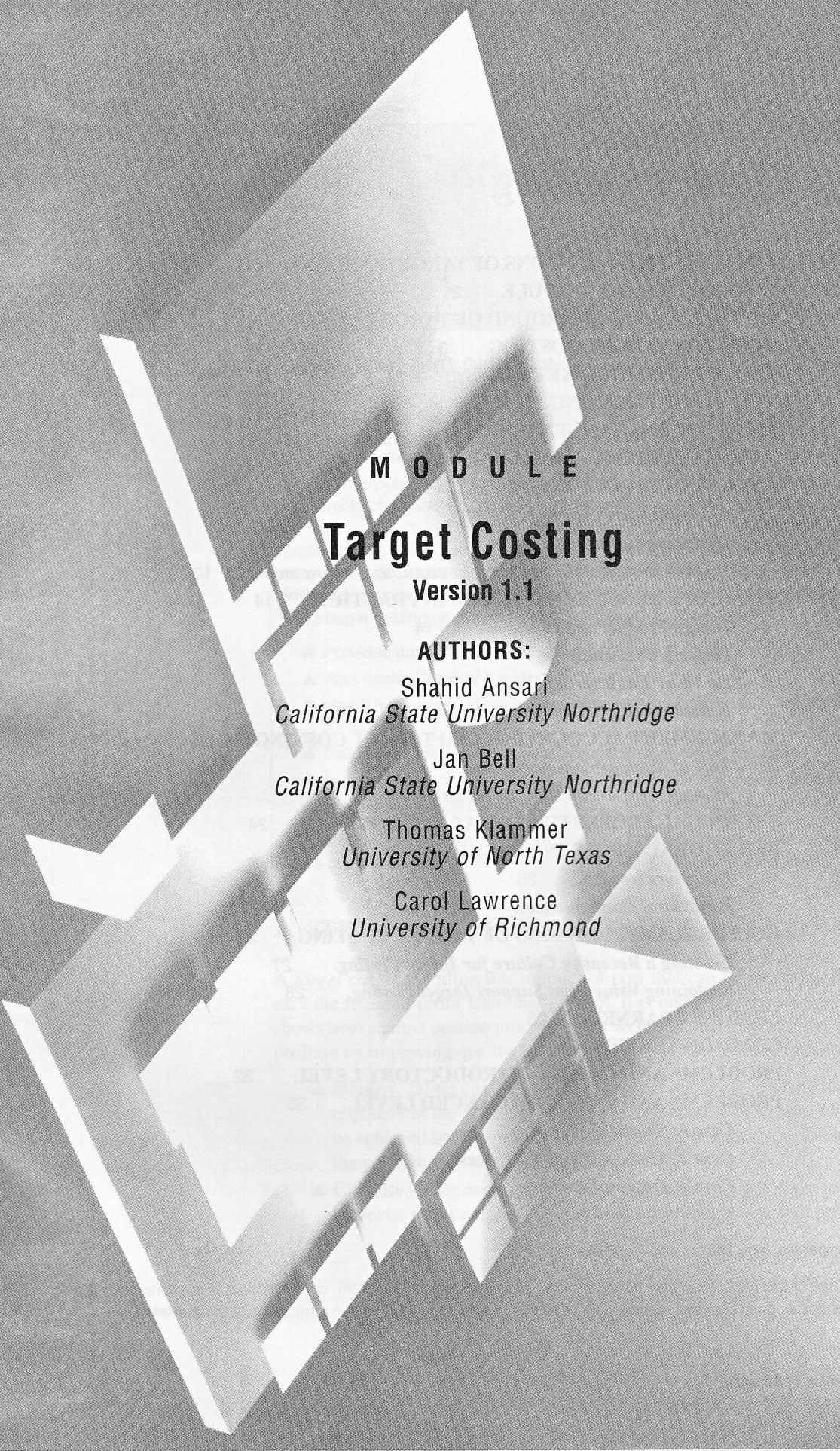

MODULE

Target Costing

Version 1.1

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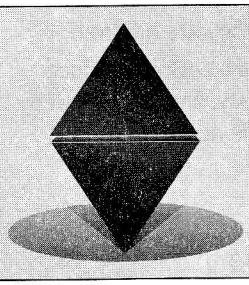


Target Costing*

TARGET COSTING GLOWS WITH THE "NEON"

In 1990 Chrysler Corporation found itself in a very unhappy financial situation. Profits were down, cash flow was tight, and the stock was trading at a low price of $10 per share. The Japanese auto industry posed a serious threat. Despite a strong Yen, they had captured and continued to preserve a healthy share of the U.S. auto market. Chrysler management decided it was time to change their approach to new car design. They adopted a competitive weapon that the Japanese auto industry had used for many years called target costing. Target costing was applied to all product development efforts in the Company including the NEON, a new small car developed for the lower price range. A price and profit target was set for the car and it was then designed to meet that profit without sacrificing major customer requirements. The results of using target costing on the NEON were impressive. The NEON:

- ▲ Provided dual airbags and a powerful engine for a small car.
- ▲ Was named "Auto of the Year" in 1994.
- ▲ Had a relatively short development time going from product concept to market in 31 months.
- ▲ Came in below its project development and investment budget.
- ▲ Is one of a handful of small cars made in the USA that makes a positive return.
- ▲ Is environmentally friendly built using a recyclable facia and non-toxic materials.

Since the introduction of target costing, Chrysler's profits have increased significantly. Its share price went up from $10 per share in 1990 to $54 per share in 1995.

▲ STRATEGIC IMPLICATIONS OF TARGET COSTING

A *target cost* is the allowable amount of cost that can be incurred on a product and still earn the required profit from that product. It is market driven costing. The Chrysler story shows how a target costing process, when well executed, can improve a firm's competitive position by improving quality, reducing costs, and accelerating the time to market.

- ▲ **Quality.** Target costing improves product quality by making it an explicit objective of the product development and costing processes. Cost targets *cannot* be achieved by compromising the features that a customer desires or by reducing the performance or reliability of a product.
- ▲ **Cost.** Reducing costs is at the heart of target costing. Unlike traditional methods, however, target costing does not wait for production to start before managing

* This module is based on material developed jointly with the Consortium for Advanced Manufacturing (CAM-I). The complete work is contained in book form in S. Ansari, J. Bell and The CAM-I Target Cost Core Group, *Target Costing: The Next Frontier in Strategic Cost Management,* Irwin Professional Publishing, 1996.

costs. It makes cost planning a part of profit planning and uses an intelligent, customer-focused design process to manage costs before they are incurred.

▲ **Time.** Target costing reduces the time from concept to marketing of products because products and processes are designed simultaneously. No time is lost in trying to determine how to manufacture a product after it is designed or in correcting design errors.

▲ PURPOSE OF THIS MODULE

This module explains the use of target costing as a strategic profit planning and cost management tool. We will identify its key principles, contrast it with traditional cost management tools, show the critical steps in the process, and demonstrate its functioning in practice. After you study this module, you will understand:

- ▲ A brief history and background of target costing.
- ▲ The need for target costing.
- ▲ The key ideas underlying target costing.
- ▲ A description of the target costing process.
- ▲ How to attain target costs for products.
- ▲ How cost reduction occurs in practice.
- ▲ The management accounting implications of target costing.
- ▲ The technical, behavioral, and cultural implications of target costing.

▲ HISTORY AND BACKGROUND OF TARGET COSTING

Target costing originated in Japan in the 1960s. As it did with quality, Japanese industry took a simple American idea called *value engineering* and transformed it into a dynamic cost reduction and profit-planning system. Value engineering originated at General Electric during World War II. It was an organized engineering approach to determining how to produce products in the face of parts' shortages. The practice was instituted to design products that could do more with fewer parts. Later it became an organized effort to examine how to provide the needed features or functions in a product at the lowest possible cost.

U.S. industry did not realize the potential of value engineering as a systematic profit and cost planning tool and did little with it after World War II. Japanese industry expanded the basic concepts of value engineering into the target-costing process. Today more than 80 percent of all assembly industries in Japan, such as automobiles, electronics, consumer appliances, and machine tools and dyes, use target costing.[1] Naturally, some of the best practitioners of target costing are leading Japanese companies such as Toyota, Nissan, Sony, Matsushita, Nippon Denso, Daihatsu, Cannon, NEC, Olympus, Komatsu, and many others.

In the United States, target costing has been used only since the late 1980s. The loss of market share to Japanese companies, as in Chrysler's case, has been a major motivation for adopting target costing. Adoption of target costing in the United States remains slow for several reasons. Some managers fail to appreciate its strategic importance. Others mistake

[1] See Y. Kato. "Target Costing Support Systems: Lessons from Leading Japanese Companies," *Management Accounting Research 4,* 1993, pp. 33–47. Also see T. Tani, H. Okano, N. Shimizu, Y. Iwabuchi, J. Fukuda, and S. Cooray. "Target Cost Management in Japanese Companies," *Management Accounting Research 5,* 1994, pp. 67–81.

it for a narrow cost reduction technique and confuse the simplicity of its ideas for a simplistic process. Still others use some elements of target costing but mistakenly think they have adopted the entire process.

▲ NEED FOR TARGET COSTING

What makes target costing so important today? The answer lies in the nature of the contemporary industrial environment. Today businesses face a global environment that has four characteristics. It is:

- ▲ **C**ompetitive, because prices cannot be increased in many key industries. Many new producers, some with a lower cost of doing business, have entered the global marketplace.
- ▲ **R**apidly changing, because the dissemination of technology and knowledge has accelerated considerably. This faster pace makes it difficult to use any one factor, such as quality, for a long-lasting competitive advantage.
- ▲ **U**nforgiving of mistakes or delays, since shorter product lives leave little time to respond to changes in the marketplace or to recover from mistakes.
- ▲ **D**emanding, because sophisticated consumers have knowledge of many products and want better quality products at an affordable price. It is difficult to sell inferior products with reduced features at a lower price.

In short, the environment is dealing a **CRUD** hand. Target costing responds by coming up with **ACES**. Target costing is a process that:

- ▲ **A**nticipates costs before they are incurred.
- ▲ **C**ontinually improves product and process designs.
- ▲ **E**xternally focuses on customer requirements and competitive threats.
- ▲ **S**ystematically links an organization to its suppliers, dealers, customers, and recyclers in a cohesive and integrated profit and cost planning system.

▲ TARGET COSTING—KEY IDEAS

Achieving target costs requires a formal process. The most comprehensive definition of the **target costing process** comes from the Consortium for Advanced Manufacturing International (CAM-I):

> Target costing is a system of profit planning and cost management that is *price led, customer focused, design centered* and *cross functional.* Target costing initiates cost management at the earliest stages of product development and applies it throughout the product *life cycle* by actively involving the entire *value chain.*[2]

The *purpose* of target costing is to ensure adequate profits by undertaking simultaneous profit and cost planning. The CAM-I definition contains six key ideas that provide the conceptual foundations for target costing. Each of these six foundations is explained below.

1. **Price led costing** means that target costs are established by first determining a competitive market price and then subtracting the required profit margin from it. This is summarized in the equation:

[2] S. Ansari, et al. *Target Costing—The Next Strategic Frontier,* Irwin, 1996.

$C = P - \pi$

where

C = Target cost
P = Competitive market price
π = Target profit

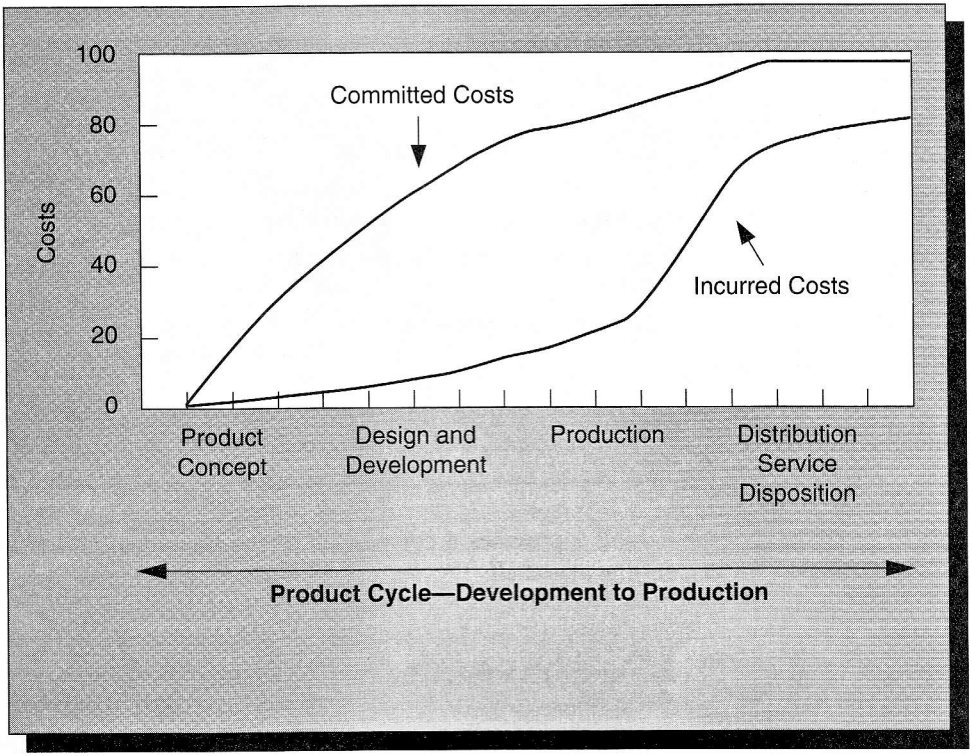
In target costing, market price is the independent variable; costs allowed for designing, manufacturing, marketing, and other functions (the target costs) are dependent on the market price.

For example, if the competitive price for a product is $100, and the company requires a 15 percent profit margin, then the target cost for this product is set at $85 (100−15).

2. **Customer driven** means that customer requirements about product quality, price, and timeliness guide cost analysis. It is essential to understand what quality features and timeliness customers expect at a given market price and what competition is currently doing or might do to respond to a company's product offerings. The target cost must not only yield the target profit but also allow the manufacturer to match competitive product dimensions. The target cost cannot be attained by sacrificing the features that customers want, lowering the performance or reliability of the product, or delaying its introduction in the marketplace.
3. **Design** of product and processes is the key to cost reduction efforts. Target cost systems design products and their manufacturing and delivery processes simultaneously. This is sometimes called *concurrent engineering.* Traditional cost reduction methods focus on production efficiencies such as waste reduction or buying in quantity to reduce cost. This is not the prime focus of target costing. Target costing focuses on product design because most costs, nearly 70–80 percent, are *committed* at the design stage, while only 10–20 percent of the costs are *incurred* at this stage. Exhibit 1 shows the typical relationship between committed and incurred product costs. As depicted there, the majority of the costs are committed at the design stage, while the majority of costs are incurred after production starts. The best opportunity to manage costs is while a product is still in design. Concurrent engineering design eliminates costly features and minimizes the need for engineering changes after production begins.
4. **Cross-functional product teams** with members representing design and manufacturing engineering, sales and marketing, material procurement, cost accounting, service, and support typically are jointly responsible for attaining target costs. The teams also include outside participants such as suppliers, customers, dealers, and recyclers. The teams are responsible for a product from initial concept through production. *A cross-functional team is not a set of specialists who contribute their expertise and leave. They are responsible for the entire product!* A good example of product team participation occurred during the development of Chrysler's Neon. During the development of this car, the financial analysts assigned to the team had to travel to Nova Scotia in the winter to observe crash testing.[3]
5. **Life cycle costing** considers all costs of owning a product over its life, such as purchase price, operating costs, maintenance and repairs, and disposition costs. Life cycle costing's goal is to minimize the *cost of ownership* to a customer. For

[3] The idea of having accountants participate in crash testing is to make them understand how the product works, take ownership of the product, and appreciate the impact of their recommendations on a product's performance. It is certainly not because they need an extra dummy for crash testing.

Exhibit 1
Typical Product Cost Curves



example, when a customer owns a refrigerator, he or she pays more than the initial purchase price. The customer must pay for electricity (operating cost), repairs, and any final disposition cost of removing the refrigerator at the end of its useful life.[4] From a producer's point of view, life cycle costing means *designing products that minimize all costs* from birth (R&D) to death (disposition or recycling costs). In the case of the refrigerator, a design that reduces weight, locates parts so that they are easy to access during repairs, and uses remanufacturable material will decrease delivery, installation, repair, and disposition costs.

6. **Value chain** members such as suppliers, dealers, and service and support personnel are part of the target costing process and help to focus cost reduction efforts throughout the value chain. Target costing systems involve an active and collaborative relationship in which cost-reduction techniques are shared by all members of this extended enterprise. A target costing system is based on long term, mutually beneficial relationships with suppliers and other members of the value chain such as distributors and recyclers.

These six features distinguish target costing from traditional cost-plus systems. Traditional cost-plus systems typically start with costs and then add a profit margin to obtain a market price. If the market is unwilling to pay the price, the firm tries to find cost reductions. Target costing starts with a market price and a planned profit margin for a product and establishes an *allowable cost* for the product. Product and process design are used thereafter to reduce product cost so it is equal to this allowable cost.

[4] The costs of disposition can be very significant for products that have an adverse environmental impact.

Exhibit 2
Comparison of Target Costing and Cost-Plus Approaches

Target Costing	*Cost-Plus*
Competitive market considerations drive cost planning.	Market considerations are not part of cost planning.
Prices determine costs.	Costs determine price.
Design is key to cost reduction.	Waste and inefficiency are focuses of cost reduction efforts.
Customer input guides cost reduction.	Cost reduction is not customer driven.
Uses cross-functional teams to manage costs.	Cost accountants are responsible for cost reduction.
Suppliers involved early.	Suppliers involved after product designed.
Minimizes cost of ownership to customer.	Minimizes initial price paid by customer.
Involves the value chain in cost planning.	Little or no involvement of the value chain in cost planning.

Exhibit 2 provides a comparison of the traditional cost-plus approach with the target costing approach.

▲ THE TARGET COSTING PROCESS

Since target costing relies on design for cost reduction, it is applied primarily to new product development efforts. Most products are developed in four stages:

1. *Product planning,* during which a product and customer niche are defined.
2. *Concept development and feasibility testing,* during which a product concept is developed and its feasibility is tested.
3. *Design development,* during which a feasible concept is turned into a detailed product design.
4. *Production*, which occurs after a final design is released.

Target costing occurs in two phases that correspond *roughly* to the first and second halves of this product development cycle. They are called the **establishment phase** and the **attainment phase** of target costing. The establishment phase occurs during the product planning and concept development stages of the product development cycle and involves establishing a target cost. The attainment phase occurs during the design development and production stages of the cycle and involves achieving a target cost. The relationship of target costing to the product development cycle is shown in Exhibit 3.

▲ ESTABLISHING TARGET COSTS

Target costs are established within the parameters defined by a firm's product strategy and long-term profit plans. These plans define new markets, customers, and products that a company plans to pursue. Product concepts aimed at specific customers are tested for feasibility and then target costs are set for feasible products. Exhibit 4 provides an overview

Exhibit 3
Target Costing and the Product Development Cycle

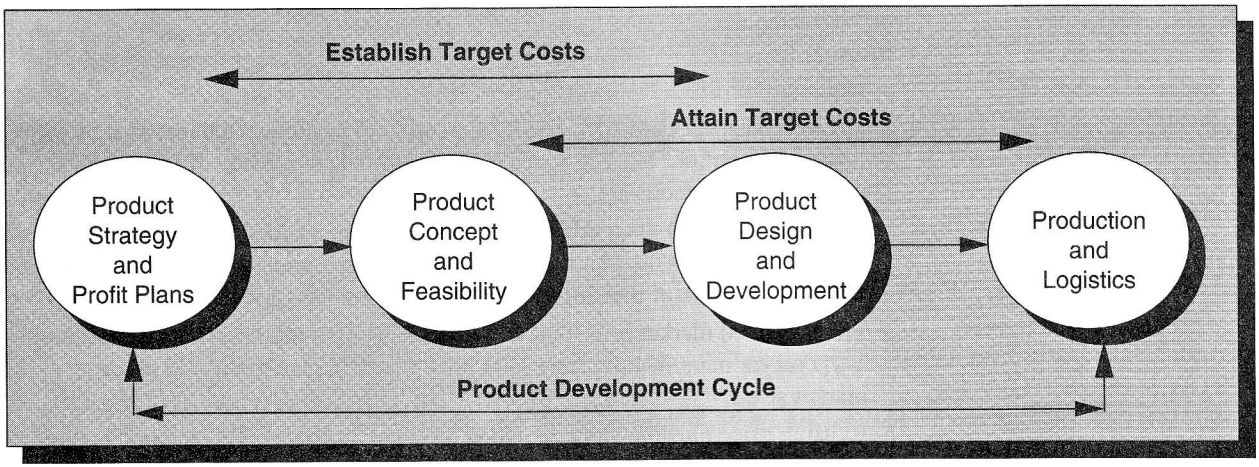
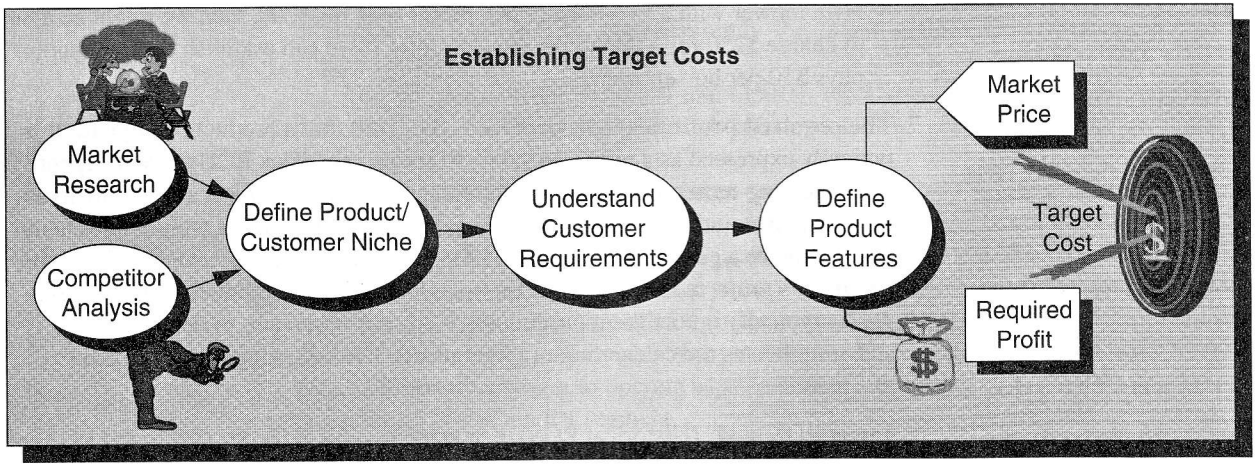


Exhibit 4
The Establishment Phase of Target Costing



of the establishment phase of target costing. It shows that there are seven major activities that must be performed to establish target costs.

1. **Market research** gains information about unmet needs and wants of customers. This research defines the market and/or product niche that a company plans to exploit. Typically, a market niche is a broadly defined class of customers such as "health-conscious eaters" or "upwardly mobile professionals."
2. **Competitor analysis** determines what competitors' products are currently available to our target customers, how the customers evaluate these other products, and how our competitors might react to our company's new product introductions.
3. **A customer or product niche** is defined by analyzing market and competitor information to decide what particular customer segment to target. A customer niche is a more specifically defined customer, such as "young, professional, two-income family between the ages of 30 and 45."

4. **Customer requirements** are determined by introducing an initial product concept and asking customers for their reactions. Preliminary designs are then refined, based on continued input from customers, until the product meets their requirements.
5. **Product features** are defined by setting specific requirements for the features the product will have and the levels of performance of each feature.
6. **A market price** is established that is acceptable to customers and capable of withstanding competition. Market prices can be established in many different ways. Three common methods are:
   a. Existing price plus the market value of new features added. For example, if a new car model has dual air bags, we might take the price of the previous model and add the value of the air bags to determine the new price.
   b. The projected market price that will provide a target market share. For example, a CD player manufacturer may set a price that will give them a 25 percent market share.
   c. Existing price plus the value of added physical attributes. This method is typically used for products for which a customer's desired performance is captured by some physical characteristic of the product. A good example is a lawn mower. A customer's performance requirement for how fast and close the lawn mower cuts the grass is closely related to the engine horsepower. Therefore, if a lawn mower with a two-horsepower motor sells for $200, then we might be able to charge $250 for a three-horsepower motor if we can establish that the market pays $50 per horsepower.
7. **The required profit target** is set. This is the profit that a product must yield. It is typically expressed as a return on sales (ROS) percent. This ROS percent depends upon the long-term profit plans and the financial return on assets a company must earn in a given industry. A common practice in Japan is to use a weighting scheme that combines a company's *historical* ROS with the average *industry* ROS and the company's *projected* ROS to yield the required ROS for a product. Japanese companies typically ignore the return on assets since it is difficult to determine and complicates the calculation of target profit. The following formula reflects this practice:[5]

   $$\text{Target ROS} = w_1 (\text{Historical ROS}) + w_2 (\text{Industry ROS}) + w_3 (\text{Projected ROS})$$

   where

   $$w_1 + w_2 + w_3 = 1$$

For example, assume that the historical ROS of a TV manufacturer has averaged 12 percent. Further assume that the industry average is 10 percent and that this manufacturer plans to increase their ROS to 15 percent in the next few years. Their target ROS for this year's TV production may be:

$$(30\% \times 12\%) + (20\% \times 10\%) + (50\% \times 15\%) = 13.1\%$$

In this example, notice that 50 percent of the weight is placed on the future ROS, and the remaining weight is divided between past (30 percent) and the industry's average (20 percent). As time passes, the weights assigned to past experience and to the industry ROS

[5] Yasuhiro Monden. *Target Costing and Kaizen Costing,* Productivity Press, 1995, p. 40.

are designed to go to zero. Only the projected ROS becomes the key variable in determining a product's target ROS.[6]

It is important to note that profits, prices, and market shares are targets to be achieved and not simply desires of management or probabilistic estimates about future states of these variables. Target costing is, therefore, an action plan requiring commitment by organizational members.

▲ TARGET COSTING—AN ILLUSTRATION

We will illustrate the key activities at each stage of the target costing process with the help of a hypothetical company, Kitchenhelp, Inc.

Kitchenhelp is a manufacturer of small kitchen appliances such as toasters, coffeemakers, grinders, blenders, juicers, electric carving knives, can openers, and other items. Competition is tough; several other major brand names on the market include Mr. Coffee, Moulinex, Braun, Krups, Sharp, and Toshiba. The company is looking for market opportunities to exploit in their various products. One such product is their coffeemaker line. Currently, Kitchenhelp makes a conventional drip coffeemaker and an espresso/cappuccino maker. How can the company apply the target costing steps in Exhibit 4 to its coffeemaker line?

You will recall from Exhibit 4 that the first three steps in target costing require that the company conduct market research and competitive analysis in order to define a market niche.

Assume that Kitchenhelp's market research and analysis show that there is an upwardly mobile, college educated consumer who is interested in more gourmet types of food at home. The company decides to go after this "home gourmet" market niche. Further market research results in the discovery that one area in which the home gourmet market niche can be exploited is through its coffeemaker line. Kitchenhelp has determined that there is a market for a coffeemaker that provides espresso quality coffee but is not as complex and time-consuming to operate as an espresso/cappuccino maker. There is also little competition in this market segment.

Kitchenhelp must form a cross-functional team to come up with an initial product concept and to test its feasibility. Assume that Kitchenhelp's product team proposes an initial product concept that combines a coffee grinder and a drip system into a single coffeemaker. The new design will grind fresh coffee beans and push extra hot water through the grinder basket to make regular coffee smell and taste more like espresso.

If this type of coffeemaker is technically and financially feasible, then the next steps for the product team are to understand customer requirements and define product features.

Market research aimed at coffee-drinking consumers is needed to better understand customer requirements. Assume that, based on surveys and focus groups, Kitchenhelp has identified eight features important to customers. These are:

---

[6] When a company produces a mix of products, the ROS for a product line is the weighted average of the ROS assigned to individual products in that line. Profit simulations are typically used to determine the optimal mix and ROS distribution for the product line. The topic is too broad to be discussed here. It is the subject of a separate module on strategic profit planning.

▲ Coffee tastes and smells like espresso.

▲ The unit is easy to take apart and clean.

▲ Capacity is at least six cups.

▲ Coffeemaker looks nice.

▲ Unit has a clock timer to start automatically at designated time.

▲ Grinder performs well with different kinds of coffee beans.

▲ Coffeemaker keeps the coffee warm after making it.

▲ Unit automatically shuts off after a designated time period.

These customer requirements become the basis for the engineering design of the coffeemaker. Engineers must ensure that the product encompasses all the features that are important to customers. This initial set of features becomes the first product definition for design purposes. The product team now must convert this customer input into a more precise product definition. For the proposed coffeemaker, the product definition will include specific items such as an eight-cup coffee carafe, grinder size, blade rotation speeds, size and shape of coffeemaker, the heating unit size, the water heater specifications, and so on. A product definition is typically in the form of a blueprint, a computer designed drawing or model, or an actual scale model.

The last two steps in establishing the target cost for this proposed coffeemaker are to set market price and profit margin.

Kitchenhelp's market research shows that the market price for an eight-cup drip coffeemaker with a clock timer is currently $69. A stand-alone coffee grinder sells for $15. Since the two features are being combined and the coffee taste is being enhanced, Kitchenhelp can charge a price slightly higher than $84. Given their desire to capture a 20 percent market share, assume that Kitchenhelp can set the target price at $100.[7]

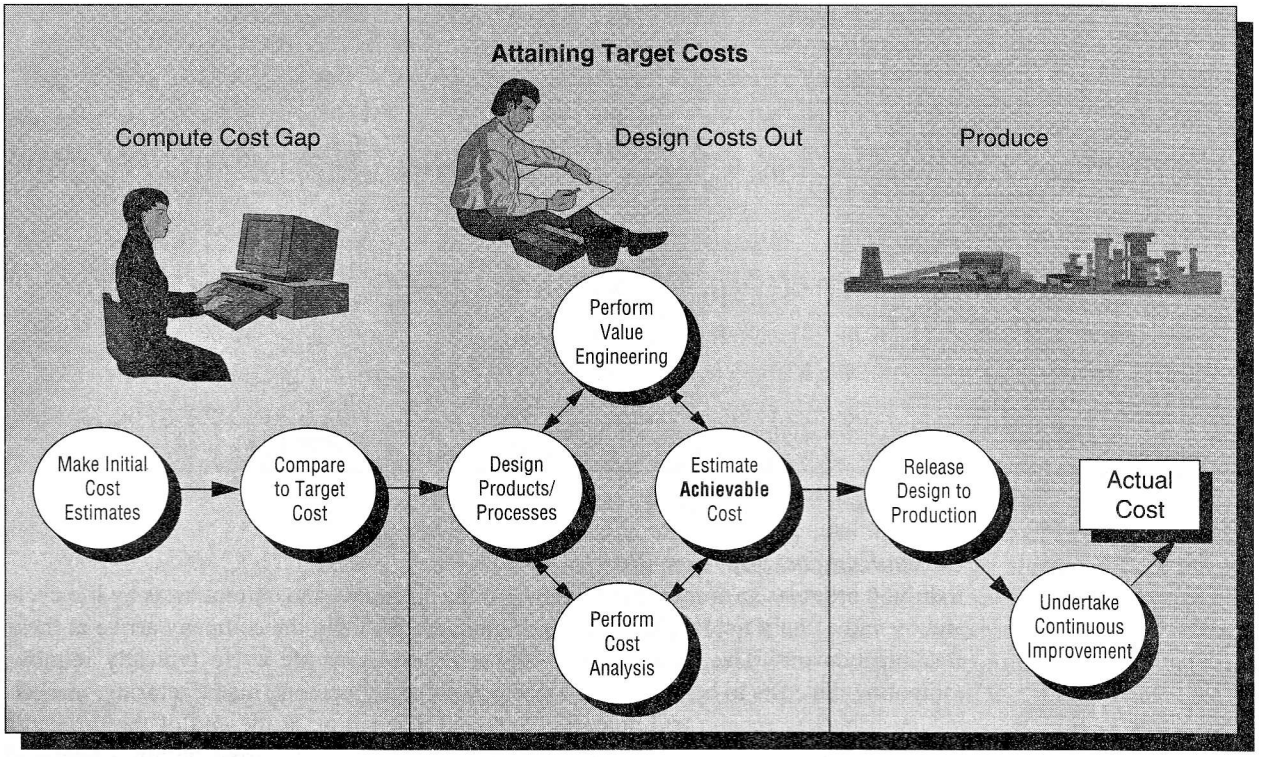
The final step is to establish a target profit by determining the desired return on sales for the coffeemaker. The common return on sales in the small appliance industry is 7–10 percent. Kitchenhelp decides to set a target profit margin of 10 percent on the product. The target cost for this new coffeemaker, therefore, is $90 (100 − 10). This is also referred to as the *allowable cost* for the product.

▲ ATTAINING TARGET COSTS

The second phase of target costing addresses how to attain the $90 target cost; that is, how to turn this *allowable* cost into an *achievable* cost. There are three steps in attaining target costs: (1) compute cost gap, (2) design costs out of a product, and (3) release design for manufacturing and perform continuous improvement. These three steps are shown in Exhibit 5.

[7] To keep the example simple, we have not introduced multiyear planning. Clearly, the price projection will have to be over the life of this product, and it will be a declining price since competitors are likely to introduce their own products. Cost reduction therefore will be more important over time for this product than it is at its introduction.

Exhibit 5
The Attainment Phase of Target Costing



Computing the Cost Gap.

Computing the difference between the *allowable cost* and the *current cost* is the first step in attaining target costs. For Kitchenhelp's coffeemaker, the allowable (target) cost is $90. ***Note that this is total product cost, not just manufacturing cost.*** The current cost is the initial "as-is" estimate of the cost of producing the coffeemaker based on current cost factors or models. The overall gap between allowable and current must be *decomposed* by life cycle and by value chain. A *life cycle* decomposition assigns total product cost to the birth-to-death categories of research, manufacturing, distribution, service, general support, and disposal. *Value chain* decomposition breaks down the cost by whether it is incurred by Kitchenhelp or by one of its value chain members such as suppliers, dealers, or disposers.

Key Point

The two breakdowns take the same total cost and provide two different kaleidoscopic views of the product cost. Each helps to highlight where cost reduction efforts need to be focused.

Exhibit 6
Comparing Allowable and Current Cost Life Cycle and Value Chain Breakdowns

Value Chain →	Inside			Outside			Total		
Life Cycle ↓	*Allow-able*	*Cur-rent*	*Gap*	*Allow-able*	*Cur-rent*	*Gap*	*Allow-able*	*Cur-rent*	*Gap*
Research and development	$3.60 (4%)	$5	$1.40				$3.60	$5	$1.40
Manufacturing	15.30 (17%)	20	4.70	$21.60 (24%)	$30	$8.40	36.90	50	13.10
Selling and distribution	5.40 (6%)	6	0.60	12.60 (14%)	17	4.40	18.00	23	5.00
Service and support	9.00 (10%)	10	1.00				9.00	10	1.00
General business overhead	18.00 (20%)	19	1.00				18.00	19	1.00
Recycling costs	4.50 (5%)	7	2.50				4.50	7	2.50
Total	$55.80 (62%)	$67	$11.20	$34.20 (38%)	$47	$12.80	$90.00	$114	$24.00

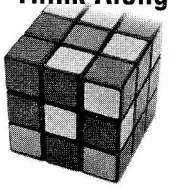
Computing cost gap—an illustration.

Exhibit 6 provides an assumed breakdown of the allowable and current costs by life cycle and by value chain for Kitchenhelp's coffeemaker. How did the company arrive at these cost breakdowns? The breakdown of allowable costs by life cycle typically requires estimating the costs to be incurred on research and development, manufacturing, marketing, distribution, repairs and other support, and disposition at the end of the product's life. The value chain requires estimating the costs that are incurred within a firm and those incurred by its suppliers, dealers, and recyclers. A company can use its past historical average as an initial estimate for these costs. For example, Kitchenhelp's past experience shows that manufacturing costs are typically 41 percent of total product costs for small appliances. Further, of the 41 percent, inside costs are 17 percent, and the remaining 24 percent represent components purchased from suppliers. These percentages can be used as a starting point to set the allowable cost for the coffeemaker for each category in the life cycle and value chain of costs.

Exhibit 6 shows these estimates for Kitchenhelp's proposed coffeemaker. It shows the life cycle breakdown as a percent of the allowable cost of $90 as follows: R&D (4 percent), manufacturing (41 percent), selling and distribution (20 percent), service and support (10 percent), general business overhead (20 percent), and recycling (5 percent). It also shows that 62 percent of the allowable cost of $90, or $55.80, is within Kitchenhelp and 38 percent, or $34.20, is in the value chain.

Kitchenhelp's initial estimate also shows that the total product cost of the new coffeemaker will be $114, a gap of $24 (114 − 90). The total $114 consists of $67 inside (gap = $11.20) and $47 outside (gap = $ 12.80). Exhibit 6 also shows that the largest cost gap is in manufacturing cost, followed by marketing and distribution costs.

Think Along



How does the information in Exhibit 6 help you to focus your cost reduction efforts?

The information in Exhibit 6 shows us that the three largest cost gaps exist in external manufacturing costs ($8.40), internal manufacturing costs ($4.70) and external selling and

distribution ($4.40). It is clear that Kitchenhelp's cost reduction efforts must be external as well as internal. The company needs to work closely with its suppliers and dealers and involve them actively in cost planning and reduction efforts. This will require partnerships and mutual trust and sharing of information among these various entities.

Designing Costs Out.

Reduction of cost through product design is the most critical step in attaining target costs. The key to cost reduction is to ask one simple question: *How does the design of this product affect all costs associated with the product from its inception to its final disposal?* To include all costs, not just manufacturing costs, may appear farfetched at first. However, many "downstream" costs such as distribution, selling, warehousing, service, support, and recycling can be greatly impacted by product design.

Consider for example a product such as a convection oven. Its weight and control panel are two elements affected by design. The design choices impact manufacturing and many other costs as well. A heavy machine will increase loading costs, transportation costs, and installation costs since two people instead of one may be needed to handle it. A fancy electronic control panel will increase the time salespeople have to devote explaining to customers how the oven works. It may also increase product support and repair costs because both electronic and mechanical components may fail in operation. Finally, the material used to give it the extra weight may pose an environmental hazard that requires cleanup at the time of disposal. All these add to a product's cost. Many of these costs can be reduced if they are anticipated and explicitly considered by product and process designers.

Cost reduction relies on four major activities: product design, cost analysis, value engineering, and cost estimation. These four activities will be explained in greater detail later in this module when we discuss how cost reduction actually takes place in practice. Cost reduction is recursive since the activities cycle back several times as the product goes from an initial concept to a final design. The recursion is a characteristic of target costing. Recursion exists to generate a cost effective design, not to correct design errors.

Release Design and Undertake Continuous Improvement.

The final stage in attaining target costs is to continue to make product and process improvements that can reduce costs beyond that which is possible through design alone. It includes steps such as eliminating waste, improving production yields (i.e. getting more production from raw materials), and other such measures. Japanese companies refer to this process as *kaizen costing*. Some U.S. companies refer to it as *value analysis,* others refer to it as *continuous improvement.* It is after production starts that actual costs can be compared against targets and lessons learned can be applied to the next generation of products developed.

The achievable cost is not an actual incurred production cost. It is an estimate, prior to the start of production, of whether the target cost can be achieved. Estimating that the target cost is achievable is simply a signal to release the product design for actual production.

▲ HOW COST REDUCTION OCCURS IN PRACTICE

Cost reduction would be a trivial task if there were no constraints on the features and functions offered in a product or on the time available to develop it. For example, Kitchenhelp could simply delete the coffee grinder from its coffeemaker and probably reach its target cost of $90. However, this would defeat the basic product concept of providing a fresh espresso taste in the coffee. The challenge, therefore, is to reduce costs without sacrificing any of the features that are important to a customer.

This section describes in greater detail the process of cost planning and reduction. We will use the Kitchenhelp example to illustrate what happens in the recursive four-step activity cycle of design ⇒ cost analysis ⇒ value engineering ⇒ cost estimation. The purpose is to describe what happens during these four cost reduction *activities* and the key cost reduction *tools* that are used. Using the data in Exhibit 6, we will illustrate how these activities lead to reducing the currently estimated manufacturing cost of $50 to the target cost of $36.90. Note that the target includes both inside and outside manufacturing costs, because suppliers are part of the product team during this cost reduction phase.

Design Product and Processes.

An initial product concept design starts the cost planning cycle. It is important to note that both the product and the process are *concurrently designed.* In our Kitchenhelp example, the coffeemaker and manufacturing process that will be used to produce the coffeemakers are designed and considered at the same time. This avoids costly changes later because machines may not be available or capable of executing a product as designed. Common tools used at this stage are Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM). Cost parameters are sometimes built into these computer models so cost impact of design changes can be simulated concurrently.[8] A product design goes through several iterations before it is released for manufacturing.

Perform Cost Analysis.

The activities here consist of analyzing what components to target for cost reduction and assigning individual cost targets to the major subcomponents and parts of a product. For Kitchenhelp it means deciding what components of the coffeemaker (heating element, control panel, grinder) to target for cost reduction and then assigning a cost target to each of these components. Cost analysis also focuses on the interaction between components and parts. Often a reduction in the cost of one component is more than offset by a cost increase elsewhere. For example, decreasing the cost of the outer shell of the coffeemaker by making it small may increase the costs of the control panel, electronic circuitry, and heating element.

Cost analysis requires five major subactivities. These are:

1. *Developing a list of product components and functions.* Cost reduction efforts start by listing the various product components and identifying the functions that they

[8] A new class of computer simulation tools called MADE (Manufacturing and Design Evaluation) models is becoming increasingly popular. These models bring together engineering and life cycle cost simulations within a single program using artificial intelligence rules.

Exhibit 7
Major Components of Kitchenhelp's Proposed Coffeemaker[9]

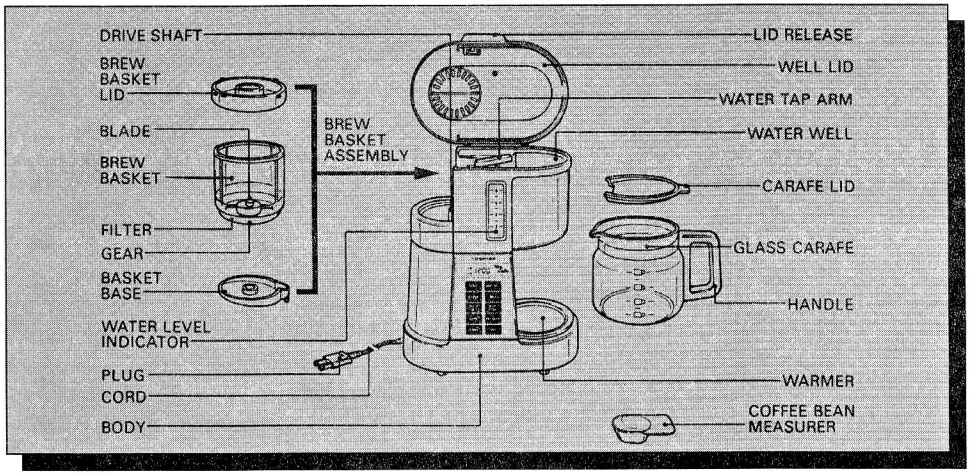


Exhibit 8
Functional Cost Breakdown for Kitchenhelp's Coffeemaker

		Cost	
Component	***Function***	***Amount***	***Percent***
Brew basket	Grinds and filters coffee	$9	18
Carafe	Holds and keeps coffee warm	2	4
Coffee warmer	Keeps coffee warm	3	6
Body shape and water well	Holds water and encasement	9	18
Heating element	Warms water and pushes it	4	8
Electronic display panel	Controls grinder/clock settings	23	46
Total		**$50**	**100**

perform and their current estimated cost. The initial product design and cost estimates provide this information. The list tells us what components and functions are needed to satisfy customer requirements and what it might cost to provide these functions. Exhibit 7 shows a diagram of the various components of the proposed coffeemaker.

2. *Doing a functional cost breakdown.* Each of the various parts and components of the coffeemaker performs a specific function. The next step is to identify that function and to estimate its cost. The functional cost breakdown is shown above in Exhibit 8. For example, the function of the brew basket is to grind and filter coffee. The current estimated cost is $9 for the basket, which represents 18 percent of the total manufacturing cost for this product. To keep the example simple, we have combined several functions and components for the coffeemaker. At a detail level, the brew basket or the electronic control panel will be broken into several subcomponents. The total for all components is $50, which is the same as the manufacturing cost estimate shown in Exhibit 6.

[9] This example is based on a coffee machine first introduced by Toshiba Corporation.

Exhibit 9
Customer Feature Ranking for Kitchenhelp's Coffeemaker

Customer Requirements	Customer Ranking					Relative Ranking	
	1 Not Important				*5 Very Important*	*Raw Score*	*%*
Coffee tastes and smells like espresso					5	5	20
Coffeemaker is easy to clean				4		4	16
Looks nice		2				2	8
Has 6+ cup capacity			3			3	12
Starts automatically at designated time				4		4	16
Works well with different coffee beans	1					1	4
Keeps the coffee warm			3			3	12
Automatically shuts off			3			3	12
Total						25	100

3. *Determining relative ranking of customer requirements.* Engineers view a product in terms of its functions. This is not a customer's view. You will recall that Kitchenhelp had identified eight features that were important to its customers. The engineer's view of a product as functions must be reconciled with a customer's view of a product as a set of features. We must relate product functions to features customers want. To do this we must first assess the relative importance that customers place on the various features. A formal survey of prospective customers asking them to rank the importance of these eight features can be used to rank customer requirements. An assumed ranking for each feature, based on survey results, is shown in Exhibit 9 above. The importance ranking is based on a five point scale. A score of five means the feature is very important, a score of one indicates that it is very unimportant. For instance, taste and smell of coffee is the most important feature and multiple grinder setting is the least.

   The last column of Exhibit 9 converts the raw scores for the importance of features into a **relative ranking of features.** This is done by first adding together the raw scores for the eight functions ($5 + 4 + 2 + 3 + 4 + 1 + 3 + 3 = 25$). Each function's score is then expressed as a percentage of this total score of 25. For example, coffee taste has a score of 5 out of 25. The relative ranking, therefore, is $5/25 = 20$ percent. It says that of the total value a customer derives from this coffeemaker, 20 percent comes from the way the coffee tastes.

4. *Relating features to functions.* The relative rankings of features must be converted into an importance ranking for each function. Since components carry out the functions of a product and are the key design parameters, this step relates customer rankings to the components that best meet that particular requirement. A tool called Quality Function Deployment (QFD) is typically used for systematically arraying information about these three variables—features, functions (components), and competitive evaluation—in a matrix format.[10]

   The QFD matrix is a useful tool for target costing because it highlights the relationships among competitive offerings, customer requirements, and design

[10] The term *QFD* comes from the quality literature, where it is used to signify the process of ensuring that product design and quality meet customer requirements. Target costing uses it for focusing costing efforts.

Exhibit 10
A QFD Matrix For Kitchenhelp's Coffeemaker

Components or Functions → / Customer Requirements ↓	Brew Basket	Carafe	Coffee Warmer	Body/ Water Well	Heating Element	Display Panel	Comparison: Competitor vs. Our Product (1 2 3 4 5)	Customer Feature Ranking
Tastes/smells like espresso	▲				▲		■ ❑	5
Easy to clean	●	●		▲			❑ ■	4
Looks nice				▲		▲	❑ ■	2
Has 6+ cup capacity		▲		▲			■ ❑	3
Starts automatically on time						▲	❑ ■	4
Works with different beans	○					▲	■ ❑	1
Keeps the coffee warm		●	▲				■ ❑	3
Automatic shutoff						▲	❑ ■	3

Correlation of design parameters and customer requirements.
▲ = Strong correlation
● = Moderate correlation
○ = Weak correlation

Comparative competitor rankings.
■ = Competitor ranking
❑ = Our ranking

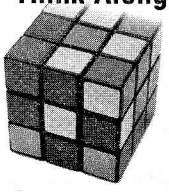
parameters. A typical QFD matrix for Kitchenhelp's coffeemaker is shown in Exhibit 10. The QFD matrix summarizes the information about product functions from Exhibit 8 with customer rankings from Exhibit 9. It adds two other pieces of information that are collected in the market research phase. First is the correlation between a component or design parameter and customer requirements. Second is information about how customers evaluate competitor offerings on these same features.

The matrix shows, for instance, that the requirement that coffee taste like espresso has a high correlation with the design of the brew basket and the heating element. Similarly, how many cups the coffeemaker can hold is correlated to the water well and the carafe size. It also shows that taste, the most important feature to a customer, is currently rated at three for Kitchenhelp and two for its competitor. This tells Kitchenhelp that while it is ahead of the competition, it still is far from what the customer would like to see as far as taste goes. On appearance, the competition obviously has a better looking product, with a rating of five. However, the customer ranking for this feature is two, which suggests that it is not worth spending too many resources in improving the appearance of the coffeemaker.

Exhibit 11
Kitchenhelp Coffeemaker—Percent Contribution of Each Component to Customer Requirements

Components → / Customer Requirements ↓	Brew Basket	Carafe	Coffee Warmer	Body/ Water Well	Heating Element	Display Panel	Relative Feature Ranking
Tastes/smells like espresso	50×20=10				50×20=10		20%
Easy to clean	30×16=4.8	10×16=1.6		60×16=9.6			16
Looks nice				60×8=4.8		40×8=3.2	8
Has 6+ cup capacity		50×12=6		50×12=6			12
Starts automatically on time						100×16=16	16
Has multiple grinder settings	5×4=0.2					95×4=3.8	4
Keeps the coffee warm		20×12=2.4	80×12=9.6				12
Automatic shutoff						100×12=12	12
Converted Component Ranking	15.0	10.0	9.6	20.4	10.0	35.0	100%

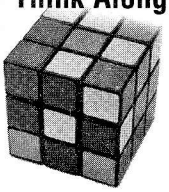
Think Along



Can you tell which design feature is most closely related to the customer requirement for starting automatically at designated time?

5. *Developing relative functional ranking.* The QFD matrix provides valuable information that allows us to convert feature rankings into functional or component rankings. This is critical because customers think in terms of features, but products are designed in terms of functions and components. To do this we need one other piece of information: the percentage contribution of each component to a customer feature. This information is shown as a general correlation in Exhibit 10. Engineers have to convert this correlation data into specific contribution percentages. Such a breakdown for our coffeemaker is shown in Exhibit 11 and interpreted as follows. The feature "tastes like espresso" is a function of the brew basket and heating element design. (You can verify this from Exhibit 10.) Engineers feel that both these components contribute equally to this "taste" feature. Therefore they assign each component a 50 percent contribution to taste. The relative value ranking of the "taste" feature is 20 percent. Therefore, since both components contribute equally, we assign each of the two components a value ranking of 10 percent. The last row of Exhibit 11 adds the value contributions of a component to all features to arrive at *that component's approximate value to a customer.* The brew basket is now said to have a value of 15 percent to a customer, the carafe has a value of 10 percent, and so on. Note that the last row and last column both add up to 100 percent. They are simply different views of customer values. The column represents value of features and the row represents the value of components.

Think Along



Can you calculate and reconcile the 35 percent value ranking assigned to the display panel?

Exhibit 12
Value Index for Kitchenhelp's Coffeemaker

Component or Function	*Component Cost (EX.8) (% of total)*	*Relative Importance (EX.11) (in %)*	*Value Index (Col 3 ÷ 2)*	*Action Implied*
Brew basket	18	15.0	0.83	Reduce cost
Carafe	4	10.0	2.50	Enhance
Coffee warmer	6	9.6	1.60	Enhance
Body shape and water well	18	20.4	1.13	O.K.
Heating element	8	10.0	1.25	Enhance
Electronic display panel	46	35.0	0.76	Reduce cost
	100%	100%		

Do Value Engineering (VE).

Value engineering is an organized effort directed at analyzing the functions of the various components for the purpose of achieving these functions at the lowest overall cost without reductions in required performance, reliability, maintainability, quality, safety, recyclability, and usability. For example, the purpose of a heating element is to bring water temperature to a specified level. This is called its "function." Value engineering asks how this function of raising water temperature to 110° can be achieved in three minutes at a lower cost. It analyzes both product and manufacturing process design and reduces cost by generating ideas for simplifying both.[11] Value engineering is at the core of target costing. It consists of the three major subactivities discussed below:

1. *Identifying components for cost reduction* is the first activity. Choosing which components to select requires computing a **value index.** This is a ratio of the value **(degree of importance)** to the customer and **percentage of total cost** devoted to each component. For our coffeemaker, the value information is in the last row of Exhibit 11, and the relative cost information is in the last column of Exhibit 8. Both these quantities are expressed as percentages. Exhibit 12 computes the value index and shows its implications for cost reduction.

   As Exhibit 12 shows, components with a value index of less than one are typically prime candidates for value engineering. Components with high value are candidates for enhancement since we are spending far too little for a feature that is important to a customer. These components present an opportunity to enhance the

[11] A useful tool for analyzing manufacturing processes is *Design for Manufacture and Assembly* (DFMA). It refers to engineering processes designed to optimize the relationship between materials, parts, and manufacturing processes. The purpose of DFMA is to reduce cost, increase quality, and reduce time to market by making it easier to manufacture or assemble parts or to eliminate them.

Exhibit 13
Value Index Chart for Kitchenhelp's Coffeemaker

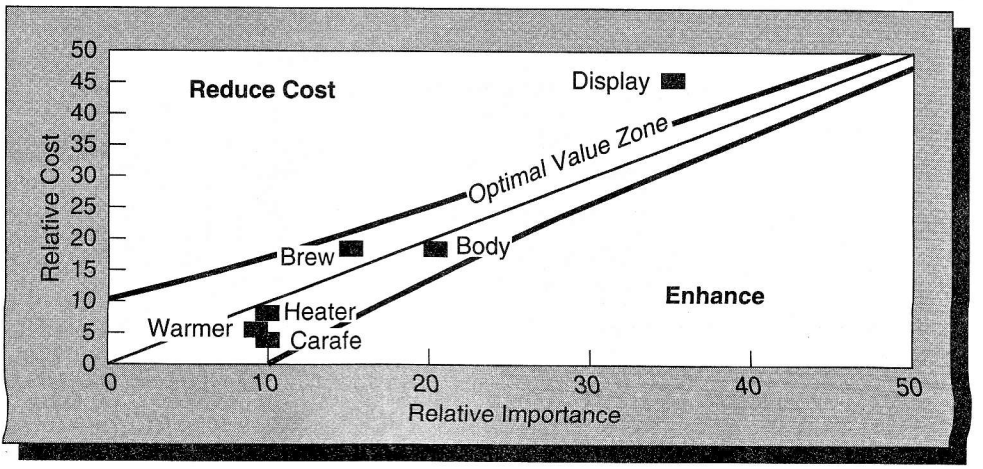


Exhibit 14
Kitchenhelp Coffeemaker—Electronic Display Panel
Value Engineering Ideas to Reduce Cost

Panel Sub-Component	*Cost Reduction Idea*
Power supply	**Reduce** wattage—more than needed in current design.
Flexible circuit	**Eliminate** flexible circuit. Use wiring harness.
Printed wire board	**Standardize** board specifications. Use mass-produced unit.
Clock timer	**Combine** with printed wire board.
Central processor chip	**Substitute** standard 8088 chip instead of custom design.
Heater connector	**Rearrange** layout of board to heater connection.

product. The two variables in the value index, cost and relative importance, are plotted on a graph shown in Exhibit 13.

The optimal value zone in Exhibit 13 indicates the value band in which no action is necessary. The optimal value zone is based on experience and opinions of the target costing team members. The zone is usually wider at the bottom of the value index chart, where low importance and low cost occur, and narrower at the top, where features are important and cost variations larger. The area of the graph above the optimal value zone indicates components that are candidates for cost reduction. Items below the zone are candidates for enhancement.

2. *Generating cost reduction ideas,* the second activity, requires creative thinking and brainstorming. The purpose is to ask what can be *reduced, eliminated, combined, substituted, rearranged, or enhanced to provide the same level of functionality from a component at less cost.* Exhibit 14 lists some sample cost reduction ideas that Kitchenhelp may consider to reduce the cost of the electronic display panel, the prime target for cost reduction identified by the value index.

Note that the cost reduction ideas in Exhibit 14 contain some general principles that can be applied to many different situations. These ideas focus

Exhibit 15
Component Interaction Matrix

Components	Basket	Coffee Carafe	Warmer	Body	Heater	Display	Cost	Available Until
Brew basket					✓		$9	2004
Carafe	✓			✓			2	2010
Coffee warmer	✓			✓			3	2010
Body		✓	✓			✓	9	2008
Heater						✓	4	2010
Display panel				✓			23	2005

on reducing the number of parts, simplifying the assembly, and not over-engineering the product beyond what will meet a customer's need. A cross-functional team is essential because these types of engineering design choices must be guided by customer and financial input.

The contribution of management accountants in evaluating cost reduction ideas is critical. Engineers need to know quickly and reliably whether the cost reduction ideas they are considering are worthwhile from a financial standpoint. For example, to consider whether to eliminate the flexible circuit, we must have a good idea of its purchase cost as well as good cost tables that allow us to determine what a flexible circuit adds to the other manufacturing costs of a coffeemaker.

3. *Testing and implementing ideas* is the last activity within value engineering. Promising ideas are evaluated to ensure that they are technically feasible and acceptable to customers. Those ideas that are feasible and acceptable to customers are developed and incorporated into the product or process design and cataloged in a *VE ideas database* so they are available for future design efforts. One tool often used for testing the feasibility of ideas is the component interaction matrix. This matrix, which helps to identify the impact of changing one component on other components, requires cost data. It ensures that no current or soon out-of-production components are used. The use of such components can increase product costs significantly. Exhibit 15 shows a sample component interaction matrix for Kitchenhelp's coffeemaker. The Cost column of Exhibit 15 shows the cost of a component. The Available Until column shows the remaining life in years before the component may be obsolete or no longer available. A ✓ entry indicates whether there is a relationship between the components.

Estimate Achievable Cost.

Cost estimation is an important activity in target costing. This activity takes place at each iteration of the product design cycle. At the product concept stage, cost estimations are rough approximations that typically use few product specifications and assume no change

in technology. New designs are generated as value engineering ideas are implemented. Each revised design requires a new estimate of achievable target cost. Each new cost estimate is different from prior cost estimates. Early cost estimates are typically performed on a concept drawing, while later estimates use a more developed design, in which many of the parts and processes have been specified. Consequently, these later estimates of achievable costs are expected to be more accurate since more data is available. Many Japanese companies require estimates of achievable cost at the design development stage to be within 3–5 percent of actual costs.

The following are cost estimation methods used in the "compute cost gap" and "design costs out" phases of target costing.

Estimating (initial) current cost.

The current or initial cost estimate is generated by using simple but reliable cost estimation methods. There are several cost estimation tools used in practice. They include statistical regression, learning curves, and parametric estimations.[12] The levels of accuracy required in cost estimates increases as the product moves from concept to completed design.[13]

Estimating manufacturing costs.

For estimating manufacturing costs, two methods are commonly used in practice:

1. **The physical attribute method** typically establishes a relationship between physical characteristics of a product and its manufacturing cost. Some common physical parameters used in industry are:

   Square feet, used for estimating construction cost.
   Wing lift, load, and seats, used in the commercial aircraft industry.
   Horsepower, used in the mechanical equipment industry.

2. **Cost tables** are common in Japanese industry. They are databases of detailed cost information that enable timely cost estimates for new products. Cost tables include data on cost elements such as material, purchased parts, processing costs, overhead, and depreciation on new investments as well as cost models. Well designed cost tables usually contain very specific information on both internal and supplier manufacturing processes. Information includes machine hour rates, labor rates, scrap rates, cycle times, and cost of operations. It also identifies the major factors (drivers) that cause costs to change. While cost tables are more useful in generating detailed manufacturing cost estimates, they can be used to generate an initial cost estimate for a new product that is likely to use existing materials and manufacturing processes.

Estimating other costs.

For other costs such as distribution, marketing, and support, two methods are used as well:

1. **Activity-based costing (ABC)** is used for items such as manufacturing overhead, marketing, distribution, service and support, and some business overhead.[14] The

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[12] These tools are described in a separate module.

[13] Japanese companies typically expect a 12–15 percent error rate in their forecasts of initial costs and 3–5 percent when the design is final. The primary purpose of an initial cost estimate is to define a cost gap and to test the feasibility of the product concept. If the cost gap is too large, product development efforts probably should be abandoned or reconsidered.

[14] Separate modules describe the use of activity-based management (ABM) and activity-based costing (ABC) for cost management.

key is to trace activities needed to sell or support the product and assign a cost based on the consumption of activities to the product.

2. **Historical burden rates** are used for items for which it is difficult to establish a direct relationship between costs and activities. Typically these are general business support costs such as accounting, data processing or legal services, which are difficult to trace to products. For example, if Kitchenhelp's past experience suggests that accounting, legal and other general support costs are 20 percent of product cost, then the 20 percent is called a burden rate. It can be used to generate an initial cost estimate for the product.

▲ MANAGEMENT ACCOUNTING AND TARGET COSTING

Traditionally, management accountants have been functional experts who do not have much contact with their marketing and production counterparts. They see their role as providing financial data, measuring performance after the fact, and auditing resource usage. Target costing requires a change in the traditional role of management accountants and the type of information they provide.

Role of Management Accountants.

Target costing systems require management accountants to have *early involvement* with a product and to learn to function as cross-functional team members.

Early involvement means starting when the product is still in the concept stage and staying with it for the rest of the development cycle. Management accountants need to provide good cost estimates for each design iteration. They must look ahead and provide information about product costs from incomplete design data. It is not helpful to wait until the product specifications are final. Further, each successive cost estimate must be more accurate as the design moves from concept to release for manufacturing. The focus is on estimation and not on actual costs.

As a cross-functional team member, a management accountant must help other team members from engineering and marketing to do their jobs. For example, engineers need to know the financial implications of their value engineering ideas. In the Kitchenhelp example, design engineers need to know what cost savings will result from the redesign of the heating element. Similarly, marketing must know what the company can afford to spend on a feature so they do not promise customers something that a company cannot deliver. For example, many customers probably desire a VCR and a TV in their minivans. Car companies such as Chrysler, Ford, and GM must have good cost data to see if the feature is affordable for them at a price a customer is willing to pay.

Management Accounting Information.

Target costing requires a shift away from traditional responsibility (department-focused) accounting systems to more process-oriented accounting information. In responsibility accounting the prime focus of accounting is the organizational unit. Process oriented data focuses on interunit and interorganizational relationships. It collects cost data by how a product flows across the units/organizations, what activities it requires, and what drives

costs at each stage. In particular, six types of cost data not routinely collected by most management accounting systems are critical for target costing.

1. **Life cycle costing** focuses on how each stage from birth (R&D) to death (disposition) contributes to a product's cost. Life cycle costing requires cost accumulation by life stages of a product instead of using traditional cost objects such as departments or products.
2. **Value chain costing** requires cost accumulation across traditional organizational boundaries to include suppliers, dealers, and others. It helps to focus on the contribution each member of the value chain must make to achieve target cost and how their actions are *co* dependent on each other. Exhibit 6 shows an example of value chain costing.
3. **Feature/function costing** is illustrated in Exhibits 10–12 of this module. This type of costing requires a management accountant to decompose and assign cost targets to product components based on how each component is related to a customer requirement and how much importance customers place on that requirement or feature.
4. ***Design driver costing*** *focuses attention on the impact of design on the life cycle* and value chain costs. It collects data on how and what changes in the physical attributes of a product (design) lead to changes in cost. For example, in the case of a tractor, Caterpillar considers weight, horsepower and bucket capacity to be the primary design drivers. Changing these parameters leads to an increase or decrease in the number of parts used, number of manufacturing processes used, and the extent to which common or standard parts can be used. These latter can be considered secondary or derivative design drivers.
5. **Operations costing** provides data about the cost of using a particular manufacturing operation. Accounting team members provide this information to designers, who can use it to design products that use less time in costly operations. For example, a final step in semiconductor manufacturing is "burn-in" tests. These tests are performed using electric ovens to test the resistance and performance of a chip under heat. Since the primary cost driver is the number of hours in an oven, overspecifying the burn-in test hours can increase costs for products that do not operate under or generate high heat.
6. **Activity-based costing** is particularly valuable for identifying drivers for indirect manufacturing costs such as material handling and for marketing, distribution, service, and support activities. It is a valuable cost management tool because it focuses attention on how product design leads to the consumption of various activities and therefore increases costs. For instance, materials handling is related to the number of unique parts purchased, which is a function of design complexity.

▲ TECHNICAL PROPERTIES OF TARGET COSTING

As a cost and profit management tool, target costing must possess two important technical properties. It must lead to better decisions, and it must provide a good process understanding of cost drivers and work flows in an organization. It performs well on both these criteria.

Decision Relevance. The six fundamental ideas of target costing, discussed earlier in this module, show how target costing brings together five critical management decisions under one umbrella. These are:

How to increase profits and returns.
How to react to competition.
What prices to charge for products.
What features to provide and what specifications to use for those features.
When to introduce new products and stop building old products.

Target costing integrates cost, quality, and time related issues into a single decision around product design. Managers consider profits and competitive reaction as part of setting prices. Costing is aimed at achieving target profits and returns. New products are timed by considering lifetime profitability and technology cycles of new products.

Process Understanding. Enhancing process understanding is at the heart of target costing. As this module shows, target costing focuses on the product as it moves through time, across units, across organizations, and across activities. All of this is accomplished by cross-functional teams who have a product and process focus, not a responsibility unit or single organization focus. In fact target costing cannot function in an organization that is not ready to adopt a process orientation.

▲ BEHAVIORAL ISSUES IN TARGET COSTING

There are two sets of behavioral issues in target costing. The first is the *behaviors needed* for successful target costing. The other is the *behavioral consequences* of using target costing.

Behaviors Needed.

Target costing requires different behaviors from all members of an organization. In this module we focus only on the behavioral implications for management accountants.[15] They need to change their behaviors in two ways:

- ▲ Management accountants must learn to get involved early and develop a tolerance for ambiguity. Design is by nature an incomplete process. It is forward looking and requires many estimations. Accountants always want verifiable data. They must shed this desire.
- ▲ Team playing is an important attribute for management accountants. They need to get involved with other disciplines, understand the technical dimensions of the product, and know what customers require. They must learn to talk to other team members from marketing, engineering, and procurement, and explain to them the financial implications of design decisions in an easy and understandable way. Effective communication is an essential behavioral requirement for management accountants who participate in target costing.

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[15] For a discussion of the behavioral implications for other organizational members, see S. Ansari et al. *Target Costing—The Next Strategic Frontier,* Irwin, 1996.

One reason target costing has been hard to implement in U.S. firms is because these two behaviors are not currently ingrained in these firms. Most managers tend to be functional specialists who know a lot about their own areas such as marketing, engineering or accounting and do not feel the need to communicate with managers in other areas. In addition, performance evaluation has not depended on team performance.

Behavioral Consequences.

Target costing can lead to undesirable behavioral consequences if not employed carefully. Kato et al.[16] report four behavioral problems experienced by Japanese companies who have installed target costing. These are discussed below.

Longer development times.

In some companies, an overemphasis on design led to a longer product development cycle and delayed the product from reaching the market on time. This behavioral dysfunction can be avoided by setting simultaneous targets for quality, cost, and time. Behavior must be driven to all three targets, not just cost!

Employee burnout.

Pressure to attain targets, particularly demanding ones, can cause employee burnout and frustration. Failure to attain targets despite working many hours of overtime and doing their best is likely to reduce employees' future aspiration levels or lead them to reject the targets as unattainable. There are three ways to reduce the likelihood of these adverse behavioral consequences.

1. *Use employee participation in setting targets.* Research on the effects of participation are mixed.[17] However, it does suggest that employees, particularly professionals such as engineers, are better motivated to attain targets when they have a voice in setting those targets.
2. *Create and manage slack.* In their pioneering work on organizations, March and Simon argued that a certain amount of slack is functional because it allows organizations to harness extra energy for crisis periods. It may be in an organization's best interest not to operate in a constant crisis mode but instead to create a certain amount of "acceptable" slack in targets whenever possible.
3. *Focus on continuous improvement and not radical changes.* Learning reinforcement theory suggests that frequent positive reinforcement is a useful way to motivate and keep behaviors on a desired path. Continuous improvement is one way to use frequent positive reinforcement. Making small incremental improvements provides employees a sense of accomplishment in the near term. Individuals do not have to meet an entire target before they are rewarded for their efforts. This incremental move toward targets can mitigate some of the pressure for meeting targets.

Market confusion.

Too much attention to customers can cause "feature creep." That is, additional features are added on without regard to cost, and a proliferation of product models causes market

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[16] The discussion of these four consequences comes from Y. Kato, G. Boer, and C. Chow. "Target Costing: An Integrative Management Process," *Journal of Cost Management,* Spring, 1995.

[17] For a summary of research findings on the effects of participation, see Peter Brownell. "Participation in the Budgetary Process, When It Works and When It Doesn't," *Journal of Accounting Literature,* Spring, 1982, pp. 124–153.

confusion. Management accountants can help to avoid this by making certain that engineers are aware of the costs of new features and that marketing does not just produce a customer "wish list." Both disciplines should be guided to consider cost trade-offs so that features are added only when customers are willing to pay for them. A good example is a Danish manufacturer of optical scanners who has adopted the slogan "state-of-the-market" technology. What they mean is that new technology is introduced in their products not because it is "state-of-the-art," but because customers will purchase those features.

Organizational conflict.
The traditional focus of target costing is product design. Other costs, such as marketing or general business support (overhead), are either exempt from cost targets or are treated as "fixed" by prior decisions and part of the "legacy" of the existing cost system. Design engineers feel that other parts of the organization are getting a free ride while they try to squeeze every penny out of a product. This leads to internal conflict. There are two ways of avoiding this problem.

1. *Set targets for all costs.* All costs, including marketing, logistics, and support, must be part of a product's target cost. This makes sense from both a cost management and a behavioral perspective. Just as we cannot exceed a certain amount to manufacture a product, we cannot exceed a target for advertising and promoting that product either. These costs need to be managed as part of achieving overall profit targets.
2. *Use target costing philosophy to manage all costs.* Target costing represents a philosophy that says costs are driven by the way we design our products and processes. This philosophy can be used to manage the "fixed" or "legacy" costs by looking at the design of these support functions and processes. Indeed, activity-based management and business process reengineering are two techniques that employ a design orientation to manage processes.

▲ CULTURAL IMPLICATIONS OF TARGET COSTING

In addition to right behaviors, introducing and sustaining target costing in an organization requires appealing to and creating a set of shared cultural values, beliefs, and mindsets within an organization.

Creating a Receptive Culture for Target Costing.

Introducing a new process in an existing organizational culture is always hard. People have their existing beliefs, values, and mindsets. A new process that does not appeal to shared organizational values is unlikely to take hold. A good example of appealing to shared cultural values is Chrysler's launch of target costing on their Neon car project.

When the Neon was launched, Chrysler was in a difficult financial situation. General Manager Robert Marcell introduced the need for target costing by showing Neon project team members slides of life in his hometown of Iron River, Michigan, where he grew up. These slides showed Iron River, named after its principal industry, iron mining, as a prosperous community located amidst beautiful lakes and woods. Later in the talk he showed pictures of Iron River as it is today—a ghost town of largely abandoned mine shafts and a population less than half of what it was in the early 1960s, with more than 75 percent of the residents below the poverty line. The reason: Iron River was unable to compete against

imports from Brazil and Canada. As Marcell put it, Iron River's inability to compete made it into "an economic Chernobyl." The talk ended with Marcell asking the team members if the present day auto industry in America and Chrysler in particular are likely to become Iron River. Can they rise to the challenge and disprove critics who think the U.S. auto industry is "soft, lazy, dumb . . . and can't compete"? Can they compete and save the auto industry and maybe in a small way make a significant contribution to the U.S. as well?

The Marcell presentation launched what Chrysler described as a cultural appeal of "dare to be different!" The presentation is a powerful evocation of symbols and values important to Chrysler workers, driving home the necessity for building small cars cost effectively. It has all the elements of an appealing story. The slides of small town U.S.A. invoke the symbols of a nostalgic past. These are the images that Norman Rockwell has burned into our consciousness forever. Add to this an element of challenge from Japanese and European auto makers. The image of a sleeping giant awakening provides a rich subtext. There is a villain to be proven wrong. The villain is the infamous "they" (the media, foreign critics, our own citizens and top management) who have lost faith in our ability to do things right. Finally, it ends with a Kennedy-style appeal to do something for the country. The Chrysler speech has all the images, symbols, values, and emotions that appeal to a Midwestern work force. It is not surprising that Chrysler's introduction of target costing has been very successful.

Sustaining Values that Support Target Costing.

Introducing target costing is only a beginning. To sustain target costing, an organization also needs a supportive culture. It must either create a set of shared values if absent or nourish them if present. While the entire organizational culture must change, our focus here is only on the cultural values and beliefs that are part of the management accounting function. Traditionally, accountants have been trained to be neutral and distant. They function as technical specialists rather than involved team members. Management accountants who participate in target costing need a different mindset. They must internalize three important values:

Customer focus means that their work must always focus on how it creates value for a customer. Serving and listening to the customer must be more than a marketing gimmick. It must be an internalized belief.

Cross-functional cooperation is another important value to be internalized. The management accountant must set aside narrow parochial concerns in favor of cross-functional cooperation. Teamwork must be the norm. The management accountant must not operate as a corporate policeman.

Open sharing of information is an important part of creating an open culture. Management accountants must provide information to team members and not use it as a source of power.

These three values and beliefs are the cornerstone of a culture supportive of target costing.

▲ LESSONS LEARNED

There are six key lessons we want you to learn from this module:

▲ Target costing is a powerful strategic tool that allows an organization to address all three dimensions of quality, cost, and time simultaneously.

- ▲ Target costing is essential for coping with today's globally competitive environment.
- ▲ Target costing controls costs before they are incurred; that is, at the design stage.
- ▲ Customer requirements must drive all target costing activities.
- ▲ Target costing uses cross-functional teams that include suppliers, dealers, and others.
- ▲ Target costing requires change in behaviors and can lead to employee frustration and burnout if not used carefully.
- ▲ Target costing requires a culture that values customer input, cross-functional cooperation, and open sharing of information.

▲ COMMON TERMS

Activity The series of related tasks that are part of work performed in an organization. It represents what is done such as the several things needed to load a truck with goods to be shipped, or responding to a customer complaint. (See process diagram.)

Activity Based Costing (ABC) A method of costing in which activities are the primary cost objects. ABC measures cost and performance of activities, and assigns the costs of those activities to other cost objects, such as products or customers, based on their use of activities.

Allocation The apportionment or distribution of a common cost between two or more cost objects. In accounting, allocation is usually a way of assigning a cost between cost objects (products, departments or processes) that share that common cost. An allocation involves dividing the cost needed to allocate by some physical quantity (ideally a cost driver).

Benchmarking The process of investigating and identifying "best practices" and using them as a standard to improve one's own processes and activities.

Budget A quantitative plan of action that helps an organization coordinate resource inflows and outflows for a specific time period. Budgets are usually financial but may also include nonfinancial operating information.

Capacity The physical facilities, personnel, supplier contacts, and processes necessary to meet the product or service needs of customers.

Cost A monetary measure of the resources consumed by a product, service, function, or activity. It also refers to the price paid for acquiring a product or service.

Cost Driver An event or factor that has a systematic relationship to a particular type of cost and causes that cost to be incurred.

Cost Management The systematic analysis of cost drivers for the purpose of understanding how to reduce or maintain costs.

Cost Object Any item (activity, customer, project, work unit, product, channel, or service) for which a measurement of cost is desired.

Competitive Analysis Tools that enable companies to quantify how performance and costs compare against competitors, understand why performance and costs are different, and apply that insight to strengthen competitive responses and implement proactive plans.

Continuous Improvement A program to improve the strategic variables of quality, cost or time in small incremental steps on a continuous basis.

Culture The collective values, beliefs, ethics, and mindsets of the members of an organization, clan, or society which is subconsciously used to interpret events and take action. It is often called the collective programming of the subconscious mind.

Extended Enterprise The extended enterprise includes an organization's customers, suppliers, dealers, and recyclers. It captures the interdependencies across these separate organizations. It is also referred to as the value chain.

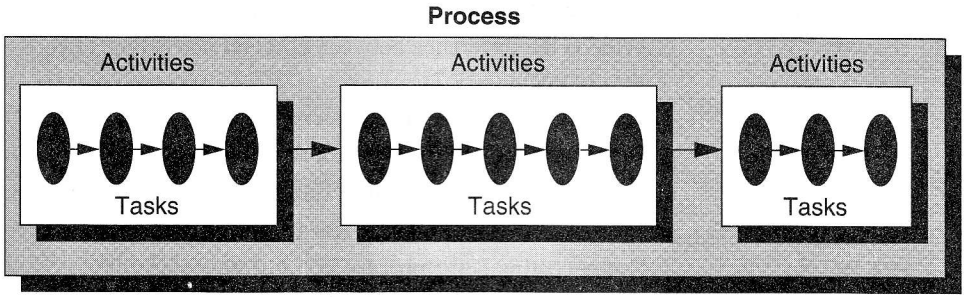
Fixed Cost A cost element that does not vary with changes in production volume in the short-run. The property taxes on a factory building is an example of a fixed production cost.

Incremental Cost 1. The cost associated with increasing the output of an activity or project above some base level. 2. The additional cost associated with selecting one economic or business alternative over another, such as difference between working overtime or subcontracting the work.

Indirect Costs Costs that are not directly assignable or traceable to a cost object.

Life-Cycle Costs Accumulation of costs for activities that occur over the entire life cycle of a product from inception to abandonment.

Process A series of linked activities that perform a specific objective. A process has a beginning, an end, and clearly identified inputs and outputs.



Quality A customer's total experience with a product or service. It includes features and the performance dimensions of those features such as reliability, usability, safety, and repairability.

Strategy The way that an organization positions and differentiates itself from its competitors. Positioning refers to the selection of target customers. Distinctions typically are made on the dimensions of quality, cost, and time.

Time The time it takes a firm to develop and produce new products or to provide existing products when customers need them.

Variable Cost A cost element that varies directly and proportionately with changes in production volume.

Value Chain See extended enterprise.

▲ PROBLEMS AND CASES—INTRODUCTORY LEVEL

1. **Self-test questions.**

a. What is a target cost? How is it different from a budgeted cost?
b. What are the six fundamental principles of target costing?
c. Why is it important to manage costs before products have been produced?
d. What are the different ways in which you can set a target market price for a product?
e. What is the difference between cost estimates done at various stages of the product development cycle?
f. At what stage of the product development cycle does target costing play a key role?
g. What is the difference between an allowable cost and an achievable cost?
h. Explain how target costing is different from cost plus pricing.
i. What does a value index of less than one imply?
j. Target costing is the process of translating a customer's view of a product into an engineer's view of a product. Illustrate what this statement means using a product. (Hint: Use a product you are familiar with such as a telephone, a watch, a radio, a cassette player, and so on.)
k. Explain how a well executed target costing process can help a firm achieve its quality, cost, and time objectives simultaneously.
l. What is meant by concurrent engineering of products and processes? How does this lead to cost reduction?

2. "HP's new Vectra 486N uses an 85-watt power supply . . . contains 450 parts, a 46 percent reduction . . . has just one screw (Dell has 25 screws)."[18] Explain how these redesign steps reduce the cost of Hewlett Packard's Vectra 486N personal computer. List the types of costs saved.

3. What is the target profit that you would recommend for a product that has the following return on sales (ROS) profile? (Consider the three items together.)

(i) Industry average return on sales for this type of product—11 percent.
(ii) Company average for this product line—14 percent.
(iii) Company's future plans for this product line—16 percent.

Explain your recommendation.

4. Listed below are several design choices for manufacturing a dishwasher. Comment on how each design choice will impact costs. List which costs will be impacted and in what direction.

a. Steel versus PVC tub for dishwasher.
b. Electronic versus nonelectronic control panel. (Hint: Electronic panels require circuit boards that can take high heat, humidity, and vibration.)
c. Subassembly for blades and rotor redesigned to use 30 percent fewer parts.
d. Rinse and hold and plate warmer cycles eliminated.
e. Use of a power supply used by the firm's existing lines of garbage disposers and trash compactors.
f. Use of a 10-year power supply rather than one that lasts 25 years.

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[18] From "Penny Pinching PCs: How They Did It," *BYTE Magazine*, November 1992, p. 131.

5. Ariane Electronics makes power supply devices in their plant located in Malayasia. The power supplies are used in various products such as hair dryers, electric knives, drills, and so on. The power supplies vary primarily by the watts of output they produce. They range from 5 watts to 30 watts. Ariane's main competitor is Nikko Electrical. Nikko sells a 45 watt power supply at a price of $22. Ariane currently has only a 30 watt power supply that sells for $16. Ariane's engineers think they can produce a 40 watt power supply that can compete with Nikko. The company's market research indicates that prices are adjusted for wattage differences between power supplies. The adjustment formula is as follows:

(Competitor's wattage/Our wattage)^0.79, where .79 is the customer's perceived value for wattage.

Based on this relationship, what is the target market price for Ariane's 40 watt power supply?

6. Assume that you worked for Chrysler in 1990 and were assigned to the development team for the Neon project. This project was developed under the target costing approach rather than the traditional cost-plus approach.

Answer the following questions regarding the development of the Neon car. Be creative, using your knowledge of cars in general, in answering the questions. You should provide car specific examples.

Required:

a. Identify the seven steps in the establishment phase of target costing. Provide specific examples of activities undertaken for each of the seven steps.
b. Discuss how each of the three steps in attaining target costs might have applied to the Neon project. Also discuss how Chrysler could design costs out or reduce costs through design improvements.
c. List some behavioral problems that may occur when target costing is used. Provide an example of how these problems may have impacted the Neon project.

▲ PROBLEMS AND CASES—ADVANCED LEVEL

7. Quote from a senior manager of a major company: "Our firm has always had a design to cost philosophy. Our engineers have to achieve very tight cost standards when designing new products. Target costing is just the new fashionable term for something we have done all along." Do you agree with this statement? Has the firm been practicing target costing?

8. Hightech manufactures color printers. It is in the process of planning the production and design of Model CX-700, one of its popular-selling models. The breakdown of the cost for producing Model CX-700 and the value index computed for this last period are shown below. (For simplicity assume there are only three components.)

Component	Cost	Function
Ink cartridge	$45	Determines color quality
Color sensor	35	Matches screen color to printed color
Paper sensor	20	Lights up indicator when out of paper

The customers want sharper colors, a better correspondence between what they see on screen and what they print on paper, and a sensor that can be connected to the PC speaker

to issue an audio "out of paper" warning. The additional spending required to provide these features and the value index for these three components are as follows:

	Additional Cost	Value Index
Ink cartridge	$ 27	.780
Color sensor	18	1.4689
Paper sensor	5	.500
Total additional cost	$ 50	

The company feels that if it were to provide all three of these features, the customers would pay an additional $49 for the printer.

Required:

Do you think that Hightech should provide all of these features in the new model? Some of these features? None? Show your calculations.

9. Just the Fax, Inc. manufactures various models of fax machines for office and home use. The following data has been collected by the market research staff about customer preferences for features for its Model P-400 fax machine. A score of one represents not important. A score of five means very important.

Feature	Importance Ranking	Competitor's Product Rank
1. Should be easy to operate	5	3
2. Memory to store faxes when out of paper	3	2
3. Speed of transmission	4	3
4. Print speed	4	1
5. Different settings for quality of original	3	1
6. Handset for phone	2	3
7. Paper size accepted	3	4
8. Interface with a personal computer	2	3

The company's engineers have provided you with the following correlations between the components used in the fax machine and features desired by customers. Features are referred to by numbers. H, M, and L refer to high, medium, and low correlation. For example, the first entry means that there is a high correlation between the component display panel and the customer feature one, easy to operate. Similarly, display panel has a medium correlation with feature five, different settings for quality of original.

Component	Features Impacted	Correlation
Display panel	1, 5, 6	H, M, L
Print engine	4, 7	H, M
Modem speed	2, 3, 8	H, H, L
Paper tray	7	H
Memory board	2, 3, 5, 8	M, H, H, M
Interface card	1, 2, 4, 6, 8	M, H, L, L, H

Required:

a. Array the data in a Quality Function Deployment (QFD) matrix of the type shown in the module for the coffeemaker example.

b. Write a brief explanation of the insights provided by the QFD matrix. In particular, what are its implications for cost planning?

Case 1: SmartCOM, Inc.

SmartCOM, Inc. manufactures internal modems for use with personal computers (PC). A modem is a device that allows a personal computer to communicate with other computers or fax machines through ordinary phone lines. The company is working with a PC manufacturer who is thinking of bundling the SmartCOM modem as a standard component with each new PC. SmartCOM's marketing manager has determined that PC buyers would be willing to pay $110 for a modem. The cost to the PC maker of installing and testing the hardware and the software is $25. In addition, the PC manufacturer requires a 10 percent return on sales. The net selling price that SmartCOM can charge the PC maker, therefore, is $74.

Research conducted jointly by the PC maker and SmartCOM's marketing personnel shows that customers want six features. These are: (1) ability to communicate at high speeds, (2) ability to send and receive clear faxes, (3) error-free communication over "noisy" telephone lines, (4) voice mail capability for multiple mailboxes, (5) compatibility with most brands of PCs, and (6) ability to work in the background.

Based on this research, SmartCOM's engineers have come up with a modem design that uses four main modules: (1) a converter module that would convert digital signals into analog signals so they can travel over standard phone lines; (2) a fax module that would provide the capability to communicate with standard fax machines; (3) a voice module that would take messages for multiple voice mail boxes; (4) a processing module that would direct traffic to the right place, that is, to the computer, fax/printer, or voice recording/playback chip. Each module has several major components. A list of the major components in each module, together with preliminary cost estimates for manufacturing or buying each component, appears in Table 1 below.

Table 1
Cost Estimate for SmartCOM Modem

Module	*Component*	*Cost of Each*	*Quantity*	*Cost*
Converter	Signal processor	$8.00	1	$8.00
	Phone I/O chip	1.50	1	1.50
Fax	Interpreter chip	2.50	1	2.50
	Printer I/O switch	1.50	1	1.50
	Fax signal chip	4.50	1	4.50
Voice	Amplifier	3.00	1	3.00
	Voice chip	5.00	1	5.00
Processor	Bus controller chip	3.00	1	3.00
	CPU	20.00	1	20.00
	Memory chips	2.00	8	16.00
	I/O controller	7.00	1	7.00
	Total cost			**$72.00**

In addition to the above, the marketing department estimates that order filling (primarily order processing and delivery) costs would run $4.00 per unit. General and administrative costs are expected to be $14.00 a unit. SmartCOM expects to earn a 15 percent return on sales.

SmartCOM's engineers have determined the relationship or contribution of each of the various functional components to customer features. This relationship is shown in Table 2 below.

Table 2
Function-Feature Mapping for SmartCOM's Modem

Feature	*Importance to Customer*	*Component*	*% Contribution to Feature*
High speed	5	CPU	40
		Bus controller	10
		Phone I/O chip	50
Send/receive faxes	3	Fax signal chip	40
		Interpreter chip	40
		Printer I/O switch	20
Error-free communication	5	Signal processor	60
		Phone I/O chip	40
Voice mail	3	Amplifier	40
		Voice chip	60
Compatibility with PCs	4	CPU	70
		Signal processor	30
Background operation	2	Memory chips	50
		I/O controller	50

Required:

a. What is the overall target cost for the modem? What is the target for the manufacturing cost of the modem?

b. What is the cost gap between allowable and current cost? What is the gap for the manufacturing cost?

c. Calculate a value index for the components of the modem.

d. For each component, indicate what action is implied by the value index.

e. Explain how value engineering can help in closing the gap between allowable and achievable target costs for the modem. List some of the major ideas you would consider for cost reduction.

Case 2: Modern Office Machines.

Modern Office Machines is a manufacturer of small office equipment. Its product line includes electric pencil sharpeners, disk holders, tape dispensers, hole punchers, computer stands, and a range of desktop accessories. The electric pencil sharpener is one of its best known products. Until recently, the company had a dominant share of the pencil sharpener market, as much as a 30 percent share of total sales in the U.S.

Because of recent competition from Far East manufacturers, who sold their pencil sharpeners for lower prices while offering comparative quality, Modern has lost sales and market share. This year only 10 percent of pencil sharpener sales were of Modern's brand. Initially, Modern had responded to competition by lowering prices and squeezing margins. Since this approach hasn't proven satisfactory, the company has decided to try a different approach of designing products to a tight cost target.

Modern established a team that included representatives from engineering, accounting, and production. The team was responsible for redesigning Modern's pencil sharpener and improving its production process to achieve a 25 percent reduction in costs over the next two years. Since the current manufacturing cost is $16, this means a cost reduction of $4 for manufacturing.

The team members reviewed the design and production of the pencil sharpener at one of its meetings. They found that the sharpener is made from stainless steel casing. The shell is divided into two parts: a base and a top. The motor, blades, and bin drawer are attached to the base using 12 screws and washers. The top is then attached to the base using another four screws. All parts are assembled by hand. The motor and bin drawer are purchased from an outside supplier. The blades are manufactured by a blade machine. At standard, the assembly takes 30 minutes per pencil sharpener.

The team also met with the marketing group and reviewed that group's research on customers' expectations about features and price. Their research indicates that there are three features a customer desires in an electric pencil sharpener: speed of sharpening, ease of cleaning scrapings, and appearance. Using a five point scale, with five representing high importance, the marketing group found that customers rated speed of sharpening a four, ease of cleaning scrapings a four, and appearance a two.

Modern's engineers familiar with pencil sharpeners' functioning felt that four components could address these features: motor, blade assembly, drawer, and outer casing. Motor and blade assembly contribute 75 percent and 25 percent respectively to the speed of sharpening. The design of the drawer is 100 percent responsible for ease of cleaning scrapings, while the appearance is 100 percent determined by the casing. They proposed a solution which would use a cheaper, less powerful motor (saving $3.00/motor) and a less expensive plastic bin drawer (saving $1.00/drawer) to meet the 25 percent cost reduction target.

The accountant on the cost planning team collected information about the current actual cost of producing each of the components and other costs. Her cost data is summarized in Table 1 below.

Table 1

Component	*Source*	*Current Actual Cost*
Manufacturing costs:		
Motor	External supplier	$ 6.40
Blade assembly	Internal	3.20
Drawer	External supplier	2.40
Outer casing	Internal	4.00
Subtotal		**$16.00**
Selling/distribution	Internal	6.00
General and administrative	Internal	3.00
Total cost		**$25.00**

Currently Modern's pencil sharpener sells for $27.00. This yields a return on sales of 7.4 percent. In general, the small office machinery industry gets a 15 percent return on sales. To respond to competitive pressure in past years, Modern had dropped its price from $29.40 to $27. Modern would like to capture its lost market share and go back to its 15 percent return on sales. However, analysis of competitors' prices and market response to those prices indicates that a price of $23.50 would stimulate sales and restore market position.

Required:

a. Evaluate the cost planning efforts of Modern in light of what you have studied about target costing. Is their approach consistent with target costing?

b. How would you change their process to be consistent with target costing?

c. Compute a target cost for the pencil sharpener. Assume that a 15 percent return on sales is required.

d. Compute a value index for the pencil sharpener's various components.

e. Which components should be targeted for cost reduction? Should any components be targeted for increased spending?

f. What target cost would you establish for each of the components?

g. In the light of your analysis, what suggestions would you provide for the redesign of the pencil sharpener?

Case 3: Dragon Development.

Dragon Development is in the business of building single family homes. It is currently in the process of developing a tract in which it will offer 20 single family homes. With the decline in real estate market, the company has been losing profitability. It wants to regain its profitability by adopting target costing to manage profits and costs.

The following *initial* specifications have been worked out for the new tract of homes that will be the pilot for the target cost system:

Table 1
Proposed Construction Specifications—
New Tract

Foundation/Roof Area (sq. ft.)	2,800
Heated Floor Space (sq. ft.)	3,600
Garage (sq. ft.)	600
Deck	500
Patios/Walkways/Lawn	5,500
Number of Bathrooms	5

The intended buyers for these homes are professional upper middle class families (e.g. lawyers, doctors, accountants, managers, small entrepreneurs, etc.) in which both spouses typically work. The quality specifications are designed to meet the expectations of this class of buyers.

Target Profit & Prices.

It is customary for developers to aim for a 20% contribution margin from each house. Recent market surveys indicate that a house with the proposed quality and design specifications will sell for around $399,000. Typically, marketing and sales commissions costs average 4% of the selling price. Therefore, if the proposed house sells for $399,000, the net price to the developer will be $383,000 (rounded off). Also, the desired profit contribution will be $80,000 (rounded off). The $399,000 price represents a drop in prices due to the recent decline in real estate values. When the concept for these homes was originally developed, this type of home sold in the $450,000 range. The Company has come to the conclusion that to earn the 20% desired profit margin with the lower price of $399,000, it must have a good system for planning and managing costs.

Cost History/Estimates.

The initial cost estimates suggest that the total development cost will be much higher than the price the market is willing to pay. Besides construction cost, the new homes are expected to have land cost of $70,000 per home and construction financing of 8% per annum with a typical construction period of 9 months. These estimates are based on using, as a *starting* cost estimate, the cost of a recent housing tract with similar quality homes. Table 2 below provides the specifications for a typical home (123 Main Street) in this recently completed tract.

Table 2
Construction Specifications—
123 Main Street (Two Story Home)

Foundation/Roof Area (sq. ft.)	1,800
Heated Floor Space (sq. ft.)	2,935
Garage (sq. ft.)	490
Deck	500
Patios/Walkways/Lawn	5,300
Number of Bathrooms	3

While 123 Main Street is smaller than the proposed tract, its quality is similar. The costs of building 123 Main Street are detailed in Table 3.

Customer/Competition Analysis.

To make trade-offs intelligently, the Company has commissioned a market survey that shows the relative values customers place on different "hard" and "soft" functionalities in a home. The survey also ranked competitor offerings on these same functionalities. This data was arrayed in a "Quality Function Deployment" (QFD) matrix so all relevant data could be related to the design parameters. The QFD matrix is shown in Table 4.

Value Engineering.

To make design changes the company formed a team consisting of the architect, interior designer, structural engineer, and framer to develop some value engineering ideas for cost redesign. The team met and came up with a set of ideas to guide them through the specific changes they wanted to consider. These ideas are summarized in Table 5.

Required:

a. What is the overall "target cost" for the new housing tract? What is the construction cost target?
b. Prepare an initial cost estimate for the proposed home using 123 Main Street as a cost model. (Hint: You may want to group costs by common drivers and then use these drivers to predict the new tract's costs.) What is the gap between the target cost and your initial cost estimate?
c. Develop a cost reduction strategy for the company that considers the life-time ownership costs to the customer and will allow Dragon to meet the target cost for the new tract (including land and financing). Use the customer preferences shown in Table 4 and the value engineering ideas in Table 5 as a guide. However, if you need to make additional assumptions state them in your analysis.
d. Write a brief paragraph on each major cost reduction strategy you have adopted. Briefly explain the quality and functionality tradeoffs you have used to meet the target cost and defend these trade-offs.

Table 3
Construction Costs—123 Main Street

Item	*Cost*
Architectural Fees	$ 7,500
Interior & Landscape Design	1,500
Building Permits	5,253
Construction Insurance	235
Temporary Facilities	750
Water Meter & Utility Trench	488
Excavation	750
Concrete Forms	1,500
Concrete for foundation and floors	8,500
Roof Covering	4,750
Garage Door & Opener	650
Site Clean-up	500
Lumber Rough for framing	17,500
Lumber Finish for doors/window trims and molding	8,944
Framing Labor	22,225
Carpentry Finish installing cabinets, trims, etc.	6,375
Doors & Frames	3,453
Windows & Sashes	6,413
Stucco Exterior	8,025
Sheet Rock (gypsum board for interior walls)	8,763
Rough Electrical Wiring	5,013
Rough Plumbing	7,975
Telephone Wiring	413
Cost of Framing Changes & Bonus for on-time finish	1,405
Bathroom and Kitchen Cabinets	7,856
Hardware for framing	900
Hardware Finish (door knobs, hinges, etc.)	1,719
Plumbing Finish	2,519
Electrical Finish (wall switches, plates, etc.)	4,954
Light Fixtures	3,591
Heating/Ventilation (equipment plus labor)	6,125
Built-in Window Planter Boxes	1,044
Insulation	4,825
Finish Flooring (carpeting and tile)	13,343
Built-in Kitchen Appliances	5,616
Spiral Stairway—Metal	2,319
Mirrors, Towel Holders, etc.	1,250
Fireplace	1,690
Blinds and Shutters for windows	3,381
Painting & Wall Paper	7,925
Garage Cabinets	438
Tile Work (materials and labor)	6,181
Fencing	725
Concrete Driveway and Walkways	5,129
Plants & Lawn	4,606
Sprinkler System	956
Total Cost	**$215,972**

Table 4
Dragon Contracting—QFD Matrix for Proposed Home

	Design Parameters													
Customer Requirements	*Square Feet*	*Number of Baths*	*One vs. two Floors*	*Electric Wiring*	*Electric Appliances*	*Finished Carpentry*	*Floor Covering*	*Finish Material*	*Competitor Ranking*					*Customer Rating*
									Low				*High*	
									1	*2*	*3*	*4*	*5*	
Spacious feeling inside	M							M			C	O		5
Adequate bathrooms	M	S						S			C		O	4
Good use of space	S		S							O	C			5
Fully equipped kitchen				S	S	S		W			O	C		5
Lots of storage space	S		W						O			C		4
Bonus room or library	S									O		C		3
Easy to maintain house/yard								S				O/C		4
Lots of decks and balconies	W		S										O/C	2
Earthquake and fire safe			S					W				O	C	5
High quality cabinets		S				S		W			O		C	3
Burglar/Fire Alarms				S				M					O/C	5
Wood or Marble Floor finish							S				O		C	3
Decorative finish								S			O		C	2
Fireplaces	W							S		O			C	1

Key to Symbols:
S = Strong Correlation ⇒ Numerical Rating = 7
M = Medium Correlation ⇒ Numerical Rating = 4
W = Weak Correlation ⇒ Numerical Rating = 1
O = Our Product
C = Competitor's Product

Table 5
Value Engineering—Brainstorming Starters*

ADAPT	What else is like this? Does the past offer similarities? What could we copy? What other ideas does this support?
COMBINE	Can we combine? Combine purposes? Combine ideas? Combine functions?
MAGNIFY	What can we add? Thicker? More frequent? Stronger?
MINIMIZE	What can we subtract? Smaller? Omit? Streamline?
REARRANGE	Can we interchange? Different layout? Different sequence? Change pace? Different pattern? Different schedule?
REVERSE	What's the opposite? Can we turn it around? Upside down, backward? Can we reverse roles?
MODIFY	Could we change the form or shape? What new twist?
SUBSTITUTE	What can we use instead? Who else can? Another approach? Another material?

* This checklist has been adapted from one used by Chrysler Corporation.

Table 5 (Continued)
Test for Value

YES	NO	
_____	_____	1. Can we do without it?
_____	_____	2. Does it do more than the customer requires?
_____	_____	3. Can we use other materials? List them.
_____	_____	4. Does a specialty vendor have it for less?
_____	_____	5. Is there a simpler way of doing the job?
_____	_____	6. Can somebody's standard item be used?
_____	_____	7. Could less costly tooling or fixtures be used?
_____	_____	8. Does it cost more than we feel is reasonable?
_____	_____	9. Are we buying too much reliability?
_____	_____	10. Using my money, would I refuse the price?