"Target costing creates strong and robust corporations. Target costing is essential to understand and manage cost and to reap high levels profit. It is used by most great companies in Japan. Target costing in conjunction with value engineering is necessary to maintain consistent levels of profitability.

As a professor and consultant of cost management and target costing for over 40 years, I am a full believer in the need for using the target costing concepts and its methodology. For companies to be great they need target costing. This book's concept of climbing a ladder to reach target costing and requiring all the elements on each rung to be in and remain in place during the climb is essential to success."

Masayasu Tanaka, PhD
Professor of Graduate School of Business and Management at Mejiro University
Professor Emeritus of Tokyo University of Science

"Jim Rains' book *Target Cost Management* is a must read for every business executive interested in global success. His extensive knowledge of Japanese productivity processes including the relationship between value engineering and target costing is evident in the book. This book from a respected world leader in value engineering provides the inspiration and details on how to incorporate target costing in your organization. The novel ladder concept for global survival and success puts major productivity processes in a logical relationship and is appropriate for all levels of the organization."

Don J. Gerhardt, PhD
Former Director of Value Engineering, Ingersoll-Rand
President, Gerhardt Engineering

"Target costing is one of the hidden treasures of companies like Toyota and Honda. Cost is not something you get when you add up the parts, it is an intentional criterion for design. Targets are set and they are met. How does that happen? Toyota and Honda have made a science of breaking down a product and its associated process and identifying the cost drivers which are then related back to the design. So the engineers can make intelligent decisions, purchasing knows what it should cost a supplier, and the result is cost reductions while maintaining quality and functionality. This is the tool that links product development to lean manufacturing and supply chain management. We are very fortunate that Jim Rains is bringing this precious information to us all."

Jeffrey K. Liker, Ph.D.
Author of *The Toyota Way*

Target Cost Management

The Ladder to Global Survival and Success

JIM RAINS

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

A PRODUCTIVITY PRESS BOOK

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

Printed in the United States of America on acid-free paper
10 9 8 7 6 5 4 3 2 1

International Standard Book Number: 978-1-4398-3559-3 (Hardback)

Library of Congress Cataloging-in-Publication Data

Rains, Jim.
Target cost management : the ladder to global survival and success / Jim Rains.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-4398-3559-3 (hbk. : alk. paper)
1. Target costing. 2. Cost control. I. Title.

HD47.35.R35 2011
658.15'52--dc22 2010025387

Visit the Taylor & Francis Web site at
http://www.taylorandfrancis.com

and the CRC Press Web site at
http://www.crcpress.com

Contents

Preface

My first exposure to this thing called target costing was upon reading an automotive best practice study conducted from 1991 to 1993 by Arthur Andersen. The findings of this study impressed me very much. I was surprised at how different the practices used by Japanese car companies were to my experience at General Motors. To my knowledge this work was some of the very first English written material on the subject of target costing. It was about this same time that members of the Japanese delegation that annually attend and present to the SAVE International Conference gave presentations on this subject. At this point my interest and thirst for information was on high alert. In the mid-1990s Cooper and Slagmulder's (1997) book *Target Costing and Value Engineering* was published. Everything in this book made so much sense to me, and I knew I needed to learn more about this methodology.

During the 1998 SAVE International Conference I arranged for a meeting with Dr. Masayasu Tanaka and other Japanese attendees. I prepared a list of about 25 questions and submitted the list to Japan before their arrival. The meeting was scheduled for 90 minutes. The discussion went into such immense detail that only the first three questions were answered. From this learning experience the following year I scheduled a 2½-hour meeting and prepared only five questions. Again, as in the first meeting, the discussions were very detailed, and again only the first three questions were answered. Since that time I have had numerous meetings with Japanese experts both in Japan and the United States.

In 1999, I attended and was a speaker at the Third Annual Target Costing Conference held in Cleveland. The conference was cosponsored by the University of Akron and the Consortium Advancement of Manufacturing International (CAM-I). CAM-I had completed its own best practice study on target costing, and I was invited to participate in their one-day target costing training class. There were several great speakers at this conference that enhanced my knowledge on this subject.

In 1999, I made my first trip to Japan and began visiting companies that excel in target costing and value engineering. These visits from 1999 to the

present have afforded me the opportunity to gain invaluable knowledge into the inner workings of some great companies.

Immediately upon my retirement from GM, I worked part-time for a Japanese firm headquartered in Tokyo called Alpha Brain. The founder of Alpha Brain was one of the original developers of cost tables in Japan. Over the years he accumulated an extensive best practice cost database that allowed users to predict future costs and to better negotiate purchased part costs with suppliers. While I had an opportunity to work for this company for only one year, it was a very valuable experience.

In 2001, I created and first presented the concept described in this book, the ladder of global survival and success. That presentation was made at a lean manufacturing conference on September 10, 2001. We all know where we were on the next day, September 11. Lean manufacturing was only on the second rung in my original version of the ladder. I did not know how a room full of lean experts would take my presentation that lean was not rated much higher on the ladder. However, I feel, based on my explanation, it was well received.

Since the ladder concept was developed I have used it in some way with every client that I have worked for. As you might imagine, there have been widespread levels of acceptance. One of the earliest and strongest proponents has been Ingersoll Rand. Their interest was great enough to support a 2½-day training seminar that featured Dr. Masayasu Tanaka and myself.

Over the years there have been several discussions with Dr. Tanaka to coauthor a book together. It seems that his busy schedule had other priorities. Thus, it became necessary for me to do it on my own. In most books of this type, the author has had extensive experience doing and working with the techniques that are being written about. I must admit that to the best of my knowledge, I am not aware of any company in the United States that has fully embraced and utilized the concepts described in this book. Portions yes, but not even close to the institutionalized effort that it ultimately required. So, no, I have never employed these techniques myself. It is an unfulfilled dream to do so. I would have never left General Motors if the company had wanted to follow the lead of Toyota and begin the target costing journey. My pleas with GM leadership to learn and practice target costing fell on deaf ears.

Acknowledgments

First, my gratitude is extended to our God and creator for giving me the knowledge, skills, and perseverance to complete this work. While some negative comments appear in this work, I am grateful to General Motors. Without my career at GM, none of this would have been possible. Working at GM for a total of 32 years, I gained considerable insight into numerous business practices, both good and bad. Learning takes place from the analysis of both. For nine years in my consulting business, I express my appreciation for my many clients. As my customers, it is my clients that provide me with the financial means, additional knowledge, and experience to better prepare me for this work. Don Gerhardt, PhD, has been especially a strong supporter of my work. Don, you may not even realize it, but your encouragement has been a blessing to me. I am extremely grateful for my Japanese friends and business associates. Thank you to all the officers, past and present, of the Society of Japanese Value Engineering. Your efforts to establish contacts at leading companies in Japan for me to visit have been extraordinary. Personally, Mr. Yoshihiko Sato and Dr. Masayasu Tanaka have worked with me for many years. I have learned so much from both of you. Your personal assistance, training, and support to me can never be repaid. *Dōmo arigatō*.

I love my work and I love my family. Blessings to my wife, Debby, my daughters, Holly and Brianne, and their families, to whom this book is dedicated.

Introduction

According to the PhD dissertation of Duward Kenneth Sobek II ("Principles That Shape Product Development Systems") at the University of Michigan, many researchers have studied the product development problem, and volumes of books and articles fill shelves of bookstores and libraries. In general, the results of this research have been twofold. First, studies have demonstrated that every successful product development organization has the same set of broad goals: develop high-quality products at the lowest cost possible, bring the product to market in the shortest time possible, deliver to the customers a product they need and are excited about using, and do so at a profit. Second, in response to these demands, many tools, techniques, and methodologies have been developed in order to help organizations improve their product development systems and achieve their goals. Thus, the question begging to be asked is: Why do so many companies fail to achieve the ultimate success that they desire? Obviously there are many opinions as to the answer. In essence, my opinions are expressed in this writing. It is my hope that businesses that strictly follow the concepts described in this work will ultimately achieve the levels of profitability that are needed to go beyond survival and to achieve ultimate success.

ARTHUR ANDERSEN BEST PRACTICE STUDY

In 1993, when I was working with General Motors, I was presented two detailed Global Best Practices reports conducted by Arthur Andersen. The first report, entitled "Product Development: Global Best Practices," detailed its findings on automotive best practices in product development. Arthur Andersen called this QCT product development. QCT stands for quality, cost, and timing. At the same time, Arthur Andersen conducted research and best practice study on cost management. Participants in this research were:

- Chrysler, Ford, and General Motors in the United States
- Toyota, Nissan, and Honda in Japan
- Audi, Mercedes-Benz, Porsche, and Volkswagen in Germany
- Dozens of automotive suppliers in Japan and the United States

The study took approximately two years to complete. When I read the report I was simply amazed at the processes and methodologies employed by Japanese companies vs. those used at Western world companies, specifically General Motors, with which I was most familiar. The differences in product development and cost management were so vast, it was reported that the Japanese did not believe the report was valid. The Japanese attention to cost during product development, even in the early 1990s, was very significant, while at the same time Western world companies paid little or no attention to cost during the product development process. Japanese leaders told Arthur Andersen that this information had to be false, because in their way of thinking, no company would be able to survive in the global competitive marketplace without detailed cost knowledge during product development. Perhaps this was a prediction of the future as we know it today.

Knowing what we now know (in 2007 through 2009, all U.S.-based automotive companies suffered significantly), the Japanese were correct. Ford barely avoided bankruptcy proceedings, and of course Chrysler and General Motors did not and needed government support to exist. What is also amazing to me is that once this report was distributed to all the companies that participated, nothing was done at GM, Ford, or Chrysler to catch up to the Japanese product development and cost management concepts. In essence the Japanese approach called *genka kikaku* or target costing, which they had been practicing since the early 1960s, was ignored by Western world companies.

The study results were performed many years ago, but may I suggest that they are still valid today in most if not all businesses. The assessment summary results from the product development study were:

- **Almost all of the Japanese status assessment participants define simultaneous engineering as "planning and deploying quality, cost, and timing targets," while the U.S. and German participants overwhelmingly claim simultaneous engineering means "integrating product and process design activities."** The Japanese

definition is more progressive and encompasses the product-process definition identified by the U.S. and German companies. Not only is the Japanese approach to simultaneous engineering more progressive, but Japanese participants claim they have been effectively practicing their form of simultaneous engineering much longer than the other companies have been practicing the more limited approach.

- **All of the Japanese carmakers say their strategy is to be a technology leader.** Japanese participants say technology is important to excite consumers and meet government regulations. A number of companies, however, told the study team that Japanese carmakers may not continue to be technology leaders because profit and cost pressures are reducing their ability to make investments in new technology. A mixed opinion about being leaders vs. followers is provided by the U.S. auto companies. Perhaps some of the same economic pressures that now face Japanese companies have caused some U.S. carmakers to shift their focus from being technology leaders to being rapid followers.
- **Japanese carmaker responses about the most effective ways to achieve cross-functional integration differ from those of their U.S. and German counterparts.** Japanese carmakers believe that the most effective ways to promote cross-functional integration are common development processes that clearly define cross-functional responsibilities, use of a heavyweight product manager system, and coordination through top-level management meetings/committees. Japanese companies believe that cross-functional integration will not occur at lower levels in the organization if it does not exist at the top of the organization. They also believe that American management does not pay enough attention to the development process. Japanese carmakers explain that having top-level management monitor and evaluate targets throughout the development process forces cross-functional coordination and discipline. Conversely, U.S. and German carmakers focus more on the use of colocated cross-functional development teams as a way to achieve cross-functional integration.
- **Japanese companies use quality tables, similar to quality function deployment (QFD) tables, but there are key differences between the way quality tables are used by best practice companies and the way QFD is described in textbooks.** For example, many textbooks describe QFD as the framework for the entire development process.

In Japan, quality tables are considered to be a tool and are used when they are needed (e.g., when a subsystem requires new functionality or for other major changes). Another difference is that, although quality tables may be used in multiple development stages, they are not as elaborately linked, as often described in QFD literature. Japanese companies cautioned that quality tables can be very time-consuming to develop and can cause an organization to inappropriately emphasize quality over cost.

- **There is clear consensus among Japanese carmakers that a product's introduction date should not change, and that product programs are seldom launched later than originally planned.** Most U.S. and German companies report their product programs are more frequently launched later than originally planned, and that they are more likely to let key timing targets slip during the development process.
- **While both Japanese and U.S. carmakers report approximately 40% of their total product design effort is redesign, the two groups differ in their views about whether their redesign efforts are necessary.** Japanese carmakers believe most of their redesign is necessary because it is a key element of their problem-solving efforts, while U.S. carmakers predict that half of their redesign work can be eliminated. German manufacturers claim a much lower level of redesign work in their development process. (Author's note: My findings are that Japanese companies have far fewer engineering changes during product development than their Western world competitors.)
- **Product development problems rarely surface later than they should in Japanese vehicle manufacturer organizations, whereas U.S. carmakers admit that product development problems often surface later than they should.** Both Japanese and U.S. companies say the magnitude of problems are often underestimated when they are first surfaced. They also claim their analytical problem-solving tools are often inadequate to address problems when they are first identified. Japanese companies explain that when problems are not identified as early as they should be, the reason is often that the formal evaluation process failed.

The Arthur Andersen's "QCT Cost Management Global Best Practices," the summary findings were:

- **All the Japanese-owned companies say that "market price – target profit = target cost" is the thought process used in their cost planning system.** In contrast, two of the three U.S. vehicle manufacturers and approximately two-thirds of the U.S. suppliers indicate that "cost + profit = price" is their most prevalent thought process.
- **Although all of the vehicle manufacturers believe that value engineering is extremely important to reducing costs, only one U.S.-owned vehicle manufacturer says it is effectively using value engineering.** All participants in Japan say their companies are effectively using value engineering.
- **All of the vehicle manufacturers believe that it is possible to accurately estimate at least 80% of a product's final costs during concept development.** (Interestingly, one Japanese vehicle manufacturer told the study team that accurately estimating only 80% of the costs during concept development is unacceptable because the remaining 20% of the costs could eliminate the target profits. That company wants to be able to accurately estimate 100% of costs during concept development.) All three U.S. vehicle manufacturers and one of the Japanese vehicle manufacturers believe that their cost estimating activities need to be significantly improved.
- **Suppliers who supply parts to both U.S.- and Japanese-owned vehicle manufacturers point out that Japanese-owned vehicle manufacturers' life cycle sales volume estimates, provided while the vehicle is still in development, are usually accurate within ±5%.** In contrast, the suppliers say that U.S.-owned vehicle manufacturers' life cycle sales estimates are often overstated by 11% to 25%. The Japanese-owned vehicle manufacturers view the estimates as **commitments** and hold sales accountable for achieving their commitments after the vehicle is in production. Conversely, none of the U.S.-owned vehicle manufacturers believe those responsible for making sales volume predictions are held accountable for their estimates once the vehicle is in production.
- **All of the Japanese-owned vehicle manufacturer participants say that profit targets, cost targets, capital investment targets, quality and performance targets, and development budgets and schedules are each effectively monitored and evaluated during the vehicle development process.** In contrast, U.S.-owned vehicle manufacturers indicate that these factors are not effectively monitored and evaluated.

When I read these reports, I loved what I read. The above summaries just scratched the surface of the detailed information that was presented in these reports. The reports piqued my interest, as I believed completely in the concepts that the Japanese were utilizing. I was shocked that GM, Ford, and Chrysler were so far behind. I was scared that as a GM employee my future with that company was in jeopardy. At that moment, I knew I needed to learn as much about target costing as possible. That learning, since the early 1990s until now, has been captured in this book.

IMPORTANCE OF CHANGE

In my workshops I have always felt that my basic function as a facilitator is to encourage change. The only way to solve problems and improve a business is to make change happen. I often refer to Darwin's theory of evolution: It's not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change.

While Darwin was focused on biological complex substances, I believe his theory is also appropriate in discussing the survival of companies. Change must occur. But not just any change. Change for the sake of change will not cut it. Change to improve is the type of change I refer to in this book.

In all of my value improving workshops, I like to begin the discussion of change with the participants. Why is change so important to the success of an organization, yet so difficult to achieve? Why do we all know that change is necessary and an essential ingredient of life, yet fight so hard against it? Why do people resist change despite the known fact that without change the organization cannot grow or improve? In short, why is change so difficult? Encouraging change needs to be the mindset of every leader in the company. For me, during my career at General Motors, I was anxious for change, but too many times heard words like "Don't rock the boat," "Let it go," and "If it's not broke, don't fix it." These comments were leaders telling me that innovation and creativity were not wanted or important. They were telling me to go back to my corner and just plod along. Are you telling your employees these things, or are you the catalyst for change?

I have always felt that an organization that does not allow its people to fail will fail as an organization. When people are not allowed to fail,

they will not be creative, they will not try to be on the leading edge, and they will not take any risks. When you look at famous inventors like the Wright Brothers, Thomas Edison, and Charles Franklin Kettering, they all had one thing in common: They were not afraid to take a risk. Their thought process of failure was that it was good information to have. What failed, why did it fail, and what can I learn from the failure to make it better the next time? If you read the stories of any of this set of inventors, you will certainly learn that failure was a major part of their ultimate success.

Alfred North Whitehead suggested that "the art of progress is to preserve order and change and to preserve change amid order." This statement, according to Dr. Rosemary Fraser, FSAVE, "refers to the ever-present interplay between stability and predictability on one hand and growth and change on the other. In the case of both individuals and organizations," says Fraser, "it is essential that stability is coupled with change. Too little change leads to the inability to adapt to new environments, while too much change results in instability and deterioration in performance. The key, then, is to determine and maintain optimum levels of each and manage change effectively."

All our habits start out on a conscious, deliberate thought level. They become automatic and free-flowing through repetition. Through repetition they free-flow to a point where you no longer need to consciously think about them. Habits are necessary to allow us to do several things at the same time. So habits are good. They do a lot for us. Habits are good so long as everything stays the same. It is when technology changes, when things change in your business, when new, unexpected challenges arise, that the trouble begins. Stress occurs. Frustration rubs nerves raw. When free-flowing habits become obsolete, watch the sparks fly.

Some people can get up in the morning, go through their habitual morning routine, drive to work, settle in, do the regular things they do, and perform by rote—and they might not wake up until 10 o'clock. They've got it down pat. They flow. Then you change routines. You change a billing system, you change equipment, you adjust to the competition, you upset their old, tried and true, free-flowing, nonthinking habits. So you run into a great deal of resistance in your divisions, your departments, your companies, not because people cannot grow and change, but because you are putting them through an extra effort, an extra learning situation. They do not like it. Old habits die hard.

So you are going to get resistance to growth in your organizations. It would be nice if you did not have to learn new habits, did not have to think creatively once again, but your competition will not allow that. It would be nice if we could stay the same, but technology keeps changing. It would be nice if we could rely on old habits, but there is too much new information coming at us.

Now let us go one more step. It has to do with attitudes. For a working definition, attitudes are subconscious habits within themselves. An attitude is kind of a deliberate emotional response to a perceived situation. It's a predetermined emotional reaction to a given situation or stimulus. An attitude is a direction in which you lean. If you lean toward something you have a positive attitude, but if you lean away from something, you are said to have a negative attitude. Not good or bad, mind you. Not right or wrong. Just positive or negative. So how do you judge if a person has a positive attitude? It is when the person tries to seek and possess the good that he or she perceives in any situation. "I like it, I want it."

With a positive attitude you unconsciously do creative things to seek an objective, to achieve, to possess. With a negative attitude you will unconsciously lean away, try to get out of it through procrastination or creative avoidance. Restrictive thinkers tell us that we are "born with" our attitudes. But ask yourself this: Where did you get your attitudes? Your attitudes about selling? Your attitudes about music? Your attitudes about foods? To say that we are born with our attitudes is a cop-out. Our attitudes came to us as part of our lifelong conditioning process. They can be changed. All you need to do is decide to change attitudes that are inappropriate.

SURVIVAL AND SUCCESS

The ladder to global survival and success first requires the reader to better understand the author's definitions of survival and success.

Some common definitions of survival are:

1. A state of surviving, remaining alive
2. A natural process resulting in the evolution of organisms best adapted to the environment

In the corporate world then, survival ultimately means to avoid bankruptcy. Bankruptcy means utter failure, since the existence of the company is no longer there. Another way of saying this is then to avoid bankruptcy, a company survives. It seems that too many companies in the past, now, and predictably into the future are satisfied with merely survival. To these companies, remaining afloat, producing products, generating revenues, employing people, and some years generating a profit is the vision and objective.

Success definitions include:

1. An event that accomplishes its intended purpose
2. An attainment that is successful
3. A state of prosperity or fame
4. A favorable or desired outcome; also, the attainment of wealth, favor, or eminence

When leaders of major corporations are asked to define success, answers include meeting this year's budget, growing the business, increasing revenue, increasing profitability, and, some even say, being able to survive.

Our definition of a great enterprise encompasses much more than all the above-mentioned success definitions. The truly greatest and most successful companies are so superior to the competition that no other company can compete with them. We call this corporate mentality "boardroom war." In war the objective is to kill the enemy. Annihilating the enemy is the only measure of success in the battlefield. Thus, the best of the best enterprises see their success much the same way. The objective is to be so competitive that all your competitors do not survive. The objective is also to be so competitive that no other company wants to enter your business and compete with you. It is then that corporate success is achieved. Then once achieved, continuous ongoing effort remains in place to ensure the successful status stays intact.

Does it sound awful to have such a boardroom war mentality? To many, it may. However, if you are a corporate CEO, it must be your ultimate objective to achieve the ultimate success for your company, its people, its community, and its shareholders. Failure to be the best leads to failure, and failure in the corporate world leads to bankruptcy. Bankruptcy leads to drastic negative effects on many people's lives. However, the problem that we see is that most CEOs are just trying to survive. That is their definition

of success, and if they can raise the price per share of the corporation's stock price a little every year, that would be even better. Without the brutal and ruthless mentality of wiping out your competition, a company always runs the risk of a better competitor or many better competitors willing to ruin or wreak havoc on it. The more competitors, the tougher it is to even survive. It has been said that anyone can win a race if he or she is the only person running. Yes, of course with no competition life would be so much easier—maybe much like it was many decades ago, before we had the fierce global competition of today. Earning profits was so much easier then. Many companies had a regional market share all to themselves. Those days are now long gone. The only way to rise above the competition is to be better in everything you do. When your products are better and your cost is the lowest, you can reduce your prices to the point that the competition can no longer make money. After they lose enough money over an extended period of time, they go out of business. The so-called belly up.

As this book is being written the world economy is in disarray. Economists have debated whether we actually experienced a depression. Almost every corporation is fighting to just survive. Look at the auto and financial institutions. Many companies have required loans and government money to keep them from bankruptcy. That cannot last indefinitely. Sooner or later every company must be able to stand on its own to survive and then to succeed. Only the best of the best will survive and then ultimately prevail. The companies that do prevail will be the ones that have had the boardroom war mentality the longest and that execute a long-range plan to achieve that vision. Their competition will be annihilated.

During the 1980s, as a General Motors employee, I remember three levels of competitive standards:

- Best under General Motors (BUGM)
- World class
- Ruthless competitor

The best under General Motors was just as it says. Go find the best practice wherever it is within GM and bring it back to your organization. In the 1980s GM was extremely large and there were numerous "pockets" of success. The idea was to copy as many of those internal best methods throughout the company. As that was done, new and better practices

would be developed and an ever-improving corporate culture would grow. This idea is a good idea. Since any part of GM had no problem visiting any other part of GM, there was always someplace to go to see a better way of doing most any business practice. In reality, with a large company this is an excellent strategy.

Since at the time GM knew it was not world class, it was known there were practices outside of GM in other industries, many that were not competitors to GM, where lessons could be learned. In this scenario, based on the specific business element that we needed to improve, we would determine what other companies out there were best in class or what we considered to be world class. An excellent example of this is when I was working to improve housekeeping in GM's North American assembly plants. The team that I was working with and myself spent an entire day at Disneyland. At Disneyland we discussed with all the key leaders the methods and practices they used to keep Disneyland clean. You may be surprised, but from what we learned at this visit, we were able to put into practice many of the same concepts at GM facilities that Disney used at its theme parks.

Finally, there is the ruthless competitor. Yes, we actually called it that at GM. You want to be that ruthless competitor in your industry. The ruthless competitor is the competitor that you fear the most. You probably already know who they are. It is that one or two companies that give you that daily headache. The one that you are always compared to. The one that everybody says, "Why can't you be like them?"

So who are you and what is your company? The one that will go the way of the dinosaur, or the one that will work to be better than a survivor? Hopefully you will choose that you want to be the one that will accept challenges and begin to implement the concepts presented in this book.

QUALITY, COST, AND TIME

So much effort in this book is focused on cost in the product development process. This should not be interpreted to mean that the author does not support and appreciate the need for quality and time. Techniques for quality and time to market are listed on various rungs of the ladder that are discussed in Chapter 1. Many Japanese companies use quality tables

that are similar to the house of quality that you can create when using quality function deployment. In fact, I believe that quality and cost targets need to be set simultaneously and worked on as a component set strategy, as one has an impact on the other. Extraordinary effort needs to be placed on all three early in the product development process. When problems do occur in any of these areas, it is much better to identify and solve them as early as possible. Best-in-class companies know this and have a detailed process in place to ensure that any problem identification can be solved before significant costs are incurred or schedules need to be adjusted. Problems identified early need less time and money to be fixed. When required, an adjustment in human resources can be made to ensure the issue is corrected expeditiously.

Using quality techniques taught by Juran, Taguchi, Deming, and others is recommended. Design of Experiments (DOE), failure mode and effects analysis (FMEA), fault tree analysis (FTA), and root cause analysis (RCA) should be used as an integrated set to ensure product quality throughout the development cycle.

Product development schedule changes can be extremely disruptive. It is puzzling to me how companies like Boeing and Airbus can miss their new airplane launch date by several years. Best-in-class companies rarely miss a scheduled launch date. They have a cadence or level schedule in the engineering factory. The engineering factory is essentially set up like a manufacturing plant with a tact time that relates to each new product development program. Staggering the programs to remove variation in the development process will ensure more effective and efficient use of engineering resources. When one of the programs misses its due dates, it causes a ripple through all of the programs, just like in the manufacturing facility. However, the disruption is greater and it is more difficult to correct. Allowing the schedule to change may cause other targets to be missed as well. The integrity and credibility of the entire process is at stake. Discipline is required for all three elements: cost, quality, and time.

WHAT IS TARGET COSTING?

My definition of target costing is a system that plans for and expects a constant, consistent, and acceptable level of profitability now and far into the

future. When there is a long-range, well-defined profit plan, future profits become predictable as well.

The main activities of comprehensive target costing are:

- Planning for target cost and target profit
- Confirmation of the target cost and profit and allocation to main portions of the product
- Assisting and promoting the activities of target cost and profit and managing them in product planning, development, design, and manufacturing preparation stages
- Achieving the target cost and profit by the activities of all areas of the business
- Evaluating target costing activities for continuous improvement

Target costing is not just about setting cost targets. It is an entire value chain approach to managing an enterprise. Cost targets are not budget targets. Too many managers have been taught that budgets are what you spend. Cost targets, by contrast, are something that you achieve. Target costing is not a financial system. Typically financial systems are used by the finance department to report costs that have already been spent, rather than to manage cost expenditures before they occur. Target costing is not just for engineers. While engineering plays a significant role in target costing, the system requires all disciplines to be in consistent alignment with the needs of the customer. Target costing is not just for marketing. By the same token, if marketing does an expert effort in identifying the exact customer needs, the entire organization needs to be focused in support of those findings.

SUMMARY

Best-in-class companies know that to develop and produce best-in-class products requires an overall consistency. That consistency is maintained not just within the development processes, but across all corporate processes. Successful firms have a much higher success rate of identifying the needs of the marketplace and supplying products to meet those needs. The best-in-class companies have what Clark and Fujimoto called

product integrity. The best firms excel at meeting all quality, cost, and time targets. In the beginning your firm will most certainly need to focus on one of the three, but in the end, the objective is to be a leader in all three. This is not an easy or short-term journey. It will take a long-term dedicated effort and commitment to succeed. That is exactly why most companies are not successful. Surviving is their goal. They are not willing to make the short-term sacrifices necessary to be the best in the future.

1

The Ladder

Have you ever wondered how companies like Toyota, Nissan, Honda, Sharp, Canon, Hitachi, and others obtain constant, consistent, acceptable, and predictable levels of profitability year after year? Do you think this is done without a plan? Or a special system? What do they do that other world leading companies do not?

Do you want to:

- Improve and optimize project development schedules to improve your time to market?
- Have an improved understanding of what functions and features your customers are willing to buy?
- Know methods to better understand what your customer is willing to pay for desired functions and features?
- Improve product designs and value for your customers?
- Reduce product development costs?
- Understand your costs in such a manner that you will be able to determine product costs before you actually begin the product design?
- Enhance resource utilization and effectiveness?
- Fully institutionalize cost management into the DNA of the organization?
- Reduce waste, increase efficiency, and increase profits?

Target costing is the system that, when implemented properly, will guarantee business success. The success we are talking about is not just getting by with acceptable levels of profit. We are talking about world-class levels of profitability. To be honest, this journey is not easy. Leadership must stop the practices that got them to their lofty positions. They must change

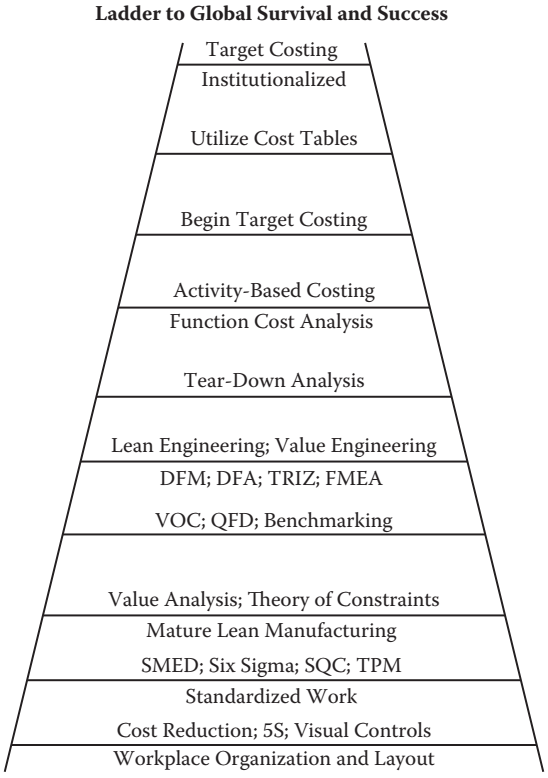


FIGURE 1.1
The ladder for global survival and success.

their ways and adopt a whole new way of thinking. Target costing is not a quick, "silver bullet" way to get rich. Target costing requires a company to drastically change the way it operates from beginning to end. Only the companies that truly want to be the best will make this change.

The ladder, in Figure 1.1, believe it or not, holds the secret to make it big in the corporate world. The ladder is meant to be exactly that—a ladder. Any corporation that thinks it can jump to the top of the ladder without progressing up each step at a time is only kidding itself. It will not be successful. Just as we use a ladder in real life, one rung at a time, so must corporate leaders progress up this ladder one step at a time. It is a long and rigorous journey, but when completed, it will ensure long, constant, consistent, and predicable levels of profitability. The first question that you may ask is, "How can one be so sure that this is the answer?" We have seen the best of the best adopt the target costing principles and concepts,

in the most competitive arenas of the world, and these are the ones that come out on top. The automotive industry is an excellent example, and Toyota, Honda, and more recently Nissan and Hyundai/Kia have demonstrated to the world that they are the best in terms of profitability. Any company in business that is not looking to be the best in profitability will not succeed. Studying and analyzing the up-front business operations of these companies proves they have the best methodology to ensure shareholder value. There are ten rungs to the ladder. There is much literature written on the techniques noted on rungs 1 to 5. The concepts on rungs 6 and 7 have less written about them, especially function-based costing. This book is intended to focus on the top three rungs. To focus on these rungs, some function-based costing information will be detailed. With that said, please do not underestimate the importance of the first seven rungs of the ladder. That underestimation will lead to failure, bankruptcy.

RUNG 1

Rung 1, in Figure 1.2, represents the simplest forms of continuous improvement. Rung 1 lists simple continuous improvement techniques, such as workplace organization and layout, visual controls, cost reduction, and 5S. The five Ss are *seiri*, *seiton*, *seiso*, *seketsu*, and *shitsuke*. In English they are:

- Sort: Define the purpose of the area. Distinguish the necessary from the unnecessary. Discard any items that are no longer needed, do not fit the purpose of the area, or have quantities that are too high. Special and strict rules should be placed on how often the remaining material will be used. Areas to examine include parts, equipment, supplies, information, furniture, signs, etc.
- Set in order: Now that all unnecessary material has been removed from the area, it is time to get it organized. Everything should be

Cost Reduction; 5S; Visual Controls
Workplace Organization and Layout

FIGURE 1.2
Rung 1.

functionally placed for safety, quality, and to eliminate the waste of motion in locating needed items. The three Es should be used: easy to see, easy to get, and easy to return.
- Shine: Get rid of trash and grime. Clean all floors, equipment, furniture, walls, lighting fixtures, etc. Cleaning is a form of inspection. People will feel better about their work area and problems will be more visible after this step is performed.
- Standardization: Use labels, floor markings, color coding, and other visuals to indicate where items should be located. Post a layout of the area and all required steps needed to be performed to ensure the workplace remains clean and organized. Put systems in place to readily identify abnormal conditions. Assign individuals who will be responsible for maintaining each area. Leaders will verify that the work is being performed and the area is kept clean. They will also use this opportunity to teach.
- Sustain: 5S toward continuous improvement requires that everyone in the organization is involved. It is a barometer telling how well a company is managed and how much worker participation is present.

If the first four steps of 5S are not sustained, or for that matter driven to constant and relentless improvement, corporate credibility is at stake. Workers will know that the company is not serious and thus will not buy into improvement. If a company cannot be serious about something as simple as 5S, then how can it be serious about any other value-improving techniques? Climbing the ladder as it is intended cannot occur.

Yet these simple techniques, if not employed or not employed properly, will lead to failure. Too many companies say they are doing 5S and visual controls, but the practice is not institutionalized and not every part of the organization participates. The practice is not done every day. The measurements to ensure constant continuous improvement do not exist. Continuous improvement means just that—continuous. This also means that continuous improvement is practiced and used continually by every employee. Professional athletes practice hard every day if they want to be the best. They even have to practice the simplest of skills to retain their top position. Many times you will see a professional golfer have a bad round and then go to the practice green and work on a certain shot that he or she had missed during tournament play. He or she will hit that shot over and over again. If that is what the pros need to do, then so do you. It must also

be said that this constant and continuous practice must be performed by all employees.

Starting here is critical for success. Equally as critical is how you go about doing these techniques. Please do not think of them as independent steps and activities. Start thinking about them as pieces of a puzzle. Think big picture first. Think systemwide first. Know before you start putting the pieces of the puzzle together what you want the completed puzzle to look like. It is important to maintain the system concept for every activity on every rung of the ladder as you progress on your climb.

RUNG 2

Rung 2, shown in Figure 1.3, deals with the beginning of a lean manufacturing process. Prior to the optimal lean journey a company must first put the basic elements in place to stabilize the processes. Single minute exchange of dies (SMED) is used to reduce changeover or setup times on equipment. This is essential to implement advanced elements of lean. World class is 10 minutes or less for a changeover. The total changeover time starts from the last good piece of part A and ends when the first good piece of part B is produced. Following quick setups, inventory reduction can begin to occur. Reducing raw, work-in-process, and finished product inventory takes money off of the factory floor and puts it in the company's bank account, so it can be used for other, more useful purposes. Why the financial systems count inventory as an asset makes no sense to me. Six sigma and statistical quality control (SQC), when properly utilized, will fix major quality issues and ensure that manufacturing processes are in conformance to customer specifications. Total planned maintenance (TPM) must be in place to improve equipment uptime. A minimum of 90% uptime is required, with goals approaching 95%. A manufacturing facility that essentially has a reaction-oriented maintenance system will always be putting out fires. When there are unplanned equipment breakdowns and

SMED; Six Sigma; SQC; TPM
Standardized Work

FIGURE 1.3
Rung 2.

repairs, a lean system cannot exist. Unusually high inventory is required to sustain customer orders in that type of manufacturing environment. A switch to proactive maintenance can be difficult in itself. With only a finite level of maintenance workers, how does one switch from reactionary to becoming proactive and preventative? The simple answer is to begin with one piece of equipment at a time. Start with your bottleneck operation and identify all the needed planned maintenance tasks to keep the machine constantly running. Then for each task determine the frequency at which the task needs to occur, such as once per shift, once per day, once per week, etc. You will also need to know how long the planned maintenance task takes to perform and whether the task can be performed when the machine is running or when it is shut off. Armed with this information about each task, a schedule must be developed that is strictly adhered to—no exceptions. The process continues until all machines in the facility operate on a preventative maintenance (PM) schedule.

When it comes to standardized work, not enough can be said. Without standardized work in place there is no basis for measurement to occur. Without a basis for measurement to occur, there is no improvement. So a strict adherence to establishing and maintaining standardized work in all levels of the organization is necessary. When I mention standardized work, I am not just referring to the manufacturing organization. In a truly best-in-class company standardized work is practiced in every department of the company. Standardized work is so important that every employee needs to be trained in it. Each person must understand that standardized work is necessary and something that he or she does. It is not something that someone does for him or her. An in-depth knowledge and understanding for every worker in every department is critical. It must be said that the standardized work described here is not the same as the methods used by the industrial engineering pioneers in the early 1900s. Time and motion studies were used by leadership to measure work performance. When actual work performance was less than the expected or standard work time, punishment was distributed to the failing workers. Under this system, time and motion studies are still necessary and original industrial engineering techniques can be used to ensure the methods being used offer high performance and operator safety, but they are not used for punishment. They are used to establish the current best method to perform any job. That becomes the standard work to perform the task, and it remains so until a new and better method is identified and validated.

It is sad to note that too many companies feel that once they have achieved this level of the ladder they are already at the top. I am sorry to report that their journey to total and complete survival and ultimate success is just getting started. Stopping at rung 2, at best, can only lead to mere survival and just getting by at the very best. Six sigma has been a buzzword for some time, as has been lean six sigma. Unfortunately, the real winners of this process technique have been the consultants that offer the green and black belt certifications. The return on investment for the companies hiring the consultants has not been outstanding. Still, the concepts that six sigma was developed from, based on the work of Deming, Juran, and Taguichi, do make sense to use and employ. It's just that having a green belt or black belt project for every employee does not make sense. Six sigma incorporates statistical quality control concepts. Maintaining capable processes is key to moving up the ladder. Unfortunately, it appears that too many companies tend to focus too much on six sigma, and because of the amount of money they have spent to train people to use it, they believe six sigma should be used to solve any problem in the company. This should not be any organization's attempt for six sigma. Like any other tool in the toolbox, it has a specific need and purpose for which it should be used. It must be stated, however, that even some the best quality control companies in the world, including Malcolm Baldrige Award winners, have gone bankrupt. In *The Toyota Way Fieldbook* the authors, Liker and Meier (2006), describe some of the key flaws of an overadvanced six sigma company. One of the common flaws is the anointment of individuals as green belts or black belts and giving those individuals special status in the organization. The problem becomes that because there are so many of them, to justify their existence they are on the constant prowl to find meaningful projects to work on. The flaw is that they have little or no understanding of the processes they are trying to improve, and that they on purpose minimize other people's involvement. The key to six sigma or any quality improvement technique is not to try to make everyone believe that you are a high-quality company because you have X number of people trained in these methods. Rather, it is to put in place the quality techniques necessary to ensure that you are truly producing high-quality products that the customer is willing to buy at a certain price. It is to identify quality problems and fix them as quickly and inexpensively as possible.

Making it to rung 2 does not guarantee survival, let alone success.

Value Analysis; Theory of Constraints
Mature Lean Manufacturing

FIGURE 1.4
Rung 3.

RUNG 3

The third rung, shown in Figure 1.4, presents a higher level of sophisticated techniques. The theory of constraints and value analysis force an organization to dig a little deeper and force a greater level of understanding of its business, its processes, and its product designs. Mature lean manufacturing builds upon the elements from the previous ladder rungs.

Where on the first rung we have cost reduction, value analysis offers significantly greater cost reduction potential while at the same time focusing on maintaining or improving customer value. Cost reduction is part oriented. Value analysis is function oriented. Function-oriented thinking offers greater mental freedom to the users. By unconstraining one's thinking, the number of ideas that can be created is enormous, especially when compared to using traditional cost reduction techniques.

Function-oriented thinking clears the mind of what things are and replaces them with new thoughts about what it must do. Value analysis (VA) was invented in the 1940s under the direction of Larry Miles, an engineer and sourcing agent for General Electric. Due to raw material constraints imposed by high demand during World War II, Mr. Miles developed the function thinking approach. He determined that the users only required that a function needed to be performed, and it needed to meet certain specifications. He also determined the customer cared little about how that functional requirement was met. Thus, using functional thinking, he was able to meet or exceed customer requirements even though there were numerous raw material shortages that prohibited others from doing the same.

The value equation, shown in Figure 1.5, is the simple basis for value analysis. In this equation, function is defined as what the customer wants the item to do. If we are studying a product, the customer expects the

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

FIGURE 1.5
The value equation.

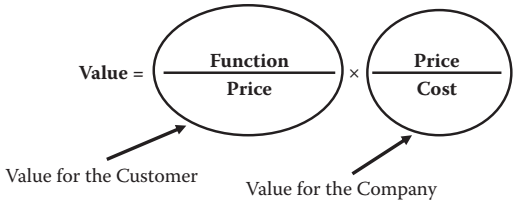


FIGURE 1.6
Value equation used in Japan.

product to perform, act, and look in a certain way. Most Japanese companies look at the value equation slightly different, as displayed in Figure 1.6. Then when you solve the equation, price cancels out and we are left with the original value equations.

Since we are only interested in improving value, we need to look at the various ways to do that. Actually, there are five ways to improve value.

1. Increase function and decrease cost
2. Keep function the same and decrease cost
3. Increase function and keep cost the same
4. Increase function at a greater rate than increasing cost
5. Decrease function at a smaller rate than decreasing cost

You need to be very careful when you decrease function. You should never take function away that the customer feels is necessary and is willing to pay for. However, we almost always find unnecessary functions in our work.

SAVE International (www.value-eng.org), the premier society that promotes value engineering around the world, has developed a value engineering (VE) standard. The SAVE standard contains the VE job plan, which consists of the following phases:

- Information phase
- Function analysis phase
- Creative phase
- Evaluation phase
- Development phase
- Presentation phase
- Implementation phase

Details of the job plan are as follows.

Information Phase

Usually the information phase starts before a formal VA workshop. Most workshop facilitators conduct a preworkshop meeting. A typical agenda for a preworkshop meeting is:

- Review of the project to be studied and why it was selected
- Identification of all the proper team members by discipline, skill, and need
- Creation of the specific objectives for the study that the selected team will be responsible to achieve. For product design studies the specific objectives are in three main categories:
  - What is the marketplace telling us that we need to fix? Using customer feedback, surveys, voice of the customer (VOC), warranty data, and field returns, we should have some design issues that need to be identified. We also need to assess the competition and determine if there are any features and functions or product inferiorities that need to be addressed.
  - What are our suppliers, fabrication areas, and assembly areas telling us about the product? If it is difficult to make or assemble, it is probably the fault of the design.
  - Finally, a cost reduction target needs to be established.
- Based on all of my team-building research I have learned that it is important to get 100% buy-in and commitment from the team members to the objectives. If any team member has an issue with any of the objectives, it needs to be openly and constructively discussed with the team and dealt with accordingly.
- Then depending on the project type, a checklist of detailed information that needs to be gathered prior to the workshop is reviewed and assignments made to bring that information to the workshop. Some information to be gathered for a product design study includes:
  - Costed bill of materials
  - Full complement of prints, drawings, and sketches
  - Forecast volume information
  - Process flow plan
  - Quality detail information, such as scrap and reoperation causes
  - Competitive teardown analysis
  - Customer information

- Actual parts and assemblies
- Supplier information

Function Analysis Phase

The simplest definition of the term *function* in the value analysis (VA) world is that which a product, process, or service must do to make it work and sell. I am not sure of the author of this definition, but I know it has been around for a while, since I first heard this definition in 1980. I am sure the definition gets its roots from the writings of Lawrence D. Miles. Mr. Miles (1989) wrote in his book *Techniques of Value Analysis and Engineering* that the "customer wants function. He wants something done. He wants something enclosed, held, moved, separated, cleaned, heated, cooled, or whatever under certain conditions and within certain limits; and/or he wants a shape, a color, an aroma, a texture, a sound, a precious material, or whatever to bring pleasure to himself and others. Thus, the language of function is the language of the heart of the problem. (p. 25)" Work functions, sometimes called use functions, describe how the product works and how it generates use to the customer. Work functions entail some form of action. Aesthetic functions describe the selling features of the product so that it pleases the customer and makes him or her want to buy the product.

Functions are described in very generic two-word connections. The first word is an active verb and the second word is a measurable noun. Mr. Miles (1989) stated, "While the naming of functions may appear simple, the exact opposite is the rule. In fact, naming them articulately is so difficult and requires such precision in thinking that real care must be taken to prevent the abandonment of the task before it is accomplished. (p. 27)" To accomplish this we need to find verb–noun combinations that are abstract and generic in nature. Active verbs describe what is do be done, and measurable nouns describe what the action is being done to. A measurable noun means just that. One must decide the unit of measure for the noun. If none can be determined, then a new noun must be created. Once one has a function, he or she should ask three simple questions:

1. Is it exactly what it does for the customer?
2. Is it exactly what the customer wants it to do?
3. Is that exactly what the customer believes he or she is paying for?

Function analysis is important because it alters the mental path of the user. Altering the mental path means that function analysis actually changes the way the user thinks about a particular product. The user no longer thinks about the product and what it is, but rather about what does it do and how else he or she can do that. This change in mindset is significant and the source of power in the value methodology.

Steps to Perform Function Analysis

There are four key steps to perform function analysis:

1. Random function identification
2. Functional analysis system technique (FAST) diagramming
3. Cost to function relationships
4. Identify the functions that have the best opportunity to improve value

Random function identification is the beginning of the function analysis phase. In this step functions are brainstormed in a random manner determining verb–noun combinations that describe the functions of the project under study. For a product design study, I usually have the team list a few functions for the entire product and identify the basic function from this group. Then we explore in detail each component of the bill of materials (BOM) and identify the function or functions of each and every part in the BOM. In administrative or manufacturing process studies you need to start with a detailed description of the process being studied. I like to use a sequence flowchart, but you can also use other forms, including value stream mapping. For each step of the process the actual time and elapsed time are important data to work from. In the function analysis phase you take each step of the process and identify all the functions that the step performs. The random list can become very long, perhaps over 50 functions for even a simple product and much more for complex products. I know to many this seems like a very laborious step of the process. But it is worth it. In Miles's book and many other texts we can find verb and noun lists that may assist the team in developing the most appropriate and precise functions.

FAST diagramming takes the function list from above and creates a relationship, or what some people call a function logic diagram. FAST diagrams are function oriented, not time oriented. Using the functions identified in step 1, they are displayed in a "logic format" that deepens their understanding among the team members participating in the study. A critical path

of functions is created by placing the functions in order by using a test of HOW/WHY LOGIC, consisting of two questions: HOW? … WHY? When HOW? is asked of any function on the critical path, the answer must be found in the function immediately to the right. When WHY is asked of any function on the critical path, the answer must be found in the function immediately to the left.

If the order of the function fails this two-way test, a function is either not placed correctly or not described correctly, or there is a missing function that needs to be identified and inserted.

One of the most important aspects of function analysis is the determination of cost-function relationships. It is this technique that identifies where unnecessary cost exists within the study item. Note that not all projects use cost-function relationships; however, this relationship is the most common. Other projects can be function relationships to time, mass, weight, or even a quality metric. The common numerator in all of these relationships is function.

A cost-function worksheet is used to help develop this technique.

1. Start by listing all functions between the scope lines across the top of the form.
2. List the parts or major subassemblies down the left-hand side of the form with the associated incremental costs.
3. Check off which function or functions each part or subassembly performs.
4. Determine how much of the cost of the part or subassembly belongs to each function. There are specific cost allocation techniques.
5. Add all columns vertically to determine how much cost is allocated to each function.

Identifying the functions that have the best opportunity to improve value is the final step in the function analysis phase. Per SAVE International, this step is performed by calculating the value index. The value index is a ratio of function cost to function worth. The function cost was just determined using the cost-function worksheet. Function worth is defined as the lowest cost to perform the function without consequence of failure. In the real world I have found the formal calculation of the value index to be extremely difficult, as most companies do not have adequate data to determine the function worth. However, once you have reached the top of the

ladder and follow all the techniques described to perform target costing, you will be in an excellent position to calculate the value index.

Creative Phase

This step in the workshop involves the listing of creative ideas. It is important to think only of functions during the creative phase. Function-oriented thinking helps to change our viewpoint. Human thought patterns must be altered to move into a new direction. We all know that our thought patterns have been developed over a very long period of time, in fact, some being formed before we were born. As we continue to grow and learn we become creatures of habit and tend to follow along the same paths, right or wrong. Thus, to say that we need to change the viewpoint of a person, we are saying that we are actually trying to alter the way people think and behave. This is very difficult, but for successful VA to result, it must occur in the minds of the team members. Without the force of function-oriented thinking this phenomenon cannot exist. Most creative sessions use traditional brainstorming techniques, but additional creative techniques such as Crawford slip writing, the Gordon technique, synectics, and bionics and biomechanics can be used.

Evaluation Phase

In this phase of the project, the VA team judges the ideas resulting from the creative session. The nonsense is separated from the more worthy ideas or thoughts. I have found it to be extremely helpful to place similar ideas and thoughts into common groupings or categories. The ideas listed in each category can then be compared to one another to determine which one offers the highest value. The advantages and disadvantages of each idea are discussed. Ideas are ranked based on savings potential, redesign time, and client acceptability. Ideas found to be not worthy of additional study are ranked low, and those ideas that represent the greatest potential are ranked high, then developed further. A weighted evaluation is applied in some cases to account for impacts other than costs.

Development Phase

During the development phase many of the ideas are expanded into workable solutions. This development consists of the recommended

design, estimated initial and life cycle cost comparisons, and a descriptive evaluation of the advantages and disadvantages of the proposed recommendations. Each recommendation is prepared with a brief narrative to compare the original design method to the proposed changes. Sketches and design calculations, where appropriate, are also prepared in this part of the study. It is necessary to complete a detailed action plan to ensure that each proposal gets included into the product design.

Presentation Phase

The last phase of the workshop is the presentation of results and recommendations to leadership. An oral presentation of the results is usually made on the last day of the workshop. The workshop findings, recommendations, the rationale that went into the development of each proposal, a summary of the performance improvements, cost savings, implementation costs, and action plans are presented so that the leadership will know first hand what changes should be occurring and when. In most situations the leadership will already be willing to help the team begin implementation to ensure the benefits are realized as soon as possible.

Implementation Phase

After the workshop is complete the most important element to move forward and create change is to implement the recommendations developed by the workshop team. Strict attention to following the Action Plan that was developed in the workshop is important and most critical to success. It is usually the VA team leader or recommendation champion that is held responsible and accountable for implementation to occur. Implementation in most cases is not easy. There always seems to be obstacles and roadblocks that must be overcome. Working through these issues will take time, energy, and perseverance. I like to say that the "tougher the game, the better it feels when you win." VA workshops without implementing results will eventually lead to the abandonment of this activity.

Integrating Lean with Value Analysis

The companies that excel in value analysis will do so through across-the-board utilization of this methodology. Most companies only use VA on

TABLE 1.1

Ideas That Result from Brainstorming the Function Form Shapes

Casting	Forging
Plastic injection molding	Rubber molding
Roll forming	Metal injection molding
Vacuum forming	Machining

existing product designs. VA is also just as important to use on manufacturing and administrative processes. If only lean is applied to these types of process, the identified waste will be reduced, even if the currently used operations or steps of the process are not the best or appropriate. A company will still feel satisfied that it removed waste. However, if VA is used and applied prior to lean techniques, a company will look at the functions of each operation and ensure that those functions are being performed in the best and most efficient manner. For example, if we are studying a stamping operation, we can apply all the lean tools and techniques by reducing changeover time to less than 10 minutes, increase the uptime to something greater than 90%, and have the most strict process capability that we can. We can also make sure that we have put in place a pull system (kanban) from the upstream operation to schedule our stamping press. If we did all of this, we would certainly be happy with our stamping operation. Function analysis, though, will force us to answer the question: What is the function of the stamping operation? Using VA function terminology, the generic two-word function, an active verb and a measurable noun, for the stamping operation can be said to "form shape." When one applies creativity to this function many ideas will surface. Numerous processes to form shapes will be listed. The initial list is shown in Table 1.1.

These ideas will multiply swiftly when we look at all the different forms of casting, forging, injection molding, machining, etc. This expansion is called combining, expanding, and hitchhiking. By analyzing each way to form a shape, we may determine that a whole new process is the best way to form a shape and replace the stamping operation as a process to make the part. Then we can implement this new process and apply lean concepts to ensure that all the waste is minimized.

The same can be said for steps in an administrative process or a product development process. The fact is that since value analysis is function-oriented and everything has a function, value analysis can be used on anything. Organizations have functions, so VA can be used to improve

an organization. Strategic plans have a function, so VA can be used to improve a strategic plan. Likewise, departments, individual jobs, financial systems, hospital and operating processes, law enforcement activities, and on and on, all have functions.

Lean Manufacturing

Lean manufacturing in many companies is the ultimate goal. They believe if they institutionalize a complete lean system they will have achieved success. Lean, of course, is the identification and elimination of waste. Moving up the lean chain includes balancing work to the tact time. Tact time is a calculation to produce today what the customer consumes today. The thought then is to balance and level schedule the entire factory to the consumption of the marketplace. Finally, kanban or pull systems can be utilized. Trying to install kanban without first ensuring the other elements of lean are all in place and working will lead to failure—bankruptcy. Once this is in place at the company's manufacturing floor, all the same concepts need to be spread to all organizations of the enterprise: purchasing, finance, quality, human resources, and especially engineering. Spreading to the supply chain is also part of attaining the status of achieving rung 3. Again, as with quality and six sigma, there have been many productivity leaders that have implemented lean across their business lines, organizations, and supply chain. But failure to move up the ladder has forced them into Chapter 11, and then to be killed by their competitors. There are numerous books dedicated to the concept of lean manufacturing. Please review those works to learn the details of establishing a total lean system. And that is a key, a lean system. Placing into effect pockets of lean activity is not going to lead to the measure of success that this book intends to emulate.

Theory of Constraints

The theory of constraints is based on the fundamentals of identifying the bottleneck operations and working only on those. The theory is that improving operations that are not the bottleneck will not improve your throughput, and thus not increase sales or revenues. Thus, a throughput improvement can only occur if the bottleneck operation is improved. Any and all processes have a bottleneck activity. In the manufacturing

arena you can identify the bottleneck operation by looking for the following hints. One clue is a buildup of work in progress before the bottleneck operation. Thus, monitoring the inventory throughout the value stream is a good idea. If some operations are starved for parts to run, then it is a good chance that the preceding operation is causing the bottleneck.

This seems to be a good spot to mention that this book refers to the proper deployment of these techniques. When it comes to a mature lean manufacturing organization I am referring to a company that has made or is working on a total system transformation. Too many companies think that if they are doing several kaizen workshops throughout the facility they are implementing lean. Unfortunately, they do not get the total big picture that is required to properly climb the ladder.

Another discipline that gets frequently misused is value analysis. I have seen too many companies call their cost reduction program value analysis. While value analysis is an excellent cost reduction tool, it is a specific methodology that must be followed. I have also been to companies that have invented their own methodology and call it value analysis, despite the fact that it does not include any function analysis, or at best give it only lip service.

When a company only climbs up to rung 3, it cannot see out of its ditch. It has blinders on. The blinders prohibit the organization to move beyond its own four walls. Having everything perfect inside, without knowing what is going on in the rest of the world, worked a few decades ago, before we had global competition. Global competition requires a successful business to remove its blinders and see beyond its own four walls. Failure to do so will most definitely lead to death.

RUNG 4

The concepts shown on rung 4 (Figure 1.7) are the first that enable a company to take off its blinders from within and begin to look outside of its own little world.

VOC; QFD; Benchmarking

FIGURE 1.7
Rung 4.

Rung 4 deals with learning and dealing with what the global marketplace is all about. Using voice of the customer (VOC) techniques a company can learn more about the marketplace. Any company that is not customer driven will never succeed. Mere survival will be its best option. Being customer driven means knowing what the customer wants and needs. This knowledge is not at the higher-order level, but at the minute detail level. Size, shape, colors, texture, and feel are all selling features as much as performance and quality. Customers have certain tastes that must be determined before design begins. Too many companies rely on the engineers to know what the customer wants. Others rely on the marketing and salespeople to relay that information to the engineers. In either event, that information must come from the customers. The opinion of engineers, marketing, and sales is just that, an opinion. Facts and data must be collected to know for sure. Today in many industries product development is too expensive to not get the product offering correct.

Our experience shows that many companies collect accurate customer information, but it is not complete. For this book and for the best-in-class companies, the information that we need to have data for is:

- Customer needs
- Customer wants
- When the need is required by (timing)
- What the customer is willing to pay for specific needs and wants
- What volumes will be sold at different pricing points

It must be noted that there are numerous methods that need to be used to capture this information. A well-trained, multidisciplined staff should be used to collect the required data. Without this total customer knowledge, a corporation is aiming blindly in its product development portfolio. The cost of failure often is catastrophic.

Quality function deployment (QFD) serves many purposes. A typical QFD looks like the model in Figure 1.8. Since it is shaped like a house, it is often called the house of quality.

First it helps to translate the customer wants and needs into engineering specifications. If done properly, they can also be translated into function terms that can be used in value engineering activities (to be discussed later). QFD interfaces extremely well with value engineering. One of the biggest problems that companies have is to translate the customer

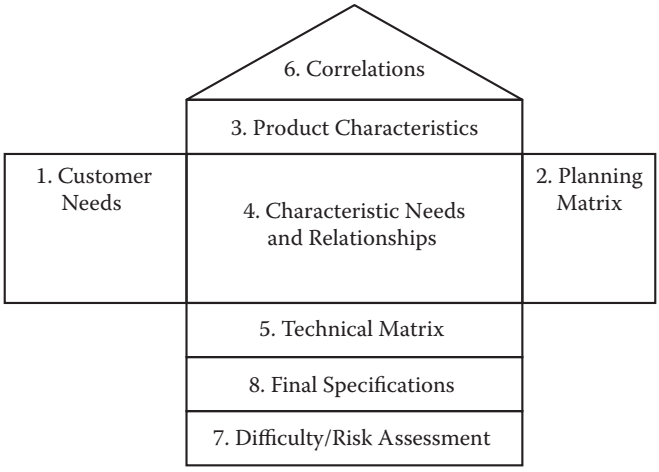


FIGURE 1.8
QFD model (house of quality).

information that is normally collected by sales and marketing into terms that product engineering can use to create design specifications. Usually in that translation key information gets lost or, worse yet, miscommunicated. In the QFD process you gather technical product characteristics. The conversion of the characteristics into functional terms can be valuable, especially at the earliest product design phase. Shown in Table 1.2 is an example of taking technical product characteristics from a study done on a refrigerator and then expressing them in function terms. These functions, along with all the other functions that the product performs, are used in an early VE study.

Second, QFD provides a basis to compare your company offerings to the offerings of your competitors. Knowing your competitors' strengths and weaknesses is important knowledge. This must be an honest assessment, however. Finally, through detailed analysis and risk management QFD helps to develop a specific strategy for future product offerings.

In 2003, on a benchmarking trip to the Hitachi Machinery Construction Company, we were told that a recent VOC exercise was done for a new product planning and development. They gathered information from 84 customers. The customer category groups were domestic, overseas, construction, and rentals. Over 1,800 customer needs were identified. The general high-value-ranked items were quality, reliability, serviceability, and special customer functions and wants.

TABLE 1.2

Conversion of Technical Product Characteristics into Functions

	Function	
Technical Product Characteristics	**Verb**	**Noun**
Ice bin and screw removal time	Ease	Disassembly
Ice bin on/off sensor	Control	Ice making
Transparent bin container	Indicate	Level
Focus group ice access rating	Permit	Accessibility
Taste/smell test after storage	Control	Taste
	Control	Odors
Icemaker volume	Maximize	Space
Icemaker removal time	Ease	Disassembly
MTBF—icemaker	Assure	Dependability
Freezing tray ice capacity	Maximize	Space
Freezing cycle time	Direct	Airflow
	Maintain	Temperature
	Control	Temperature
Ice tray shape option cost	Change	Shapes
Icemaker manufacturing cost	Ease	Assembly
Filter replacement time and cost	Ease	Maintenance
Digital ice level indicator	Indicate	Level
FG—dispensing control rating	Control	Dispensing
Focus group—indicator design	Indicate	Time
Ice crusher	Crush	Ice
Dispenser insulation efficiency	Maintain	Efficiency
	Insulate	Compartments
Dispenser manufacturing cost	Ease	Assembly
Dispenser noise level—front	Control	Noise
MTBF—dispenser	Assure	Dependability

Benchmarking is also included on rung 4. No company can be the best in all practices, processes, and systems. Thus, to be the absolute best, a company must determine which practices, processes, and systems it needs to improve. Once this list is developed using weighted criteria evaluation a priority list is developed. A company then determines what company is best in class in that specific activity and does everything it can to learn how the best-in-class company performs that activity. Often, if the company is not a competitor, it will allow your company to visit and observe firsthand how it is done. To receive this type of treatment, you normally have to establish a network at the top levels of the relating companies.

If it is a competitor that is determined to be the best in class in a particular activity, then getting firsthand information is much more difficult, but not impossible. As an employee of GM we developed several methods to gather information from competitors. Note, gathering the information was not GM's problem. Knowing what to do with it was another issue.

For several years, I have visited companies in Japan to learn more about their value engineering and target costing practices. It is through many visits to different companies and also repeated visits to the same companies to learn and review their progress over the years that I have been able to capture numerous concepts presented in this book.

Another element of benchmarking is to learn what not to do. Mentioned earlier in the introduction to better learn about housekeeping, I visited Disneyland. During that same analysis I visited many GM plants, some that were good and some that were bad. Knowing what not to do is just as important as knowing what to do.

Congratulations, you have taken the blinders off. Now that we have collected all the knowledge that rung 4 requires of us, it must be used. Failure to use this valuable information would be stupid and a waste of precious resources of people and money.

RUNG 5

Rung 5 elements, shown in Figure 1.9, provide the techniques needed to take properly collected customer information and apply it in the product development process. Lean engineering, value engineering, design for assembly, *teoriya reshoniya izobietatelskikh zadatch* (TRIZ), and failure modes and effect analysis (FMEA) are great tools.

Yet these tools are only great if they are provided with correct and valid information. The old saying "garbage in, garbage out" certainly applies here. The information gathered in rung 4 must be complete and accurate. Care must be given to make this happen. Again, this is why using each step of the ladder and building one upon the other is so critical.

Lean Engineering; Value Engineering
DFM; DFA; TRIZ; FMEA

FIGURE 1.9
Rung 5.

The most valuable technique on rung 5 is value engineering (VE). The key concept in VE is to recognize that the final output is not the product, but the functions and how well those functions are delivered to the consumer. Every major successful manufacturing company utilizes VE early in its product development process. VE, like VA, is function oriented. VE is used on products and processes that do not exist and is done during the development process. Value engineering is used in construction. All value improvements must be made during the design phases of a construction project, since it would be essentially impossible to make any changes to a facility, highway, waste treatment plant, or dam after it is completed. Manufacturing companies need to think of this the same way. Making changes to a product design or process always costs more after they exist. In many cases the cost of change cannot be justified.

In the beginning of VE in Japan, Japanese companies immediately recognized this benefit. They called value analysis, which is after the fact, second-look VE, because it is exactly that, a second look. Thus, first-look VE was created to review product and process designs during product development. This started in the design phase. After perfecting this, it was determined that the application during the concept phase of product development was very useful. This came to be called zero-look VE. Now some companies in Japan even start using VE prior to concept and call that inspirational VE.

Results of a recent survey of over 300 major companies in Japan indicate that value engineering is used by all but 1%. Most use VE as their premier technique to ensure costs are controlled very early in the product development phases, starting with preconcept. It seems most Western world companies have not learned how to do this, and thus do not realize the tremendous competitive advantage it is to know your costs going into the design phase, rather than coming out, or even much later.

As mentioned during the value analysis discussion, a broader use of VE needs to be expected. VE, even in the early product design stages, should also be used for the design of manufacturing processes, equipment, and tooling. VE can also be used to study the engineering design process, product distribution and logistics, and the servicing of one's products in the marketplace.

What is amazing is that all the other techniques on this rung integrate very well with VE. Design for assembly (DFA) and design for manufacturability (DFM), while being a part-oriented technique, can be used in

the VE job plan. For example, DFA is used in the information phase, and DFM can be used in the evaluation and development phases.

There are several design guidelines that come into play when using DFA. Simplify the design and reduce the number of parts because for each part, there is an opportunity for a defective part and an assembly error. The probability of a perfect product goes down exponentially as the number of parts increases. As the number of parts goes up, the total cost of fabricating and assembling the product goes up. Automation becomes more difficult and more expensive when more parts are handled and processed. Costs related to purchasing, stocking, and servicing also go down as the number of parts are reduced. Inventory and work-in-process levels will go down with fewer parts. As the product structure and required operations are simplified, fewer fabrication and assembly steps are required, manufacturing processes can be integrated, and lead times further reduced. The designer should go through the assembly part by part and evaluate whether the part can be eliminated, combined with another part, or the function can be performed in another way. To determine the theoretical minimum number of parts, ask the following:

- Does the part move relative to all other moving parts?
- Must the part absolutely be of a different material from the other parts?
- Must the part be different to allow possible disassembly?

DFA can be used on your products, but it is advised to include competitors' products as well. Both DFA and DFM can be used in the evaluation phase and in the implementation phase to evaluate and then fine-tune the final recommendations.

Teoriya reshoniya izobietatelskikh zadatch (TRIZ) is a Russian technique that can be utilized to enhance creativity and idea generation. TIPS is the acronym for the English translation of TRIZ: theory of inventive problem solving. TRIZ was developed by Genrich Altshuller and his colleagues in the former USSR. The practice started in the late 1940s and is now being practiced throughout the world. TRIZ research began with the hypothesis that there are universal principles of invention that are the basis for creative innovations that advance technology, and that if these principles could be identified and codified, they could be taught to people to make the process of invention more predictable. The research has proceeded in several stages over the last 50 years. Over 2 million patents have been examined, classified

by level of inventiveness, and analyzed to look for principles of innovation. The three primary findings of this research are as follows:

1. Problems and solutions were repeated across industries and sciences.
2. Patterns of technical evolution were repeated across industries and sciences.
3. Innovations used scientific effects outside the field where they were developed.

In the application of TRIZ all three of these findings are applied to create and improve products, services, and systems.

Lean engineering is an important element to survival and success. Time to market is critical in the current global environment. For simple survival a company must move at least at the same speed as the market leader. Only recently (within the last 15 years), in the Western world, has it been discovered that the actual design process itself must undergo the watchful eye of lean and synchronous concepts. Lean engineering is defined as the production of quality engineering deliverables with a minimum consumption of time and resources in a stable, capable process. Thus, lean engineering takes lean manufacturing concepts and applies them to the product development process. The entire objective is to identify and eliminate waste in the process to improve productivity, reduce cost, improve throughput, and reduce lead time. We believe that for a company to be truly lean, it must employ lean engineering concepts. It can be proven (and probably has been, but we do not have the facts available) that the best path to a total lean enterprise is to have a lean engineering organization. To achieve a lean enterprise, the product design must lend itself to lean; what we mean is a lean design will enable a lean purchasing department, a lean finance department, a lean marketing department, a lean service organization, and especially a lean manufacturing environment.

One definition of a synchronous organization is a systematic approach to identify and eliminate waste and non-value-added activities through continuous improvement in all products and services. Objectives of a synchronous organization are to:

- Optimize all resources to produce world-class products and services at the right time in the right quantities based on customer demand
- Establish an efficient and effective business system based on continuous improvement of our competitive position

- Eliminate or manage constraints to improve throughput and reduce inventory and operating costs

In lean engineering, design development processes and organization structure need to be reviewed and improved. For example, the comparison of point-based vs. set-based engineering approaches has been evaluated. In Sobek's doctoral dissertation "Principles That Shape Product Development Systems," he offers a comparison of each, shown in Table 1.3.

The differences in the two approaches are not subtle. The point-based approach used by most Western world companies tends to optimize components within the design, where the set-based approach works to optimize the entire product system. This difference becomes much greater when used on larger, more complex products, like airplanes, automobiles, etc. The set-based approach has been practiced by Toyota for many years and has resulted in improved products in cost and quality.

The product development cycle is becoming the critical, key link to an organization's success. The faster a company can develop and implement a new design, the better chance it has of becoming first to market with a key new technology, appearance, or clever product scheme. Moving design concepts from the "drawing board" (drawing boards are a thing of the past, with all new designs on the computer using 3D software and math models) to the production floor and into the showroom is now where companies must excel. Quality designs have been a given for many years. Cost-competitive designs have been given high consideration for many years as well, to ensure company profitability. But now so is rapid product development time. In addition to completing designs in record time, the cost to produce those designs is also extremely critical. Engineering resources are a premium expenditure. Thus, it behooves an organization to make the design community as effective and efficient as possible. This is what I call the lean engineering factory. Just like lean manufacturing, lean engineering must be a constant and pursued on a daily basis with all areas of the organization that relate to the product development process. Once funds and resources have been spent, the time to recoup that investment is critical. Thus, a decrease in time to develop and produce a product is a huge cost management activity. The faster the spent money can be utilized to generate sales revenue, the greater the benefit to your bottom line and cash flow position.

TABLE 1.3

Design Process Functions and Associated Point-Based and Set-Based Principles

Functionality	Point-Based Approach	Set-Based Approach
Search: How to look for design solutions.	Iterate on existing ideas. Brainstorm new ideas.	Define feasible regions.
Communication: What (ideas) to communicate to others.	Communicate your best idea.	Communicate sets of possibilities.
Integration: How to integrate the system.	Pass the idea among the team members for critique.	Look for intersections.
Selection: How do you determine which idea is best?	Elaborate formal schemes for selecting the best alternative. Make prototypes to confirm that the solution works.	Design, in parallel, each alternative until it is not worth pursuing further. Look for low cost test to prove infeasibility.
Optimization: How do you optimize your design?	Analyze and test the design. Modify as necessary to achieve objectives and improve performance.	(same as previous)
Specifications: How do you constrain others with respect to your own subsystem design?	Maximize constraint in specification to ensure functionality and interface fit.	Use minimum critical specification to allow optimization and mutual adjustment.
Decision risk control: How to minimize risk of "going down the wrong path"?	Establish feedback controls. Communicate often. Respond quickly to changes.	Establish feasibility before commitment. Pursue high-risk and conservative options in parallel. Seek solutions robust to physical, market, and design variation.
Rework risk control: How to minimize damage from unreliable communications.	(same as previous)	Stay within sets once committed.
Management: How do you control the process?	Review designs and manage information at transition points.	Manage uncertainty at process gates.

The following and many other techniques can be employed to ensure time to market:

- Establishing a tact time like cadence of product development programs and level scheduling them will reduce resource variation and enable more efficient and effective use of engineering resources, both human and equipment. Instilling a schedule discipline is necessary. Running several product development programs simultaneously through your engineering factory in a batch mode will cause capacity problems, missed schedules, and incur greater costs.
- Identify and solve problems early in the product development process. When this is done, much less disruption occurs to the schedule. Also, the cost to fix the problems identified early is much less than later in the development or, worse yet, production stage.
- Employ common parts and subassemblies within and across product families. There are many component parts that do not need to be redesigned. Most internal component parts have no influence on a customer's buying decision. Since these parts have essentially no impact on sales revenue, creativity on these parts is a waste and does not contribute to the profitability of your company. If you look at door hinges, as one example, on Toyota models you will see the same hinges used on various models year after year. Most other vehicle manufacturers do not do this and create new designs on every new model.
- Like using common parts, the utilization of proven technology will help ensure your time to market. New technology should be proven outside of a specific program and placed on the shelf ready to be deployed as needed. Trying to invent, design, and validate new technology tied to a specific product development program will almost always lead to schedule and cost issues.
- The use of design standards has enabled companies like Toyota to reduce product development lead time. Common and consistently used design standards that follow the continuous improvement philosophy maximize engineering skills, speed up the design process, and improve the quality of the finished product.
- Virtual validation can reduce lead time. Whenever product validation can be performed via computer rather than constructing prototypes will save time and money.

- Ensure that your supplier community is in compliance with your beliefs and is using many of these same techniques. It can be said that one of the main reasons Toyota is so great is that it has two suppliers that want to be as good or better than Toyota: Aisen Seiki and Denso. Both of these companies work closely with Toyota to ensure quality, cost, and time targets are met.

The last 18 months of my GM career was devoted to implementing lean engineering. At that time GM was essentially four times uncompetitive to Toyota in vehicle product development, as it took GM twice as many people and about twice as long to design a new vehicle. GM needed to change the way work was done. We used value analysis coupled with lean manufacturing concepts to develop new methods and processes that allowed work to be performed with improved productivity and reduced lead time. It is my opinion that lean engineering is much more difficult to implement than lean manufacturing. Manufacturing tasks are less complex, take less time to perform (seconds vs. weeks), are highly repetitive and easier to measure, and have been under study by industrial engineers for over eight decades. Engineering work is highly skilled, with technological advances happening at enormous speed. With the elimination of drawing boards and the implementation of designs totally on the computer, productivity enhancements are definitely occurring. However, measuring the effectiveness of these changes is rather difficult. Automobile factory workers are measured to the hundredth of a minute using standard time data that are fairly universally accepted, but engineering work does not have any standard time data, and only has estimates given by the people who do the work. Also, the engineering processes are complex, especially in the automobile and other high-tech industries. Thus, the ability to define, review, measure, and then improve engineering processes is much more difficult.

The point is: Even moving at a good speed in the direction of the competitiveness edge, if this is slower than the speed of the leader, it may take some time, but surely this company will not survive, or will have to increase the speed. Another challenge is that best-in-class companies are usually powerful in R&D and investment capacity. That is what makes them accelerate their speed continuously and what must be followed by those who want to survive.

Failure modes and effect analysis (FMEA) is a continuation of the quality effort initiated on rung 2; only it has the emphasis of identifying

quality or failure modes during the product design phase. Thus, like VE is cost avoidance, FMEA is failure avoidance. An FMEA is a procedure in operations management for analysis of potential failure modes within a system for classification by severity or determination of the effect of failures on the system. Failure modes are any errors or defects in a process, design, or item, especially those that affect the customer, and can be potential or actual. Effects analysis refers to studying the consequences of those failures. When FMEA is properly used in the early design development phases it can provide an analytical approach, when dealing with potential failure modes and their associated causes. When considering possible failures in a design—like safety, cost, performance, quality, and reliability—an engineer can get a lot of information about how to alter the development/manufacturing process, in order to avoid these failures. FMEA provides an easy tool to determine which risk has the greatest concern, and therefore an action is needed to prevent a problem before it arises. The development of these specifications will ensure the product will meet the defined requirements.

While others are not mentioned, there are many other value improving techniques that should be utilized to ensure that the most competitive product is launched and that the product development time is the shortest possible. A continuous improvement effort needs to be sustained for this to occur.

RUNG 6

Figure 1.10 has a single but important entry: teardown analysis. Many Western world companies say they do this and are completely satisfied with their activity and approach. Yet in our opinion few do this with the integrity and detail that is performed in world-class companies. Yoshihiko Sato, known as the father of teardown in Japan, has expanded teardown into a detailed science. Every company that I have visited in Japan uses the Sato method of teardown. Only by being taught and utilizing his methods via a trained facilitator, can a company truly learn and understand

Teardown Analysis

FIGURE 1.10
Rung 6.

this teardown approach at its fullest. Sato's definition of teardown as described in his book *Value Analysis Teardown: A New Process for Product Development and Innovation* (p. 1), is a method of comparative analysis in which disassembled products, systems, components, and data are visually compared. It is a technique by way of clarifying how the disassembled items differ from each other, and with the result to take away any advantage from the differences noted. Sato's approach is based on the belief that even identical twins are different. It takes a detailed analysis to identify every minute difference, understand the differences, and determine the benefits, if they exist, of the differences.

There are several teardown (TD) elements within the Sato methodology. They are dynamic, cost, material, matrix, process, and static as depicted in the paper written by Rains and Sato for the 2008 SAVE International Conference entitled "The Integration of the Japanese Teardown Method with Design for Assembly and Value Engineering."

Dynamic TD: Dynamic TD applies the principle of comparative analysis to the assembly process. Essentially the comparisons are focused on the effort and time it takes to assemble and disassemble the products being studied. It works very well to integrate design for assembly with dynamic TD. During this TD the company's products are compared to those of its competitors. Each is carefully disassembled, preferably using video cameras. Team members practice assembly and disassembly of all products under study. Minute attention to detail is necessary to compare and document differences among each product analyzed. Then it is important to time the actual assembly of each competitor's product and compare the time to that of the baseline product from the company organizing the study. The results of dynamic TD are reduced labor costs to manufacture and assemble a product and less capital expenditures.

Cost TD: The focus of the cost TD element is to make detailed comparisons of your product components with those of your competitors. Each component part may have many slight differences. Each difference is then noted and a cost estimate for this difference is determined. As in the dynamic TD, very minute details must be observed. Each detail of difference is recorded. The team members must then quantify the cost difference of each item noted, knowing some will be higher and some will be lower when compared to the base product. In

most product studies the majority of the cost saving ideas are a result of the cost TD element. This does not diminish the importance of the others, as they all contribute to a higher value product design for the customer and the company. Upon completion of the cost TD the result is reduced material and, in some cases, less overhead expense. Quality and performance improvements should also result.

Material TD: Material TD focuses on material choices, material surface treatments, and altering material chemical properties through various treatments, such as heat treating and stress relief. Another subelement of material TD is to analyze material offal for metal parts and resin waste for injection-molded parts. Because of the detailed nature of material TD the expected results will vary depending on the project. However, in general the result is savings in material and labor costs. These savings are normally obtained by reduced scrap and offal, material wastes, alternative material choices, alternate coating processes, and what are often third-party processes like plating and heat treating.

Matrix TD: As mentioned earlier, only more advanced companies that have already made an effort for part commonization will benefit from this element. Matrix TD will further deproliferation efforts by reducing part numbers through the utilization of common parts on different products in the same or different product family. The utilization of carryover designed parts to new product designs is also a result. The objective of the matrix TD then is reduced expenses in both the variable and fixed cost arenas. Design development costs should be reduced, which include design time, validation cost, and a much improved time-to-market experience.

Process TD: Once part commonization is mastered, process standardization can also be mastered. When common processes can be institutionalized, process development time and production rates can be minimized. This results in lower capital and tooling investments and in lower piece part costs that are derived via simple and common equipment and tooling. When this is achieved, floor space savings result, which may lead to a reduced facility size and resultant facility expenditures. It also results in faster time to market, especially in a high-capital-intensive business.

Static TD: Static TD represents the original element of teardown presented to Mr. Sato by General Motors many years ago. Yet as simple as this element seems, Mr. Sato was able to develop many

improvements to what GM showed him. In static TD the component parts are appropriately displayed to enable ongoing investigation and cost reduction. This visual display becomes a permanent component within the company and organization for constant and continuous improvement.

A more advanced company will use the teardown data in the following ways. First, when coupled with value engineering, a numeric equation for value is determined. You may recall that value engineering measures value as function divided by cost. Prior to the actual teardown, detailed performance criteria are selected and defined. Each competitor product receives a comparison score for how it rates vs. the performance criteria. This weighted score becomes the numerator of the value equation. At the conclusion of the cost TD, a total cost for each competitor product will be known, and this becomes the denominator of the value equation. Then a total value score for your product and each competitor's product is calculated. From these data one can create spider charts to graphically display the results. An example is shown in Figure 1.11.

Another advanced teardown technique is to integrate teardown with value engineering. A key step is to develop a FAST diagram and a cost-function worksheet for each competitor product. Understanding function cost is very important not only for your own products but also for those of your competitors. This data will be used in the next rung of the ladder.

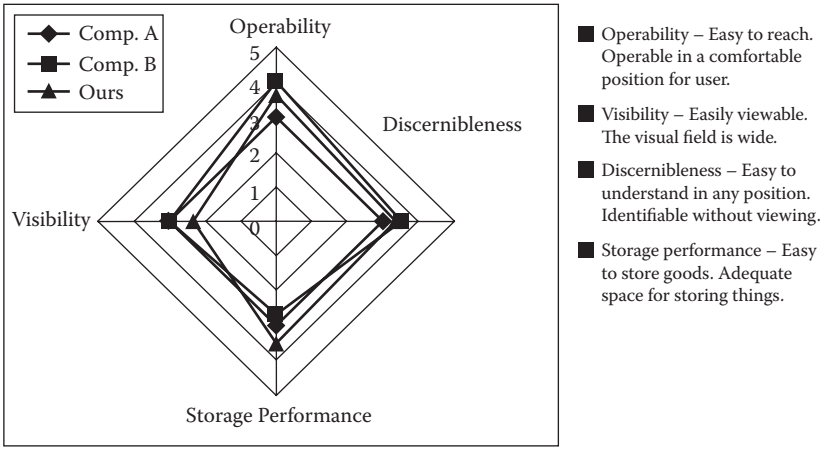


FIGURE 1.11
Sample spider chart comparing competitors.

RUNG 7

To say it very simply, Western world finance forces corporate executives to make bad decisions. Whenever a decision is made that hurts the long-term bottom line, it is a bad decision. Why do Western world corporate leaders focus so much on today's numbers at the sacrifice of tomorrow's? The best companies of the world have two accounting methods. One is financial accounting, which is traditionally used to report to shareholders and financial markets and used for the annual financial report. Unfortunately, this is the only accounting system that most companies utilize. The second accounting system is managerial accounting. Companies that utilize managerial accounting use this set of books and numbers to base their strategic decisions on. Managerial accounting allocates costs differently than traditional accounting. Since companies spend millions of dollars on Oracle and SAP accounting systems that do not handle managerial accounting, it generally is not used and supported within the company. Rung 7, shown in Figure 1.12, lists activity-based costing (ABC) and function cost analysis. ABC has been around for over 20 years, but it is rarely used by most Western world companies. Most companies have never heard of function cost analysis or understand what it is.

Wikipedia defines ABC as a costing model that identifies activities in an organization and assigns the cost of each activity resource to all products and services according to the actual consumption by each: It assigns more indirect costs (overhead) into direct costs. In this way an organization can establish the true cost of its individual products and services for the purposes of identifying and eliminating those that are unprofitable and lowering the prices of those that are overpriced. In a business organization, the ABC methodology assigns an organization's resource costs through activities to the products and services provided to its customers. It is generally used as a tool for understanding product and customer cost and profitability. As such, ABC has predominantly been used to support strategic decisions such as pricing, outsourcing, and identification and measurement of process improvement initiatives.

Activity-Based Costing
Function Cost Analysis

FIGURE 1.12
Rung 7.

Similar to ABC, but not exactly the same, is function-based costing (FBC). Every product, process, system, and procedure performs numerous functions. In most cases only a few functions drive their total cost. Thus, developing, maintaining, and using function cost models will go a long way in predicting future costs.

Here is a simple example to better understand function-based costing. Assume you have a stainless steel shaft for a precision rotor. An impeller is attached to one end of the shaft. The shaft raw material cost is $10.00. The labor and overhead to machine and prepare the shaft is $8.00. The shaft performs several functions, which are transmit torque, deliver torque, prevent corrosion, resist wear, and secure components (for the knurls that hold the lamina that is pressed to the shaft and the threaded end to hold the impeller). The basic function, or the real work being performed by the shaft, is deliver torque. During a value engineering workshop one of the steps of the function analysis phase is to allocate cost to functions. Allocating cost to functions is difficult for many untrained people. First, the untrained would say if a function is important it should get most of the cost. Sometimes that is true, but most often it is not. The importance of the function often has little correlation to the actual cost to perform the function. In the cost-to-function allocation, we care only about the actual cost to perform the function. I would allocate the $18.00 of part cost of the shaft as displayed in Table 1.4:

Deliver torque: $1.50 (this is the cost of the length of the shaft that interfaces with the impeller and the cost to machine that end to allow attachment).

Transmit torque: $3.50 (this is the cost of the raw material for the least expensive material to transmit the required torque over the required distance; I used cold rolled steel).

Prevent corrosion: $5.75 (this is the additional cost of stainless steel over cold rolled steel, since the only purpose of having stainless steel is to prevent corrosion).

Resist wear: $5.35 (this is the cost of the several machining and polishing operations that are required to obtain the tight tolerances and smooth surface finish to meet the requirements).

Secure components: $2.00 (this is the cost to machine knurls to the diameter of the shaft where lamina is later pressed on the shaft, and threads to attach the impeller).

TABLE 1.4

Shaft Cost to Function Allocation

Part or Operation	Quantity	Direct Cost $	Function—Active Verb/Measurable Noun				
			Deliver Torque	Transmit Torque	Prevent Corrosion	Resist Water	Secure Components
Stainless steel shaft	1	$10.00	$0.75	$3.50	$5.75		
Labor and overhead	1	$8.00	$0.75			$5.25	$2.00
Totals		$18.00	$1.50	$3.50	$5.75	$5.25	$2.00
Function–Percentage:		100.00%	8.33%	19.44%	31.94%	29.17%	11.11%

Many companies in Japan have been doing function-to-cost analysis for over 30 years. They have accumulated a detailed-by-function cost database. It is this database that is used to create functional cost tables that can be used to predict future product costs. This will be discussed more in Chapter 8.

Neither ABC or FBC is a prerequisite to ensure survival and success. However, your success will be enhanced by learning, understanding, and using one of them. My personal preference is FBC, as it is this costing method that is primarily used in the companies that I have benchmarked. Merely reporting costs after they have been spent, which is what most financial systems do, will only lead to survival at best. Constant and consistent use of managerial accounting to make strategic business decisions is a key ingredient to success. More importantly, it is better to predict future expenditures than to report money already spent.

RUNGS 8 TO 10

This book is written with the objective to go into the detail of rungs 8 to 10, as shown in Figure 1.13. To begin target costing (rung 8) at a company is a major undertaking. The Japanese term for target costing, *genka kikaku*, literally means "planning for the achievement of true costs." Originally, target costing was a search for this elusive concept of *genka*, or real costs. *Target cost* would literally be translated as "should-cost," and *target costing* would be translated as "planning on how to achieve this should-cost." This is arrived at through a combination of theoretical methods as well as through actual manufacturing best practice benchmarks that include innovation.

Maybe a better fit to the American way of thinking is "hitting the home run." Cricket players call this "hit for six." The reason we refer to the home run ball is that without the full and continuous use of target costing a company is destined to always hit singles at best, and all too often strike out.

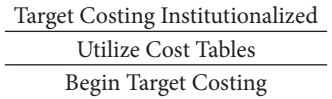


FIGURE 1.13
Rungs 8 to 12.

Kaizen, or the first three rungs of the ladder, is designed for the singles. Target costing and using the information gleamed from the marketplace destine a company to hit the "long ball." During a target costing forum (that this author developed and moderated at the 2000 SAVE International Conference in Reno, Nevada), Yoshihiko Sato from Japan gave the following definition of target costing. The definition he used was developed by the Cost Planning Special Committee of the Japan Accounting Association. They stated that target costing is a "comprehensive profit management activity to plan and develop a product through establishing targets for quality, price, reliability and delivery satisfying customer requirements and through striving to achieve the targets simultaneously across the processes." In other words, target costing when used effectively and properly, is based on using strict cost management techniques and tools, but only with the higher-order function to make money in mind. Thus, another term for target costing that I predict will gain buzzword status is *profit engineering*. Unfortunately, too many Western world product designers and engineers feel that they have no responsibility for corporate profitability. This predicament is sad and must be turned around.

The use of cost tables in Japan is extensive. This is rung 9. In fact, cost tables have been used for over 40 years. Cost tables are a secret competitive weapon for Japanese companies. Through the use of cost tables Japanese companies are able to control their costs in a detailed manner, before any costs are actually committed or incurred. It is a fact that most Western world companies do not know what new products cost until it is too late to do anything about the cost, even if it is determined that it is not competitive. In world-class companies, this problem does not exist, and cost tables along with the responsible organization department; the cost planning department manages and uses them through every step of the development process. Essentially every major company in Japan has a cost planning department. I do not know of any U.S. company that has one with the same or even similar levels of responsibilities as those in Japan. If you go to a Japanese company, one knows exactly who in the company is responsible for making a profit. Western world companies will argue that it is everyone's job. Yeah, right. Making money requires special people working in special ways to guarantee cost targets never get exceeded. The cost planning department has this responsibility. They acquire the best people in the company to work in this department, because of their great responsibilities.

The cost planning department is responsible for creating and maintaining the cost tables. In many Japanese companies the tables have existed for so long and have so much detail that they now have computer programs that use the data with easily updateable algorithms. They can update costs for material/commodity price changes, foreign currency exchanges, and various labor and shipping costs anywhere in the world. The computerized cost tables can also be integrated with CAD workstations so that a design engineer can see what costs he or she is creating, as they are being created. Without this readily available detailed cost information it becomes impossible to accurately predict product costs before the design work is started. Japanese companies cannot believe that Western world companies operate without this cost information.

The length of time to go from rung 8 to rung 10 varies greatly. It primarily depends on the length of your product development time cycle and your commitment to adhere to the discipline of making it work. The first few times you develop products using target costing concepts, mistakes will happen. It will not work perfectly the first time. In addition, the development of cost information in a useful format takes time as well. Thus, like anything in life, if you want to get good at it, you must practice. The more product designs that go through this process, and your ability to apply the lessons learned to each new program, will then determine the time period. Products with long development times, like automobiles, airplanes, etc., may take as long a six to eight years to fully develop target costing. Products with short development lead times, like computers, cell phones, etc., may take only two years. In any event, the company will receive benefits along the way. The key is to persevere and never give up. For target costing to become institutionalized, it must be a constant and consistent practice that is never over, abandoned, or shortchanged.

The target costing process steps are not extraordinary; the results of consistently following them are extraordinary. Toyota transformed itself from a nearly bankrupt company in the early 1960s to the "machine that changed the world." Along the way, it developed a cost management process commonly called target costing. The results of target costing include faster to market, improved design efficiency, lower development cost, reduced product cost, improved technology, and superior quality. Products developed using target costing processes are better able to take advantage of lean manufacturing methods because they are lean by design.

Applying this process properly will most certainly require a firm to rethink its entire strategic planning process and its costing philosophy. Despite the pain to change, the payoff is high. Four decades of experience in Japan stand in testimony to the power of target costing to deliver planned profit, and in so doing keep the organization constantly focused on delivering value. The companies in the West that can adopt target costing the soonest and the fastest will find that they will have a very important strategic and competitive edge that will take them far into the future.

SUMMARY

To initiate being the best-in-class company you first need to be competitive. However, being competitive only keeps you in the game. For many, just being in the game is good enough. But to be the true market leader, you need to think of competitiveness as the best possible combination of satisfying the marketplace and customers and, at the same time, making money. There are only two ways to make money: either raise your prices or reduce your cost. In today's competitive marketplace, raising prices is normally not an option. This leaves the reduction of cost as the only viable option. Doing this and still maintaining customer satisfaction is the key to survival and success.

2

The Rails of the Ladder

On February 28, 1953, Francis Crick walked into the Eagle pub in Cambridge, England, and, as James Watson later recalled, announced that they had found the secret of life. Actually, they had. That morning, Watson and Crick had figured out the structure of deoxyribonucleic acid (DNA). And that structure—a "double helix" that can "unzip" to make copies of itself—confirmed suspicions that DNA carries life's hereditary information. I liken the rails of the ladder to this in that if used properly, they contain the secret to global success.

In real life when using a ladder, how often do you think about the rails of the ladder? For me, my thoughts focus on the rungs to ensure that my weight is placed appropriately and that I do not tip the ladder to one side or the other. The fact is that the rails provide all the support for the ladder and all the weight that goes on each rung. Thus, we can say that without the rails the rungs will crumble to the ground. In the ladder model for this book the ladder rails represent the organization, the correct and proper organization that must be in place to support all the rungs on the ladder. The organization that works for rungs 1 to 3 may not work for rungs 4 to 6. Certainly it is felt that a new and different organization is required to fully benefit from rungs 8 to 10.

The organization begins and ends with the organization's top leadership. Since the rails provide the support for the rungs, they also provide the thinking and mentality for the entire organization. One can think of this as having the mentality in the DNA of the organization. Thus, the rails are like the arteries and veins of the human body. They carry the necessary nutrients to the body. In the ladder the rails also carry the necessary nutrients to the organization to ensure that the techniques on the rungs are carried out and utilized properly.

There are six main elements to the rails of the ladder:

1. Corporate strategy
2. Focus on long-term profit goals and objectives
3. Customer focus
4. Respect for humanity
5. Respect for the environment
6. Leadership

CORPORATE STRATEGY

Of these six main ingredients the corporate strategy is by far the most important. There are many companies with excellent leadership that have a high concern for the employee and environment, but do not have the correct plan in place to implement. Without the best corporate strategy, or worse yet a bad strategy, failure will occur sooner or later. Think of General Motors, at one time the biggest company in the world. It had great leadership, it treated its employees better than any company, and while it may be disputed, it did have a concern for the environment, but for sure not to the same extreme as its Japanese competitors. Yet despite having these main ingredients well entrenched in the company, it eventually ended in bankruptcy and needed government support to survive. Of course, the bankruptcy led to a change in leadership, additional hurt to the people employed and retired from GM.

So what is the correct corporate strategy and how does it get ingrained into the culture of the company? Obviously this is not an easy question to answer, and obviously a detailed answer is company specific, but in general it can be answered.

The first step is to adopt the mentality described in the book's introduction. Having a corporate boardroom that has a mentality to destroy its competition must be in place. Having listened to many Japanese presentations on several occasions, I have heard the translation for *competitor* to come across as "the enemy." This requires a radical change from survival. Corporate goals need to change.

Another death spiral is the use of outsourcing. If you do something in-house, you want to be best in the world. This requires a commitment from management to provide the leadership and resources for training, best-in-class tools, technology, employees, etc. Companies do not have enough resources to have best-in-class core competencies in all areas. Thus, it does make sense for outsourcing to occur, based on a certain set of conditions. Outsourcing to eliminate problems is not one of them. Most companies believe that if they outsource away their problems, the problems will go away. What a joke! What happens is that the problems are hidden for a while, then come back and appear with a vengeance. Hiding problems never fixes them. Again, when a company begins to outsource, the fixed costs get spread over a smaller base, making the remaining in-house business less competitive. Another issue with outsourcing is that the shift to overseas outlets will cause the spread of technology to others outside of your business. As others learn more about your technology, you will begin to lose your competitiveness. Furthermore, outsourcing causes new problems in the effectiveness of logistics and product movements. These issues usually result in higher freight costs, reduced quality, overstocking, longer lead times, product obsolescence, and many others.

Although there are many others, finally, one last example of a death spiral: When the economy lacks robustness, companies cut back aggressively in many areas, like sales and marketing (big mistake) and research and development. Reducing research and development is a huge mistake for long-term thinkers. When the economy picks up, consumers want to buy new products, not the ones that were previously available. The companies that continue with their research and development and have the best new products in the marketplace will be the winners in the next robust economy. Those that did not develop new products will barely be able to survive.

FOCUS ON LONG-TERM PROFIT GOALS AND OBJECTIVES

During a Japanese corporate leader keynote presentation at the 2009 SAVE International Conference, the speaker talked about companies that have been around for over a thousand years. There is, in fact, a few Japanese

companies that have existed that long. U.S. history, of course, is much shorter than that, but how many companies in the United States can we say have been around for over two hundred years? So is thinking that your company will be operating in a thousand years a new way of thinking about your company? Perhaps it should be. Being a winner in the global corporate battlefield requires a long-term profit planning scenario instead of this week, this month, or this quarter. In America it seems that too much attention is paid to each quarter's profitability. The analysts on Wall Street seem to demand that the profit results for every quarter exceed the previous. However, when I survey large groups of people, they all tell me that they would much rather invest in a company that has a long-term profit horizon than a short-term profit plan. Based on benchmarking activity in Japan, the most profitable companies, like Toyota, Denso, Canon, and Sharp, have a 10- to 20-year profit plan. They also have shorter-term profit plans, but the shorter-term plans correlate with the mid- and long-term plans. These long-term profit plans are not just on some piece of paper and stuffed in a drawer. They are used extensively by all top leaders to ensure that every decision today meets the long-term profit plans of the future. Mistakes noted above, like outsourcing, and reducing efforts in sales and marketing and research and development, all play a role in long-term profit planning. If the higher-order function is to "kill the enemy" and the enemy is the competition, then that can only be accomplished with long-term thinking. Each competitor becomes a battle plan. The companies that win the most battles will win the war.

While visiting Canon in 2006 in their main product display area, where many visitors are invited, I saw a very large plaque with the following information on it:

> Slogan: "Innovation and Sound Growth"
> Management Goals for 2010 (Consolidated)
> Becoming a Top 100 Global Company in Terms of All Major Management Indicators
> Net Sales: ¥5.5 trillion
> Operating Profit Ratio: 20% or more
> Net Income Ratio: 10% or more
> Shareholder's Equity Ratio: 75% or more
> (Based on exchange rates of 1US$ = ¥110 and 1 Euro = ¥135)

I have no idea how long this plaque had been displayed in this area, but it was very impressive to me that Canon had this long-term vision

displayed for strangers to see. This was an obvious display of long-term profit planning, but via private meetings in Japan I have become aware that several companies have profit plans that exceed 10 years, and some up to 20 years. This is certainly different from the companies that I have seen in the United States.

My method of profit planning is different than what I have seen in most companies. For one, I am only interested in profit, where in many companies they are only interested in profit margin. In my opinion, that is a huge mistake. Why a company has profit margin goals, it disturbs me. In fact, I have seen where this goal actually gets in the way of making a profit. With a high profit margin goal the product's pricing becomes too high, which decreases market share, volume, and revenue. As volume decreases the fixed costs of the remaining products become higher, affecting their margins. High profit margins do the opposite of killing your competition. They invite new competitors into the marketplace. They will also want a piece of the action because they are lured by the possibility of making money. As these new competitors enter the marketplace, to keep your sales, you will need to reduce your margins anyway, but now you have more enemies to kill. This becomes a death spiral. In many cases, to obtain the profit margin goals of various products within the entire product portfolio, a firm actually prices itself out of the competitive marketplace. Yes, it meets its profit margin goals, but it sacrifices the greater goal of making money. I believe almost every business needs to have a price leader in its product portfolio. This is a product that can be made extremely affordable to the consumers. It is okay to take a small loss on this product. It may seem strange, but I say the higher the volume, the better. Some business leaders would never do that. They might ask, "You want me to sell at a loss and sell as many as I can?" While the answer is not always yes, I do believe, in many situations, that does make sense. It makes sense under the following scenario.

- I have several other products in my enterprise portfolio that contribute to the bottom line; in other words, I am looking at my profitability from an enterprise level rather than at each individual product line. As long as the entire product portfolio meets my overall profit objectives, it is okay to have some products that do not make money.
- The reason why I am not concerned with a high-volume loser: Just the impact of having that volume helps make all the other products in

> my portfolio cost less, and thus more competitive. The larger volume base that I have (assuming that I do not have to buy capacity) makes all of my other products less expensive because some variable and all the fixed costs are spread over a larger base.

To me the math is simple, and I cannot understand why so many companies choose to have profit margin goals instead of profit goals.

To generate the overall profitability of a company over a long period of time, two essential numbers are necessary to develop: life cycle profit and life cycle cost. The better that these numbers can be forecasted for future years, the better your profit plan will become. Life cycle profit is calculated by subtracting life cycle cost from life cycle revenue. Thus, future sales volumes are extremely important to know. Most world-class companies are slightly conservative on their volume forecasts. As previously mentioned, my definition of target costing is to ensure that a company enjoys constant, consistent, predictable, and acceptable levels of profitability. The only way for this to happen is to have a detailed plan for it to happen.

An element to the success at Denso is its mission: contributing to a better world by creating value together with a vision for the future. The Denso mission is something that everyone reviews and follows when at work. They refer to it as a compass that points them in the right direction. Their 2015 vision, described to me in 2005, is "consideration" and "fulfillment" to the world. The definition of consideration is gentle to the people and the environment. The definition of fulfillment is the joy to drive a car.

CUSTOMER FOCUS

I have learned that Toyota always starts with the goal of generating value for the customer. The reason for this is that customers have a right to choose. Manufactured products and services have to fit to what the users want, like it or not, in a free global economy. To ensure that your products or services are chosen, you must simulate being a user to understand what the end customer needs explicitly and ensure their demands. When I do my value engineering workshops it is rare that the companies that I work with have recently completed a voice of the customer or a quality function deployment activity for the product under analysis. Then what happens

is the engineer or the marketing representative on the team goes on to tell me what he or she thinks the customer wants in the product. While I know it has offended people, I tell them that I am not interested in their opinion. Without the exact customer information, I would rather have them tell me, "Based on what I have learned with numerous discussions with the customer, this is what I believe the customer wants."

The customer is not just the end user. The customer is everyone upstream in the product value chain depending on where you are. The customer is the distribution center, the transportation company, the material handling loader, the next operator on the line, the fabrication area, the raw material supplier, etc.

Several years ago, I learned about the Japanese word *ikebana*. Ikebana is the art of flower arrangement. The story goes as follows: During ancient times in Japan there was a powerful princess. Every day she would have her servants arrange the flowers for her. If the princess was not happy with the arrangement, she would have the servant beheaded. If she was happy, the servant would survive. The moral of the story is that if you do not give the customer exactly what they want and what they are looking for, you will die. If this way of thinking becomes part of your ultimate culture in everything you do, like it is for many Japanese companies, where everyone in the organization fully understands the needs of their customer, then you will have made a significant and important first step in the rail element.

Please do not *assume* that you know what the customer wants, like many of the above-mentioned princess servants. Their fate will be your fate. In Ray Miller's book *That's Customer Focus*, he says that the biggest mistake a company can make is to assume that it knows what the customer wants. When your organization really knows what the customer wants, you can create long-term customer loyalty. That is only accomplished, however, by understanding that customer needs are always changing and that your organization continues to keep a pulse on those changing needs. Once your organization fully understands the real customer needs, they must be spread through all levels of the organization. All systems, people, and processes need to be aligned with what customers value.

In the most successful companies in the world, it actually takes more than just knowing exactly what the customer wants. You must also know what they will pay for that need and how many they will buy at any given price point.

By continuously providing what the customer wants at the price that they are willing to pay for it, you will be well on your way to achieving the ultimate success. The main portions of this book will help you deal with ensuring your costs are below those price points that are determined by the marketplace.

Methods utilized that can be employed to gather customer information are numerous and may be dependent upon your particular industry. Some common techniques are:

- It is believed that the chief engineer that works at Toyota spends more time in the marketplace than the marketing people. He often takes one year between projects to visit customers and dealers to learn more about their likes and dislikes. This firsthand information becomes a guideline for future development programs. This position is sometimes titled the concept champion. As the concept champion, in addition to meeting the cost, quality, and timing targets, the chief engineer is responsible for anticipating and meeting the needs of the customer. The chief engineer does not rely on third-party information. Instead, he talks directly with consumers and dealers so that he has firsthand information to develop the concept of the next vehicle program that he is assigned to. In all cases the chief engineer has the responsibility to oversee the program and resolve all conflicts that may surface.
- Questionnaires can be used to determine the importance of various quality demands for current and competitor products. However, care must be made to ensure the wording of the questions. Many questionnaires have a bias caused by their wording.
- Much can be learned from observing consumer behavior. Several years ago, when JVC was launching a new video recorder, it placed several different designs on a table in a shopping mall. It observed which product people were attracted to and picked up first. Then JVC quizzed that person on what characteristics of that product attracted him or her to it.
- There are many marketing organizations that will help to conduct customer focus groups. Here again, care must be given to eliminate any bias with the interaction with the customers.
- The Internet is being used extensively today to get consumer opinions on products, and especially service industries, such as financial

institutions, hotels, car rental companies, shopping experiences, and many others.

- By studying warranties, consumer complaints, and field service issues, problems with existing products can be determined and corrected in the new design.
- Learning and knowing the latest trends in fashion design perhaps can be used in many industries. One can learn about people's preferences on colors and other tastes by observing people in malls, parking lots, restaurants, bars, and even museums.
- Observing the end user during the use of your product may be one of the best indicators of how your product is used and how you can better service that user.
- Ultimately understanding the value that customers place on specific functions is critical. Knowing what they want, without knowing the value or worth to the customer, will lead to expensive mistakes. Harry Cook, PhD, at the University of Illinois, developed what he calls an S curve. Internal automotive ambient noise is an example of his process. Potential customers are seated in a mocked-up vehicle cockpit. A baseline noise level is introduced to the potential customer. As the level of noise is decreased, the cost or price for that feature is increased. The customer can select choices as to whether or not the price increase is acceptable as the noise level is decreased. Eventually the point of diminishing returns will occur and the buyer will not pay any more for a quieter ride. By the same method, as the noise level is increased the price for ambient noise is decreased. Eventually the noise level will become so high that the customer will indicate that he or she would not buy the vehicle with that noise level, regardless of how low the price is. Using this test over many different market groups will develop an acceptable range of noise and price for various market groups.

RESPECT FOR HUMANITY/EMPLOYEES

People always expect a good life. The workplace should not be an exception to this human need. Certainly the biblical phrase "Do unto others as you would want them to do unto you" applies. It has been proven that

people who like what they do and work in a healthy, clean environment will be more productive, make less mistakes, and be less prone to injury. In a fully lean environment we have learned that the only employee in a manufacturing facility that adds value to the product is the fabrication and assembly operator. It then becomes everyone else's responsibility to support the value-added operators and operations so that they can better perform and focus on their value-added work. For this to occur, first everyone needs to understand this and all other lean concepts. This is done through extensive training and actual practice of the taught concepts. Too many companies follow the philosophy of "on-the-job training." On-the-job training causes injuries, bad quality, and inefficient productivity. That is not a recipe for success. The training for all organizations does not need to be the same. Product designers may get different training than people in manufacturing or human resources. However, there should be some general topics that are considered sacred and taught to everyone, even if some get more in-depth than others. Some general topics are lean and synchronous concepts that are taught and put into practice, cost management, value analysis, value engineering, concern for the customer (both internal and external), safety, and the idea submission process.

The later idea submission process is one that many companies may overlook, but it is this process, even in the toughest of economic environments, like that experienced in 2008 through 2010, that has allowed companies like Toyota and Honda to be able to sustain some levels of profitability. Toyota has a philosophy of saving a yen here and a yen there. With all the yens saved at the end of the year, it is not uncommon that the total is greater than $1 billion.

All work, whether in the factory or the office, needs to be designed so people are safe and do not cause injury to themselves or others. A safety first attitude is very important. Lack of safety in the workplace is waste. Harming humans is not ethical. Injuries in the workplace are expensive.

Several years ago I worked with a U.S. army depot. This army depot had the worst safety record of any depot in the world. The cost because of poor safety and people being injured at work was very high. Since this depot was located in a remote area, finding workers was an issue. This added to the cost, not to mention the lack of nearby healthcare. The problem was perpetuated because as more and more workers were injured, new people that were not properly trained were placed in jobs and then they became injured. There was very little safety promotion to prevent accidents, and

when accidents did occur, effort to determine the root cause and put into place corrective action was lacking. Another issue was that in the few cases where work rules and methods were established, there was little effort to ensure that they were followed. This type of situation can and must be avoided.

Companies once thought that there was a bottom-line trade-off between safety and efficiency. Now they embrace ergonomics because they have learned that designing a safe work environment can also result in greater efficiency and productivity. Recently, U.S. laws requiring a safe work environment have stimulated great interest in ergonomics—from ergonomic furniture to ergonomic training. But it is in the design of the workplace as a whole where the greatest impact can be seen for both safety and efficiency. The easier it is to do a job, the more likely it is to see gains in productivity due to greater efficiency. Analogously, the safer it is to do a job, the more likely it is to see gains in productivity due to reduced time off for injury. Ergonomics can address both of these issues concurrently by maximizing the workspace and equipment needed to do a job.

During a portion of my employment at General Motors I was responsible for reducing the cost of material handling in our vehicle assembly plants. GM for years had focused on direct labor operators, but until this time, little effort had been made to make the indirect labor costs as effective and efficient as the direct labor workforce. During this period, working with a third-party computer service company, I developed a computer system that would measure material handlers' productivity. Our metric, which was the same as the direct labor workforce, was to ensure 95% efficiency and 75% value-added work. Much of this productivity improvement came through the elimination of fork trucks and the institutionalization of small lot delivery. Small lot delivery is more efficient in many ways besides labor. However, it forces workers to pick and place containers. Using ergonomic concepts, we needed to be sure that we had every container just right, stored just right, and handled just right. To expect 95% productivity of your workers, everything needs to be just right for them.

In 1999 I visited the Toyota Motomachi vehicle assembly plant, where Toyota assembles the luxury Crowne vehicle. Their basic philosophy is to create a manufacturing process where workers play the leading role, and where workers are determined to be the most important asset of the manufacturing facility—achieving a manufacturing process in which anybody can work by reducing the workload. All of the effort is to motivate the

workers. Toyota leadership focuses on group activities while emphasizing individual responsibility, verifying the significance and objectives of work, and creating a work environment where people can work comfortably. To make it a pleasant place to work, there are many efforts to reduce noise, create open space, and optimize airflow. The plant is air conditioned. They coordinate colors to please the senses to establish a feeling of warmth. They believe the worker is more important than the plant. The plant manager stated that it is possible to automate the entire vehicle assembly process and eliminate all people, but it is a saying at Toyota that people must have a part in the process. Thus, what I have observed is that the most physically demanding jobs are automated and everything else is done by humans. It was also mentioned that if the line were 100% automated, it would have to be three times as long. In my 2005 visit to Toyota it was stated that in the development of human resources, teamwork is the key. Besides teamwork the most important elements when it comes to people are giving people a fair challenge, kaizen or continuous improvement philosophy, *genchi genbutsu* ("go and see"), and respect. Respect is not mandated or taken. Real respect can only be earned. Toyota sees respect for people as a boost to morale and helping to keep people energetic.

Communication to employees deserves special consideration. What information and how it is delivered should be reviewed and changed if appropriate. It has been said that the root of most problems is communication. Perhaps you have played the game of giving one person a message and having that message whispered around the room of several people only to find out that the last person to hear the message had a totally different concept than what was originally intended. When verbal communication is used in this manner, especially for important information, your business is destined for trouble. All important information should be communicated in written format so that the story does not change when it is handed from person to person.

Consideration of what information people need to know is important. Design engineers at Toyota are responsible to get the information that they need. This follows the Toyota Production System concept of "pull." Most companies use the "push" method, where all types of information are distributed throughout the organization regardless of the need. It is my opinion that a combination of the two methods, depending on the type of information, needs to be utilized.

In Maramaldo's (2010, p. 3) book, *The Complete Total Competitiveness Theory*, it is stated:

> There are no doubts among experienced managers that business competitiveness is a direct result of human behavior within the organization, or better yet, it depends on people. If people are fully engaged, results tend to be better, but if people are not engaged with the company's objectives, results are hardly satisfactory. Any organizational system must be in harmony with its management philosophy and compatible with an intense use of people's individual and team competencies. Of course this is not new, and we may better understand what is going on today by revisiting recent business history. A few decades ago, western businesses were devastated in their results by the outcome of the Japanese companies and their new ways of managing and of achieving competitiveness. Their techniques became the center of western world attention, with the understanding of the connection of behavior, with systems and administrative processes.

Respect for humanity goes beyond the workplace. The Walkman was invented with the thought that it is better to listen to music without disturbing others, as opposed to the boom box, which no matter your musical preference can be very disturbing to others. You may also see people in foreign countries wear a filtered mask and think that it is to protect them. For many people that wear these masks, they are doing it to protect you from the germs that they have. Of course as discussed in the next section, the concern for the environment is tied into the concern for humanity and the future of humanity.

RESPECT FOR THE ENVIRONMENT

Leading companies demonstrate their commitment to the environment via numerous methods. First, they create a corporate culture to preserve the environment. Most do this by establishing a corporate vision or mission for the environment and lay out specific goals and objectives. The more specific the goals are, the better. Note the Canon objective below and its metric for measurement. Finally, the actual achievement of those goals proves the environmental worthiness of the company. Talk with no action will not make a company a world leader and global

survivor. The companies mentioned below have the following information on their Web sites.

Canon: Canon has an environmental vision, environmental charter, and environmental promotion organization. Below is material from Canon's charter:

Corporate Philosophy:

Kyosei

Achieve corporate growth and development while contributing to the prosperity of the world and the happiness of humankind.

Environmental Assurance Philosophy

In the interest of world prosperity and the happiness of humankind, pursue maximization of resource efficiency, and contribute to the creation of a society that practices sustainable development.

Fundamental Policies for Environmental Assurance

Seek to harmonize environmental and economic interests in all business activities, products, and services (the EQCD concept); offer products with lower environmental burden through innovative improvements in resource efficiency, and eliminate anti-social activities that threaten the health and safety of mankind and the environment.

	EQCD Concept
E: Environment (environmental assurance)	— Companies are not qualified to manufacture goods if they are incapable of environmental assurance.
Q: Quality	— Companies are not qualified to market goods if they are incapable of producing quality goods.
C: Cost D: Delivery	} Companies are not qualified to compete if they are incapable of meeting cost and delivery requirements.

Toyota: Harmony between man, nature, and machine on home page.

Our Environmental Commitment:
Green. That's how we'd like the world to be. As an environmental leader, Toyota does more than meet industry standards—we seek to raise them. With an unwavering commitment to environmental protection, Toyota strives to create clean and efficient products, and to conserve resources before our vehicles even hit the road. The Global Earth Charter, under our Guiding Principles, was set forth to promote environmental responsibility for every aspect of our company and significantly reduce the impact our vehicles have on the planet. That's why we subscribe to a recurring 5-year

> Environmental Action Plan that sets earth-friendly goals. Toyota is happy to report that we've successfully achieved our first Action Plan for U.S. operations, and have now launched our second.

Hewlett Packard:

> Our Commitment to Sustainability—Our efforts to reduce our impact on the planet are industry leading as reflected in our holistic approach to product design, operational management, and recycling and reuse. HP also has future years' goals and highlights how they will be achieved.

Many companies in Japan, in an effort to reduce energy usage, allowed all workers to remove the historical practice of wearing ties and suit coats. Air conditioning has been turned off, and to help maintain the comfort level for the people, casual dress is promoted.

There are just so many ways for companies to preserve the world's natural resources, reduce emissions, and reduce pollution to air and water. The Brundtland Commission of the United Nations on March 20, 1987 stated, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition makes it easy for businesses to ignore sustainability issues and assume someone else will take care of it. A better definition of sustainability as "the capacity to endure" forces all of us to recognize that sustainability must be part of the business culture.

Sustainability is a mindset that is changing business practices. Everyone from employees to stockholders wants to be sustainable and demands it of their organizations. However, for sustainability to be truly successful it must be fully integrated into the missions of corporations. It requires a paradigm shift from the narrow viewpoint where the profit is focused solely on that specific business to a larger viewpoint where success and profit are viewed within the context of the human society. Companies are struggling with incorporating this large change into their business in a meaningful and cost-effective manner.

Some companies such as Johnson Controls have successfully integrated sustainability into their corporate culture. Their vision statement includes: "The idea of sustainability has taken on increasing relevance in recent times—but has literally been at the heart of Johnson Controls' values since the very beginning. Our products, services, operations, and community

involvement are part of a holistic approach and commitment to promote the efficient use of resources around the world."

LEADERSHIP

Wikipedia describes leadership as "the process of social influence in which one person can enlist the aid and support of others in the accomplishment of a common task." A definition more inclusive of followers comes from Alan Keith of Genentech, who said, "Leadership is ultimately about creating a way for people to contribute to making something extraordinary happen." This quote is more about the future than the past. Leadership earned the right to become the leaders based on past experience, wisdom, skills, and how those attributes were used. Best-in-class companies need a new mindset of executives, who should be more determined to take risks, have strategic visioning, and have a future focus in their decision making. Their professional and schooling history is less relevant, and the selection of new executives should be balanced on their future potential as well as their past experiences.

According to the late Jules Masserman, American psychoanalyst and former member of the faculty of Northwestern University medical school, leaders must fulfill three functions: The leader must provide for the well-being of the led, provide a social organization in which people feel relatively secure, and provide a set of beliefs. While most leaders do this, they fail to put in place the proper set of beliefs.

Abraham Zaleznik (1977), in his *Harvard Business Review* article, titled "Managers and Leaders—Are They Different," delineated differences between leadership and management. He saw leaders as inspiring visionaries concerned about substance, while managers he viewed as planners who have concerns with process. On page 39 of his book *On Becoming A Leader*, Warren Bennis (1989) further explicated a dichotomy between managers and leaders. He drew twelve distinctions between the two groups:

1. Managers administer; leaders innovate.
2. Managers ask how and when; leaders ask what and why.
3. Managers focus on systems; leaders focus on people.
4. Managers do things right; leaders do the right things.

5. Managers maintain; leaders develop.
6. Managers rely on control; leaders inspire trust.
7. Managers have short-term perspective; leaders have long-term perspective.
8. Managers accept the status quo; leaders challenge the status quo.
9. Managers have an eye on the bottom line; leaders have an eye on the horizon.
10. Managers imitate; leaders originate.
11. Managers emulate the classic good soldier; leaders are their own person.
12. Managers copy; leaders show originality.

In Stephen Covey's (1989, p. 101) book *The 7 Habits of Highly Effective People*, he describes the difference between manager and leader this way: Management is bottom line focused, while leadership deals with the top line. The top line refers to what we need to do. What are the right things to be working on in our company? Then the management traits can take over to ensure proper execution. Covey states, "Management is efficiency in climbing the ladder of success; leadership determines whether the ladder is leaning against the right wall." May I also add, are you climbing the right ladder? In other words, are you going in the right direction? It is possible to be making progress, and you will feel very comfortable in the path you are taking. How do you know that you are on the correct path? How do you know the path does not end up at a dead end? Leadership gives its troops the marching orders. Leadership must ensure the troops are marching in the correct direction. Lao Tzu, an ancient philosopher, stated, "The journey of a thousand miles starts with but a single step." The problem with this statement is, are you going in the right direction with that first stop? Heading down the wrong path can result in unfavorable results, and an enormous waste of time and money.

Can you imagine a company that has the first five ingredients in place, but does not have a sustainable leadership team in place? It is not an accident that the world's most successful companies have had a constant and consistent leadership team. Having the same people focused on the same core values and driven to the same end result most certainly by itself is a huge competitive advantage. Companies that experience leadership turnover on a regular basis have no hope of becoming a true global champion. How can a company move forward when every new CEO or general manager

comes in with a new game plan? Only a constant and consistent practice of these ideals will lead to global success. A constant leadership team is significant, but when that team follows the first five ingredients mentioned here, and has them as the structure and support to hold the ladder firm and stable for a long period of time, that is just the ultimate.

The leadership cannot just be a figurehead to the organization either. For target costing, especially, to become institutionalized, it will take hard work, time, and an ongoing commitment to make it work. That commitment means being intimately involved into all levels of the corporate organization on a daily basis. Even when it is institutionalized, it has been learned that the system does not run on automatic pilot. Continuous care and nurturing are never ending.

Since this book is mostly about target costing and target costing is mainly practiced in Japan, I think it is important to point out a few differences between leadership characteristics and culture between the United States and Japan. These differences, of course, are not specific, but general in nature. These characteristics are based on my experience in visiting many companies from both countries.

1. First, as previously mentioned, is a huge difference in the long-term profitability planning. Japanese leaders really do think long term.
2. Japanese leaders generally receive much lower compensation than U.S. leaders.
3. Japanese leaders normally have worked for the same company their entire career. Many U.S. leaders switch companies during their career.
4. Japanese leaders only get promoted to the top after they have been placed in strategic management positions and have proven they are truly the best candidate for the position. In many cases U.S. leaders are purposely chosen from another field or company where they have been successful, but know nothing about the business that they are being promoted to.
5. U.S. leaders seem less interested in working with people in the trenches than their Japanese counterparts. Japanese leaders understand that training people in the organization themselves is one of their most important responsibilities.
6. Japanese leaders are promoted from the cost planning or cost management department. U.S. companies do not have these departments. (This department will be explained in detail in Chapter 6.)

There are essentially three tiers of leadership in a typical company: upper, middle, and first-line management. Below the leadership are the people responsible to carry out the objectives and missions of those imposed by the leadership. Thus, it is absolutely necessary for all leaders at all levels to know exactly what those objectives are and how they will be accomplished. The support must come from the top, and then filter down to the middle management leaders. Between the two of these, gaining top management support is the easiest. But I include middle management support because without the middle managers onboard, the program will not go very far. It must also be stated that you need more than leadership support. You need leadership participation. That participation needs to be visible to all workers of the company. This on-site demonstration of a fully committed and dedicated leader, willing to work in the trenches as well as the corner office, is very important. Even top leaders need to employ continuous improvement in their jobs. Humans learn by practicing and doing, not by watching. We cannot learn to play golf by watching the pros on television or in real life. We cannot learn to hit a baseball by going to the ball park to see a game. We must grab a golf club or bat and participate in constant practice and strive for continuous improvement.

You may say that should not be a problem if the top leadership is supportive and participative, but over my 25 years of working with and being involved in various value-improving programs I have found that the middle managers are the key to success or failure. The reason why middle managers hold such a key role is that in most companies, these people control all the resources. They get to decide if key projects get to be worked on, if key team members can be made available, if financial resources can be expended, and what gets implemented. In other words, for an organization that wants to be truly successful, all key middle managers must be believers and avid allies.

SUMMARY

All six ingredients must be in place for a company to reach the top of the ladder and sustain itself at the top. All the rungs must be properly used. The completed ladder model is shown in Figure 2.1. For all the rungs to be used, the structure and support must be strong, firm, and committed

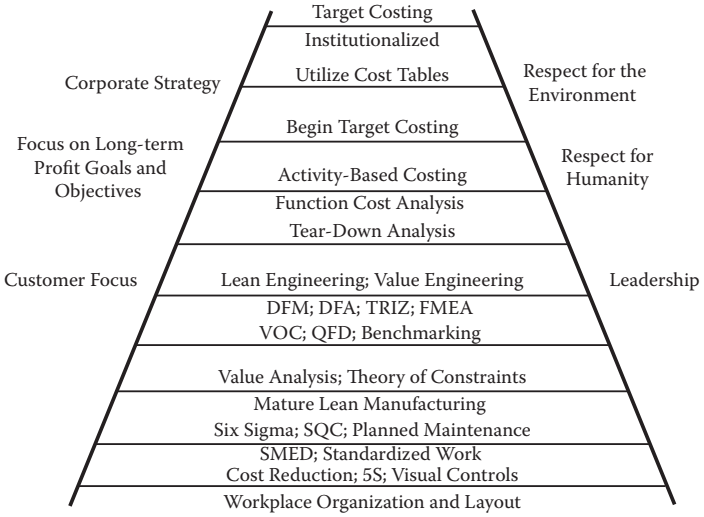


FIGURE 2.1
The complete ladder model.

for the long haul. Reaching the top of the ladder and not using the rungs below will cause the ladder to crumble. The ladder will also crumble if there is any failure in the rails that support the rungs; thus, having the correct strategic plan and leadership team in place will provide the necessary foundation. Respect for the customer, people, and the environment adds support. The ultimate vision must be long-term profitability.

All the rungs must be properly used. Climbing the ladder is a long-term project. Patience and perseverance are necessary. Once you climb up one rung, all the rungs below that rung must stay in place. This is not a program of the month where you use one and then move on. This is not a smorgasbord line where you pick and choose the items you like and leave the others behind. You do not have to reach the top of the ladder before you will gain benefits. Benefits will happen all along the way. My guess is that your benefits may actually exceed your expectations. That is not a reason to stop since you may think you are reaping all that there is to reap. Your success may have been the result of correctly reaping the low-hanging fruit. To be really great and achieve the ultimate success, you need to go for the fruit that is hard to get. That will separate you from many of your lazy competitors.

3

Basic Concept of Target Costing

What is a strong enterprise? Certainly a company with excellent performance and growth qualifies. Companies that have vitality, strong products, and unique technologies need to be included. In general, a strong enterprise is one that plans for and expects a constant, consistent, and acceptable level of profitability now and far into the future. This then becomes my definition for target costing as well. When there is a long-range profit plan, future profits become predictable. This is the key concept of a fully integrated holistic target costing activity.

WHAT ARE THE CHARACTERISTICS OF STRONG ENTERPRISES?

A strong enterprise must have **strong product development capability**. These are companies that introduce best-selling products with regularity. They rarely, if ever, introduce an unsuccessful product. With a successful marketing system and short development time to meet time-to-market requirements, leading companies control their competition. For example, Honda must be successful on every new product launch because it has fewer new products to develop and the cost to develop is high. It is amazing how many companies launch new products that are unsuccessful in one way or another. The most common errors when launching a new product are higher costs than planned and significantly missing the forecasted volume projections.

Quick business speed and timeliness to market is another strong enterprise trait. This does not just apply to product development, but to

the entire organization. All staff areas have to be equipped to rapidly put a new product in production and into the marketplace. Fortunately for Air Bus and Boeing, the two main players in the commercial airline manufacturing business, based on recent experience, neither is very good with timeliness to market. If one of them, or perhaps even a new competitor, were to enter the market having market timeliness, the other's competitive position would be severely threatened.

There is a need for **vitalization of business systems and the organization.** "How you do things today is obsolete tomorrow" is a saying in strong enterprises. They know that continuous improvement in all business systems is necessary to become the best of the best and to stay there. Based on my 40-plus years of experience with manufacturing companies, I have noticed a very important trait of the best companies: It is always the best that want to get better. These companies have that drive to get to the front and stay there. Their drive to always want to get better is what got them in the lead to begin with. These companies are destined for success, because they are not satisfied with where they are in the competitive landscape. Great companies must have this attitude. They must never relax when they get to the top.

Great companies have the **ability to set aggressive targets and challenges to achieve them.** Setting aggressive but achievable targets is difficult. If the targets are easy to achieve, the company feels very good about itself with the achievement, even though it is falling behind its competition. If the targets are too difficult to achieve, or worse yet impossible, the organization knows this and their effort to get better is not strong. When a person is given a knowable impossible task, in most cases he or she will not try very hard to achieve it. It may not seem important, but improper goal setting can make or break a company. When I was working for GM, in the 1990s executive leadership had what they called stretch goals. These goals were not a stretch; they were impossible and everyone in the organization knew it. Having unreachable goals for the organization does not work.

One definition of inoperability is: "Getting the *right* information in the hands of the *right* people at the *right* time without productivity loss." Strong enterprises have **business policies that keep business managers well informed.** I have witnessed big enterprises that have so much information that they really do not know what information they have. The people that require certain information do not have it, and yet at the same time they are bombarded with information that they do not need. When

I retired from General Motors, I recall saying to myself as I walked out the door for the last time, "If GM only knew what it really knows." What I meant by this is that GM had so much information scattered throughout the company, but most people that needed information to do their job better did not know it existed, or did not know how to get it. Another, similar problem is to overcome communication issues; there is also the tendency to overcommunicate information to people that is not necessary for them to know. What a shame. I am sure many other companies, even much smaller than GM, have the same problem.

Successful companies have a **strong business sense and concern for the well-being of mankind and the environment.** These companies are socially responsible. Being a good corporate citizen is part of the makeup of a strong enterprise. Being environmentally friendly with its products, disposing of its products, and conserving energy usage within its offices and manufacturing facilities are all traits of an environment-friendly corporation.

A strong enterprise must **have hardworking and productive employees.** Creating a work environment that encourages and allows people to maximize their productivity is necessary. I have seen business systems in place that actually prohibit workers from being productive. Some of this is not having decision making performed at the lowest possible level of the organization. Corporate bureaucracy often gets in the way of productivity and prevents people from performing at their best. Eliminating waste from all people's work needs to be a driving force to become a strong enterprise. Along with this, it is necessary to have proper training in place to ensure people have the knowledge and information they need to be the most productive.

We have found that there is a relationship of strong enterprises and target costing. Not all strong enterprises survive. Some Deming and Malcolm Baldrige Award winners have gone bankrupt. Companies that have won productivity awards and have strong lean manufacturing systems in place are not financially stable. Some companies have placed the sole success of their business in the hands of six sigma and its trained black belts. More and more companies are learning that six sigma is not the "silver bullet" that they imagined it would be. This shows there is much more to survival and success than winning awards in productivity and quality. Enterprises that change and are adaptable to changes in the business environment can be successful. The best enterprises perform new product development in order to adapt to environmental changes. They have a new product development ratio for the best-performing products. The product development

ratio (PDR) is calculated by dividing the sales revenue of new products introduced within the last three years by the total sales of the company. If the ratio is low, then the company is not making enough investments to ensure future growth. If the ratio is high, the investments for product development cannot be sustained and can cause a company to lose too much money in some time periods. The best companies need to maintain a consistent PDR over time at between 20% and 30%. Only when the economy is very good should this number exceed 30%.

Finally, **commitment and accountability** must permeate throughout the organization. When a target is agreed upon at a best-in-class company, that target represents a commitment. This complete buy-in is established via a company culture that can be established anywhere. Of course, it must start with the top leadership. Cross-functional activity led by senior executives plays the key role in the implementation of the target objectives. Note that it was stated that the target is agreed upon. Top leadership edicts and mandates do not create commitment and accountability. The workforce is only committed through a regulated process to gain that commitment.

The best-performing manufacturing companies in Japan that not only survive, but succeed at the highest levels, have one major ingredient in common. They all have an institutionalized target costing system in place. From the CEO down into the troughs of the company, target costing is a way of life for all employees. Target costing is in the DNA of the company. All decisions are based on the premise of cost and its impact on profitability.

ROOTS OF TARGET COSTING

Target costing received its roots from Western world thinking. The Japanese target costing system started to emulate the U.S. government design–to-cost concepts from the 1940s and early 1950s. Soon afterwards the Japanese companies began to practice value engineering in earnest as a method to control purchased part costs. In the 1960s these companies recognized the significant advantages of attacking costs during the product development process. When they discovered the real impact of this, it became a competitive advantage to perform design-to-cost activity and use value engineering with it during product development.

A company cannot enter into a target costing environment without a complete understanding of cost management. Dr. Masayasu Tanaka in his book entitled *Cost Management*, views cost management as the management of the company by cost. Not cost control, but control of cost. Not management of cost, but management by cost. Target costing is the new type of cost management. Included in target costing are devices and systems to predict and control future costs. Companies can no longer try to manage cost by reporting expenditures after they occur. Yet this is all that is done by financial systems in place at most companies. What a shame that large corporations invest hundreds of thousands of dollars in financial systems like Oracle or SAP and still do not have the most important cost data that they need to be successful.

To better understand this concept, we need to discuss some of the history of target costing in Japan. Approximately in 1961, value engineering was introduced into the design stage of the Toyota Corolla. This led to the early stage of target costing as practiced at Toyota. Toyota began using target costing as a cost management tool beginning in approximately 1963.

The early stages of the target costing concept in Japan varied from company to company. Many used the concept as a tool in their procurement department to better control purchasing expenditures. Others learned that the up-front use of target costing as a strategic target cost management tool of new products mainly carried out in the development, design, and manufacturing preparation stages was critical. In the beginning small departments were responsible for establishing the target cost and allocating the cost into main portions, systems, subsystems, and even individual components. They were also responsible for maintaining a cost estimate during product development and eliminating the gap when the estimated cost was higher than the target cost.

TARGET COSTING BECOMES COMPREHENSIVE TARGET COSTING

It was approximately 10 years later, around 1974, that Toyota discovered target costing as a cost management methodology was not sufficient. Toyota learned and changed target costing into a profit engineering methodology. This is when a major shift occurred and target costing was transferred from

managing costs to managing profits. I call this new target costing perspective comprehensive target costing. In addition to the original activities of target costing, comprehensive target costing adds the management of achieving the target profit of new products. It includes setting the target cost and target profit throughout the life cycle of the new product, and managing such activities as the product planning, development, design, manufacturing preparation, manufacturing, physical distribution, sales, after sales, usage, and disposal. You can see that this is a major shift in thinking, philosophy, and of course effort to develop, maintain, and control. It is anticipated that any of you reading this can then realize if a company can actually do this, they are in the best position to control their destiny and overcome their competition.

Toyota learned the need for comprehensive target costing when it determined that the original version of target costing did not work. It was mentioned earlier that Toyota used value engineering in the early 1960s. Its design-to-cost or original target costing started in 1963. Its own design department encouraged the need to use value engineering in design, rather than only with purchased components. The Corolla was first introduced to the market in 1965. In 1967 there was a minor design change in the vehicle. The new model introduced in 1969 was a major success, and target costing was then expanded to other parts of the organization and into the supplier community. Finally, in 1973 there was a full model change. The vehicle was released with all design cost targets met. However, the vehicle did not sell very well and it was not profitable. This is how Toyota learned that it needed to move beyond the original target costing system and developed comprehensive target costing. Target costing was converted from a cost management system to a cost management and profit management system. They learned to become focused on a target profit, rather than a target cost. Thus, perhaps the term *target costing* is misleading. Perhaps *target cost management* or *profit management* is a better term to describe the target costing concept.

The main activities of comprehensive target costing are:

- Planning for target cost and target profit
- Confirming the target cost and profit and allocation to main portions of the product
- Assisting and promoting the activities of target cost and profit and managing them in product planning, development, design, and manufacturing preparation stages

- Achieving the target cost and profit by the activities of all areas of the business
- Evaluating target costing activities for continuous improvement

The effects of target costing as practiced in Japan can be immense. For one, target costing strengthens cost leadership and thus cost competitiveness. Several years ago there were over 50 portable radio companies in Japan. Today there are essentially only two: Panasonic and Sony. That is the result of boardroom war. A second result of target costing is a stabilization of quality. Since target costing is customer driven, a target costing company has no choice but to meet all product expectations demanded by the marketplace. The target costing company places an emphasis on reliability and durability. These companies believe in and develop consistency and reduce the variability in their processes. They have a focus on process capability. A third result is a shorter development and design schedule. It may seem odd, but with a more intense up-front effort in the product development process, development lead time is actually shorter. This is because many companies that do not perform target costing find out too late in the development process that the new product costs too much. They then must alter the product design, revalidate, and perhaps even buy new tools. All this second effort increases product development time and cost. Companies in this position must make the choice of entering the marketplace either late or with a product that does not have optimum profitability.

The overall measure of success is profitability. All decisions that are made in a target costing environment must be made to its impact on profit. Figure 3.1 shows the interrelationships within a target costing environment. The first column is the required total understanding of the marketplace. You need to know the needs and wants of the customer, what they will pay for those needs and wants, and at what volume they will buy. You need to know your competitor's products very well, their functions and features, and costs compared to yours. Finally, you need to know the marketplace perception of your products compared to your competitors'. The second column is the product development plan that is developed from the information from the first column. In the Arthur Andersen best practice study ("QCT Product Development," p. 20) it was stated that "the entire development process is structured to plan and achieve quality, cost and timing targets. The targets are important because they focus the organization on the requirements to succeed in the marketplace, considering customer

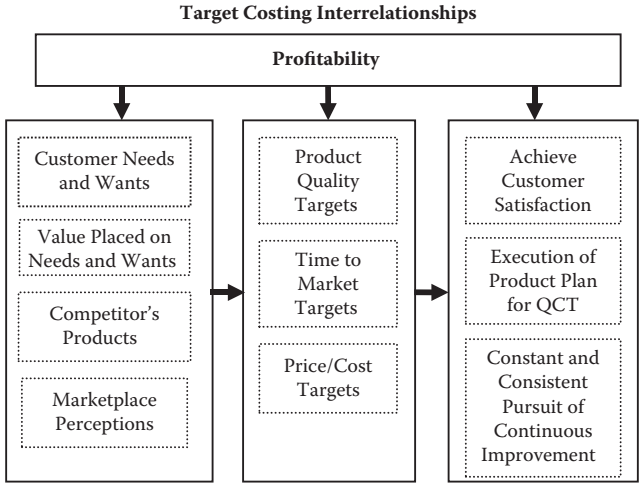


FIGURE 3.1
Target costing interrelationships.

needs and competitor actions." The third column is the implementation and successful execution of the product development plan. In addition, a continuous improvement mentality to ensure constant and consistent improvements must be in place.

PROFIT VS. PROFIT MARGIN

This book will continuously mention profit. Profit is different from profit margin. In many situations that I have seen a higher profit margin actually generates a lower profit. When the predominant metric of a company is profit margin, leadership can make bad choices, especially when it comes to pricing. What is better? A 10% or 20% profit margin? Most people will answer quickly and say of course it is 20%. Take a look at Table 3.1, which makes a comparison of different profit margins.

TABLE 3.1

Comparison of Different Profit Margins and Effect on Profit

Product	Profit Margin	Sell Price	Cost	Annual Volume	Profit
A	20%	$100	$80	1,000	$20,000
A	10%	$88	$80	20,000	$160,000

What the table shows us is that the 20% margin only earns the company $20,000. Yet with a lower profit margin, say 10%, the company is able to reduce its selling price and be more competitive in the marketplace. With the increase in sales volume the company is actually able to generate eight times more profit with a lower profit margin. To make this scenario even more dramatic, the higher volume and its impact of spreading the fixed costs across a larger base were not factored. If they were factored it would make the 10% scenario even more attractive and other products in the portfolio more cost-effective.

COST MANAGEMENT

In the most successful companies the cost management activity is of premier importance. Cost management means to run your business using cost as the main criteria. The cost management activity needs to be both continuous and integrated throughout the organization. When fully institutionalized, cost management concepts will be used in all products, services, organizations, processes, and procedures within and around the company. Thus to be effective, the cost management concept has to be accepted as a policy by company leadership. Leadership must establish the proper atmosphere and the proper resources for it to thrive. In Tanaka et al.'s (1994) book *Cost Management* the following preconditions are generally accepted by all Japanese companies that embrace target costing:

1. Product plans that are both timely and effective in cost terms are a key foundation of profitability.
2. The source of profit is not the physical effort involved in production and selling but the intellectual effort in planning and designing the production and sales processes. Those involved in intellectual work should not be diverted from it by other responsibilities. Line managers and workers are there to realize the plans created by the intellectual efforts of others.
3. Managing the intellectual effort should focus not on improving efficiency but on achieving effectiveness in product specifications. Great effort is required; the designers' slogan should be "Your next specification is God."

4. Cost is not simply incurred; it should reflect only purposeful spending. Any spending should be able to be linked to the generation of profit.
5. Cost information should be generated to show the sources of profit. Thus, from point 2 above, cost accounting should focus on the intellectual activity stage. The fixing of a product specification removes most of the ability to alter costs.
6. Appropriate cost information and expertise must be available at all preproduction stages, and design should have target cost achievement as an objective.

It seems that the keys points that should be taken from the above-listed preconditions are the tremendous focus the organization needs to place on cost management and, more importantly, who and where that emphasis is placed. In one of my visits to Canon, the leadership made an impression on me that all cost is for profit. It is certainly necessary for leadership to more than just embrace cost avoidance thinking. Cost avoidance thinking and its acceptance have to be the predominant effort for the generation of profit.

Another key point is the utilization of engineering resources. In Japan engineers go through several years of extensive training. The training includes technical, cultural, and procedural skills and knowledge. Since the investment in these people is so high and the skills taught to them is extensive, care is taken to ensure that this valuable human commodity is used properly. Their utilization is maximized by leveling product development activities much like you would in the manufacturing environment. Level schedules in product development reduce the variation of workloads in the various development activities. For level schedules to work properly, they must be strictly adhered to, again to minimize the waste of these precious human resources.

In most accounting systems the two main cost elements are variable and fixed. In essence, variable costs vary based on production volumes. Examples include all direct and indirect material, direct labor, and many overhead accounts, such as employee benefits, scrap, warranty, hourly and salary indirect labor, most maintenance costs, most energy and utility costs, and others. Fixed costs in general remain regardless of production volumes. Some examples include salaries of top-level leadership, sales and marketing, depreciation, building maintenance, property taxes, insurance, and others. The key to profit management is to make as many

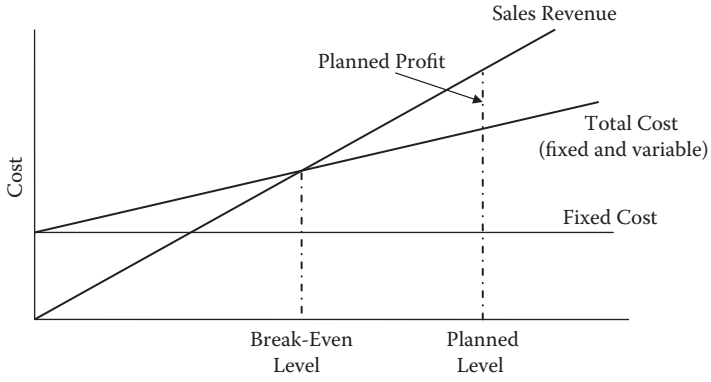


FIGURE 3.2
Basic break-even model.

of the variable costs as controllable as possible. When this is done, then the variable cost becomes the basis for profit management. If this can be accomplished, then the need for an arbitrary overhead percent of direct labor allocations can be avoided. Using percent cost allocations is essentially worthless in managing cost and thus managing for profit. Another benefit of understanding costs in this level of detail is that an improved break-even point can be calculated. Working to lower the break-even point is imperative in best-in-class companies. (See Figure 3.2.)

This model works best when it can be developed on individual saleable units. To be able to accurately develop the profit contribution without using gross percentages of overhead contribution of every product in the product portfolio will give your company a tremendous advantage in cost management. Then the aggregate profit contributions can be determined. Sales and model mix calculations can be manipulated to control sales price and sales volumes. By playing what I like to call "what if" games, using linear regression and algorithms leadership one can make improved decisions to optimize profit performance for the entire enterprise.

COST VISIBILITY

Target costing addresses costs as design commitments are made. In essence, the design community is the cost creator of your company. Product designs

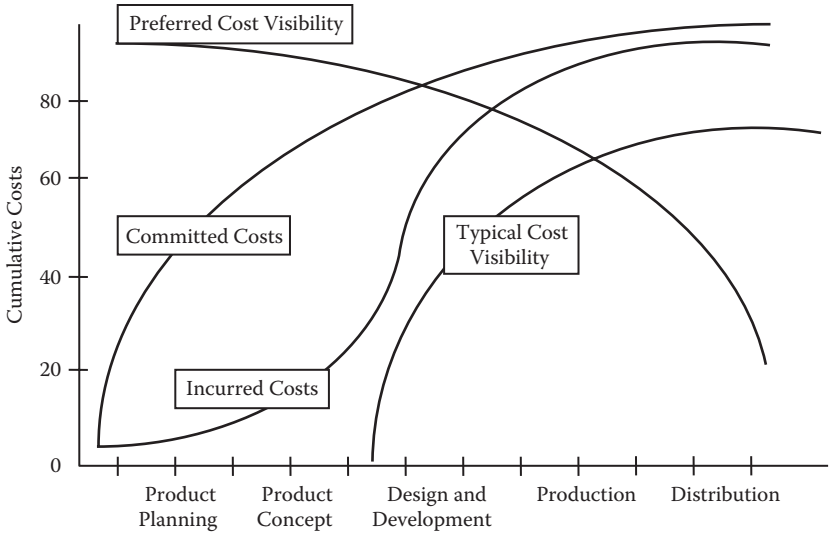


FIGURE 3.3
When costs are committed, incurred, and known.

exiting concept development phases have at least 75% of their final costs already committed. Thus, knowing those costs before they are committed is necessary to ensure profit objectives are achieved. Figure 3.3 shows the difference in cost knowledge that can result using target costing.

ENGINEERING CHANGE REQUESTS

In 1998 I attended and presented at a target costing conference cosponsored by the Consortium of Advanced Manufacturing International (CAM-I) and the University of Akron in Cleveland. Dr. Kentaro Koga, a Harvard graduate and professor at Waseda University in Tokyo, reported results of a research study from thirty-five projects with seven Japanese camera manufacturers. The study was performed in the early 1990s. A summary of his findings were:

- Frequent cost revisions occur.
- Frequent interactions among product designers, process engineers, and procurement officers occur.

- There is a very strong influence of the product manager over the product plan to lower product manufacturing costs as well as the product design.
- Product designers intensify their interactions when they foresee difficulty in meeting the target cost.
- Frequent uses of cost tables occur.

What he also said was that over 90% of engineering change requests in this study were made to lower costs. This was quite shocking to me, since my experience to date had been just the opposite, where about 90% of the engineering changes added cost. Since the design engineer is responsible for meeting the target cost and product performance specifications, he or she routinely works to change the design to meet the expected target cost.

SURVIVAL TRIPLET

In Cooper and Slagmulder's (1997) book *Target Costing and Value Engineering* (p. 31) there is a description of what is called the survival triplet. "The survival triplet consists of three dimensions that define a product, which are cost/price, quality and functionality." Each dimension has a minimum and maximum range depending on the product, its brand image, competitor levels, and customer preferences in the marketplace. When I discuss these three dimensions with companies I ask them which is the most important. Without fail, as I poll a group of people, the result is that all three will be offered as the most important, with each person's justification for his or her choice. I also always hear that all three are important. My response is "Yes, they are all important, but which is the most important?" as I am trying to get them to select one dimension as a focus. My answer to the question of which is the most important is "It depends." So you must ask, "Depends on what?" Let me answer that question with the following explanation.

Let's take the U.S. automobile industry. Many years ago Japanese automobiles sold in the United States were considered junk. They were perceived by the marketplace to lack quality and just did not have the strong appearance that U.S. automotive manufacturers produced. So the Japanese companies chose to focus and maintain the quality dimension as

their most important. They continued with quality as the most important until quality got to the maximum of the range. Going beyond the maximum would not offer any more sales, or at least not enough more to justify the effort to take quality improvement any further. Thus, we noticed in the late 1990s and early in this decade a switch at Toyota. They switched from a quality focus to a cost focus. Toyota launched its CCC21 (Construction of Cost-Competitiveness in the 21st Century) cost reduction program. With CCC21, Toyota reduced cost at the individual component part level. In the five years of this program it has been reported that Toyota reduced cost by over $9 billion. Starting in 2005, Toyota's cost reduction efforts switched from individual component parts to looking at whole subsystems, modules, or systems. This effort is called value innovation (VI). Toyota's long-term strategy involves developing both global and regional car models in order to compete worldwide with a full line of products.

At the exact same time that Toyota switched from a quality to cost dimension focus, Hyundai/Kia began to expand its penetration into the U.S. market. In 2000 the market perception of these Korean models was that while they were affordable, lacked the necessary quality, and did not measure up to the other vehicle manufacturers. So what did Hyundai/Kia need to do? Yes, you guessed correctly. They switched from a cost focus to a quality focus. They also backed up the quality focus with the best vehicle warranty program in the industry. Once they began doing that the U.S. market perception started being altered and they are gaining market share.

So yes, it depends. It depends on the customer and the current given perceptions of the marketplace of your products vs. those of your competitors. In the example given, at the same time Toyota was moving from a quality to a cost focus, Hyundai/Kia was moving from a cost to a quality focus.

Now that you have a basic understanding of the target costing concept, you will have a chance to learn if target costing is needed in your company. Chapter 4 will pose several questions that you should honestly answer in a simple assessment to determine if target costing is for you.

CULTURAL DIFFERENCES

One could easily question whether cultural differences, especially between and Japan and Western countries, would make the adoption of a strict

target costing activity difficult to install. In the book *Riding the Waves of Culture* by Trompenaars and Hampden-Turner (1998) you would find that for almost every behavior survey that was performed from their research, Japan and the United States were on opposite sides of the spectrum. Their research probed many different areas, such as habits, attitudes, leadership style, relationships, rules, and even how we relate to nature. With such a vastly different way of thinking, how do Western cultures take on such an enormous venture such as target costing?

In my opinion target costing is only partially cultural. First, the guiding principle of target costing is customer driven. It does not matter what your cultural background is for you to understand that without customers, you will not survive. What you need to recognize and know is what customers that live in different cultures need and want, regardless of what your culture is. Too many Western world companies have the attitude that they know what the customer really wants without going to the specific marketplace to really know for sure. This is the way to disaster. A second guiding principle of target costing is cost management before, during, and after product development. Western-based companies have gotten in the habit of only controlling costs after product development. Everything is cost savings after cost has already been committed. It must be realized that paying attention to cost after the fact is not good enough. This realization is not based on a cultural difference. It is based on the leadership commitment to drive cost out of its products very early in the development process. Cost avoidance must be recognized as a good thing, not something to be avoided, as I have heard from finance people in major companies. When you finally realize that regardless of your cultural background you must still compete in the global marketplace with companies from different cultures, then those cultural differences need to be neutralized.

SUMMARY

Perhaps the best simple model that I have seen is described in Maramaldo's (2010, p. 110) book, *The Complete Total Competitiveness Theory*. Figure 3.4 shows his competitiveness dynamics model, where Vu equals value for the user and Vp equals value for the producer.

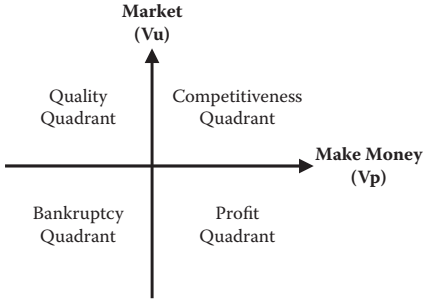


FIGURE 3.4
Competitiveness dynamics model.

In this model it is easy to see which quadrant you want and need to be in. No quadrant other than the competitiveness quadrant is acceptable for the long term. Even if your business is in this quadrant, but in the lower left portion of it, you may at best be surviving, and may have a tendency to fall to one of the other less desirable quadrants. Every effort in target costing is to move your business to the competitiveness quadrant direction and to escalate it to the highest levels on each axis. You must keep in mind that the level of customer satisfaction is a moving target. Customer needs constantly change. The measurement of this axis is continuous. Or in other words, each axis will move as conditions change and point zero will change as well. The best companies will actually be able to either predict the future or be that market leader, or better yet both.

4

Does Your Firm Really Need to Do Target Costing?

Target costing must be used to ensure *constant*, *consistent*, *predictable*, and *acceptable* profit levels beginning at product launch. With that said, it is possible that target costing is not a realistic endeavor for some companies or organizations. Certainly, even though many target costing concepts would apply, nonprofit organizations would not receive the full benefit of target costing. For the few remaining monopolistic organizations, they also may not need or receive the full benefits of target costing, since they face no real threats. With that said, many of the target costing concepts could and should be used in government agencies. With limited dollars to spend, it is in the best interest of the taxpayers to utilize public money wisely. It seems, though, that most companies do not fall into either of those categories. Any company participating in the global markets with any sort of competition will benefit from target costing.

We know that there are many firms reading this that think they are already doing target costing. It is our belief that this is true, but only for a very small minority. We believe that most companies that believe they are doing target costing in actuality are not, or are at such a preliminary level that they have a long journey yet ahead of them. In any event, regardless of your organization's status on the path of target costing, this book will benefit you.

IS TARGET COSTING FOR MY COMPANY?

Here are some preliminary questions that you need to ask yourself about target costing:

1. Are product level target costs achieved most of the time? This question deals with the establishment of a product level target cost prior to concept development. The question is asking, do you establish a product level target cost prior to the concept development stage of new product planning, and is that product level target cost tracked throughout the product development process and met at the start of production?
2. Does your firm allocate the target costs of its products to the component level and use the resulting component level target cost as the basis for establishing supplier prices and in-house manufactured costs? This question is asking, how well do you take the product level target cost and allocate it to systems, subsystems, and component parts?
3. How accurate are your allocated costs? Taking question 2 a step further, this question is asking if you accurately predict future expenditures before they are created. In other words, do you have a detailed cost database that can accurately predict the cost of a component part before it is designed.

Even if you can honestly answer yes to these questions, you are well on your way, but there is still much more that needs to be considered.

Target costing works to avoid expense before it ever occurs, or in other words, avoids costs as the design is being created. Most companies do not realize that the design engineer creates product cost. Unfortunately, in most Western world companies, those same designers have no clue what cost they created, when it is being created. They are held accountable to make sure that the design works, but are rarely held accountable for the cost that they create. This is not true for the best companies in Japan. In some Japanese companies, design engineers are called profit engineers because they are held accountable for the profitability of the products that they design. They believe that the most effective way to manage cost is before it is committed. It is better to save money that was never spent. The problem with this concept is that Western world finance does not recognize this

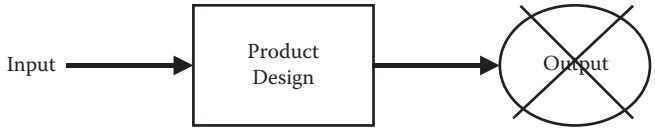


FIGURE 4.1
Cost as an input to product design, not an output.

savings. Cost avoidances do not show up on the accountant's ledgers. Thus, most companies do not give credit for cost avoidances. Since these companies can measure cost savings, which is money already being spent, they have top-down cost savings objectives. The entire organization is working to save money that is already being spent, because they can measure that number. With no credit offered to workers for cost avoidance, they make no effort to develop and design a product at its lowest possible cost at the start of production. They would rather spend money on the cost of change so that they can get credit for cost savings after the fact.

Thus, a key concept to target costing is for cost to be an input to the product design rather than an output, as shown in Figure 4.1.

If a company waits until the design is complete before knowing what the design cost is, it is simply too late. If the cost is determined to be too high and profitability not acceptable, the cost of change and the time to make changes will hurt that product's chances of survival in the marketplace, or the subsequent delays will disrupt harmony in the marketplace and the product development organization.

So to really determine if your firm needs to do target costing, and if it can handle the pressure to do it fully and properly, you need to honestly answer these questions:

1. Are you facing more intense global competitive pressure? Except for a very few, the answer to this must be yes. Competition is great for the marketplace and the consumer. The more choices consumers have, the better their chance of buying a higher-value product. Generally, in most markets there are new competitors entering the marketplace, and most of the new competitors are from low-cost countries. Low-cost country manufacturers have learned that if they can copy an existing design and produce it for less, they can significantly penetrate their products into the marketplace. Once they have entered the marketplace and have established a consumer base,

they could eventually become a very formidable competitor. If one or more companies that compete with your firm have the boardroom mentality described earlier in this book, then you have no choice but to begin the target costing journey. Without it, the chances of survival will be slim when stacked up against such a stellar competitor. It is the best strategy to prevent new competitor entries into the marketplace through aggressive business strategies.

2. Do you really know what your customers are looking for, and do you really know what the customers are willing to pay for what they are looking for, and do you really know how many they will buy at a given price? Too often we find firms where the sales or marketing group tells the company that the customer needs a certain specification or feature in the product. Then the company eagerly develops and designs for that perceived need, only to find out later that the customer is not willing to pay for the added feature, or the cost of the feature exceeds the price the customer is willing to pay. Then, also not knowing a future sales volume forecast, many design and manufacturing decisions tend to be wrong, forcing wasted cost in the end product. A severe example of this occurred at Delphi in 1999. Delphi had developed the quad-steer system for GM vehicles. The system was fantastic. It greatly shortened the turning radius for large vehicles. It made parking large pickup trucks a breeze. It greatly enhanced the ability to drive, tow, and park trailers. In short, the product met all the needs of the customer. Late in the product development stages GM determined that consumers were willing to pay approximately $2,000 for this option. The problem was that the estimated cost of the design was closer to $4,000. Since the development was essentially complete and prototypes were already in vehicles being tested, it was too late in the development process to go back and change the design to take the required significant cost away. Instead, GM placed a high price on the option. The result was that the option did not sell and was eventually dropped.

   Another example of poor up-front planning occurred when GM rolled out the LS Saturn. GM had invested significantly to retool the Wilmington, Delaware vehicle assembly plant. It also worked diligently with the local union to negotiate an agreement similar to the one patterned by the original Saturn plant in Springhill, Tennessee. The business case for the new vehicle forecasted a volume that

required two full shifts to produce the demand. All business decisions for that facility were made with that volume forecast. All part suppliers needed to tool and have capacity for two shifts. The incoming and outgoing logistics were planned for this volume as well. After production started the plant never had a demand to support more than one shift. With so much fixed cost already in place, for both GM and its entire supplier community, this vehicle program had little chance of success.

Japanese companies that excel in target costing place a very high priority on knowing all elements of the marketplace before designing and detail planning a new product. They must know the features and functions the customer needs and wants. They must know how much they will pay for features and functions, and they must know how many they will buy. Accurate volume forecasts are necessary.

3. Have you recently altered your product development process? Does your product development process focus on customer-driven product functions? What is the trend of your research and development budget? Companies that give up on research and development do not survive. Some companies are very good at utilizing the copycat system, where they let others come up with new products, then they rapidly bring a similar product of their own to the marketplace. Companies that do this can only hope to survive, at best. They will never be world-class leaders because their whole business strategy is to "play catch-up." A few years ago, at a visit to the Omron Kenihanna Innovation Center outside of Kyoto, Japan, we observed a highly technical and organized research, innovation, and development operation. Care was given to provide an atmosphere for innovation in the building architecture and layout. Special rooms were provided for research to occur with the involvement of important suppliers and key academic institutions that have an excellent history of bringing patents into production.

   Speaking of patents, one of the best companies in the world is Canon. Canon has placed in the top three worldwide corporations for patents submitted to the U.S. patent office for approximately 20 years. They are so good at patent submission that the Canon research and development organization is a profit center for the company. They earn license fees and royalties from their research and development efforts.

Time to market is a competitive weapon in today's global marketplace. Thus, it is essential to constantly use kaizen concepts to continually review your new product development process to remove waste, increase productivity, increase throughput, and reduce lead time. Function-oriented (value analysis) workshops and synchronous concepts integrate well together to make significant improvements to the development process. Just like a manufacturing process, leading corporations view their new product development process the same way. They look at lead time reduction, reduced inventory, and eliminated scrap and rework, straight through flows using kanbans and level schedules. Having the new product development process march to the tact time streamlines the entire organization.

In 2000, General Motors produced a new vehicle design on average about every 20 days. However, the vehicle design was not cadenced. The design went through the design factory in batch mode. Several new vehicles were introduced at the same time. This caused wide variations in resources like manpower, test facilities, supplier prototypes, etc. When you have such a wide range of variation, you have to have capacity for peak periods. During these times everyone and everything is very busy. However, in the valley the demand for all of these resources is low, and thus people, equipment, etc., are not fully utilized, causing significantly higher costs. Instead, it would have been much better to schedule the engineering factory much like the manufacturing factory. Put in place a tact time and level schedule system to minimize the peaks and valleys. The benefits should be obvious.

4. Do your suppliers play a key up-front role in your development process? Are you willing to share cost information with your suppliers, and are your suppliers willing to share cost information with you? Developing such a relationship with the key members of your supply base takes time. It involves mutual respect and trust. For many companies in the United States we have observed the opposite. This is especially true with the automotive original equipment manufacturers (OEMs). They have worked hard to leverage their buying power, which worked as a short-term success. But in the long term, it eroded the trust of their key suppliers. There was no mutual respect or trust between the OEMs and the suppliers. We have heard of suppliers that were crushed so hard by the OEMs that they could no longer produce parts profitably and refused to make production schedules. They decided they would

rather give up that business than continue to work under the duress of the OEM buyer constantly demanding lower prices. They simply called the OEM and told them that their tool was on the shipping dock and they should come by and pick it up. This type of dialogue is obviously a severe measure for a supplier to make, but it is a known fact that some have had to make this decision.

It was mentioned earlier how Omron involves their key suppliers very early in the development process, at research and development. One of the key successes of Toyota is that it has two suppliers that it has developed long-term working relationships with and developed mutual respect and trust.

Without Aisin Seiki and Denso as trusted suppliers, Toyota would not be anywhere near as successful as it is. It is my understanding that Denso actually wants to be better than Toyota. With a supplier that has this type of dedication to the parent company, they all have an enhanced ability to succeed.

5. This next question is our favorite, and certainly one of the most difficult for a company to answer. Is your leadership willing to leave their ego at the door? To totally embrace a target costing philosophy requires corporate leaders to rethink everything that they have used to become the leaders that they are. What we mean is that almost every corporate leader got to that level of the organization because he or she has shown extreme knowledge of the business and exceptional leadership skills. These leaders are smart people. They have worked hard and long hours. They have operated in such a way that it got them to be where they are today—corporate leaders.

   That is exactly the reason why these leaders would be reluctant to make a change and go with the target costing philosophy. Their success stands as a roadblock to change. Everything they have ever done seems to have worked for them because it got them to their lofty corporate position. Their habits, their behaviors, and their attitudes are locked in place. To adopt target costing into the DNA of the company, those previous experiences and leadership traits may no longer be valid. This is not to say that target costing can happen without a strong leader. Most certainly a strong leader is essential to make it happen. But the way that strong leader thinks and acts cannot be the same as how he or she has historically ran his or her business. How leaders lead must change in a target costing environment.

Changes in organization must occur. Most certainly performance metrics must change, and how those performance metrics are measured. The level of decision making within the company must change. Responsibility and accountability changes must occur. Financial reporting must change. This is extremely difficult, and perhaps the main reason that will prevent target costing from working in Western world cultures to the extent that it has in Japan and now in many companies in Korea.

SUMMARY

Now that we discussed these questions, a decision needs to be made. Does your firm really need to go forward and climb the ladder to the top and institutionalize target costing? Perhaps there is not a competitive killer in the global marketplace, thus eliminating any fear of not surviving. Maybe target costing is not for your business because you are happy being mediocre. Perhaps your definition of success is just to survive and you are happy with that situation. Or are you willing to take the risk of not implementing a target costing strategy for your firm? A decision to not utilize target costing is a decision. The ultimate long-term future of your business is at stake.

Target costing takes a long time to institutionalize, even with the total commitment of the entire organization. According to Dr. Masayasu Tanaka, it takes three to five years for the impact of target costing to be evident, and it takes more than 10 years to be extremely competitive. We do know that there will be benefits along the journey. Thus, it is recommended that the sooner you get started, the sooner you will receive the benefits of using target costing, and the sooner you will enhance your chances of survival and success.

5

Getting Started on the Target Costing Journey

One of the first steps in the target costing journey is to better understand what target costing is and what it is not. The topic of target costing has now been around long enough and gained sufficiently wide acceptance that it can no longer be called an emerging management technique. Yet there remains a certain amount of ambivalence and confusion about target costing. Some companies have experimented with target costing only to abandon it after encountering resistance from managers to the change from traditional cost management systems. Others have moved in the direction of target costing, but have failed to make the necessary strategic commitment to the idea to reap its full benefits. The following discussion addresses some of the myths about target costing and offers practical suggestions for a successful target costing implementation.

MYTHS OF TARGET COSTING

The first myth is that target costing is primarily about setting cost targets. Target costing is not just the act of setting cost targets—it is an entire value chain approach to managing an enterprise for profit. A value chain approach is totally different. Target costing begins with understanding what the market values are—what the customer or prospective customer wants and is willing to pay. It is especially important to keep these customer value expectations at the front of the workforce's awareness throughout the whole product development cycle and to take a very disciplined approach to deciding where to position a new product or

modification. Otherwise, a lot of features may get added to products in the development stage that are fun for the engineers and designers, but do not reflect what customers want, which is why many new products get launched that do not sell. The decisions made regarding product development must also make business sense to the producer. If a product feature does not add value to a customer, in the long run it probably will not add value to the producer.

Target costing involves translating customer value expectations into an acceptable product price and taking away the profit that shareholders expect to make to get the target cost. Once a product target cost is determined, decomposing the cost into the parts of the product can be difficult, and it has to be done based on the features that a product provides to the marketplace or the functions it performs. Customers do not care how many engineers were on the project or how much tooling cost was incurred, they care only about the cost of the various product features and functions that they are willing to pay for.

Another myth is that cost targets are just cost budgets. Target costing is totally different from traditional budgeting systems, especially those in contract environments where managers have been taught for years that budgets are something you spend. It is difficult to change the workforce mindset from cost budget (which represents something to be spent) to cost target (which represents something to be achieved). Cost budgets and cost targets are, fundamentally, conflicting concepts that should not be in the same universe. Ideally, the word *budget* should be banned in a target costing environment because it carries too much baggage from the old model.

A final myth about target costing involves where it fits in the developmental life cycle of a product. Design-to-cost systems were tried at many companies years before the introduction of target costing, but many of these applications failed miserably because they focused on far too small a part of the product life cycle. They mistakenly assumed that everyone else in the value chain was going to engage in the system, and that all of the financial information was readily available so that people could do value engineering and value analysis studies. In a lot of cases the value chain was simply not ready to accept the new model. To be successful, target costing, like value engineering, must be embraced across the entire product life cycle, from very early concept development and market research all the way to the disposal of the product.

Although not limited to target costing, there is also a common misconception within the broader framework of corporate financial systems regarding the idea of cost management. In most present-day financial systems, there are organizations that are in charge of cost management, but what they really do is report cost, not manage it. Cost cannot be managed because it is a result of what you do (the work that is done) and how you do it (the processes and environment where the work is accomplished). If you do a good job at managing what you do and how you do it, you should have a favorable cost outcome.

To have a successful target costing application, one must begin by determining the product's strategic market position and customer expectations regarding product features and functions. Cost targets must not be viewed by managers as spending allowances or unrealistic spending limits, but rather as goals to be achieved through collaboration with colleagues and other parties up and down the value chain. Above all, target costing must be viewed not as a costing method, but as a model for managing cost across the entire value chain. If this is done well, the final product will meet customers' expectations, and both costs and profits will be within acceptable boundaries.

ORGANIZATIONAL BREADTH

Table 5.1 shows the organizational breadth required for target costing to thrive. Essentially every staff area is involved at all times, but the X's depict the main product development segments and areas of involvement.

The major roles and responsibilities of each area are:

Strategic product and profit planning

- Identify which products need to be developed
- Create a sale price and life cycle profit plan for identified products
- Develop a product plan schedule that factors all products going through development

Sales and marketing

- Identify and understand customer perceptions
- Identify and understand the voice of the customer

TABLE 5.1

Staff Areas' Responsibility for Target Costing

Organizational Elements	Product Strategy and Profit Plans	Product Concept and Feasibility	Product Design and Development	Production and Logistics
Strategic product and profit planning	X	X		
Sales and marketing	X			X
Cost planning and management	X	X	X	X
Technology planning	X	X		
Product design	X	X	X	X
Process design	X	X	X	X
Cost estimating	X	X	X	
Procurement		X	X	X
Manufacturing			X	X
Industrial engineering	X		X	X

- Identify competitor strengths and weaknesses
- Determine what value the customer will place on certain features and functions
- Determine how many they will buy at certain price points

Cost planning and management

- Set target cost based on information provided from the above two departments
- Allocate the target cost to the responsible engineering and manufacturing groups
- Establish investment targets
- Allocate the investment targets
- Predict/estimate future costs
- Ensure that the target cost is met by using VE and other value-improving techniques

Note that the cost planning department is sometimes called cost management or cost engineering. Every major company in Japan and many in Korea have this department, yet we do not know of any Western world companies that have the same organization with the same roles and responsibilities. Details of this department are discussed in Chapter 6.

Technology planning
- Introduce innovative product features
- Introduce proven materials, composites, and latest electrical technologies
- Introduce innovative equipment and processes

Product design
- Create designs that meet the functional and specification requirements
- Create designs that do not exceed the allocated target cost

Process design
- Assist product design to ensure product designs are easy to manufacture and assemble
- Ensure equipment and tooling are available when required

Cost estimating
- Create cost tables
- Maintain cost tables
- Work in conjunction with the cost planning department

Procurement
- Develop procurement plans
- Work with key suppliers
- Use cost tables to develop prices for purchased components
- Monitor to ensure prices do not escalate during the development process

Manufacturing
- Participate as required in the product design
- Be responsible for ongoing kaizen to continuously improve manufacturing processes and reduce cost

Industrial engineering
- Identify and solve manufacturing problems and issues
- Maintain standardized work practices
- Help implement kaizen opportunities
- Provide accurate manufacturing floor cost data

Industrial engineering as a discipline in major companies seems to have lost favor. As a degreed industrial engineer (IE) myself, I often wonder why this has occurred. I have seen two reasons for the disappearance of IEs. The first is for decades the IE focus was placed on improving the effectiveness and efficiency of direct labor. My definition of an industrial

engineer is the effective and efficient integration of man, material, and machine. This could also be the definition of lean when you really consider the result of lean activities, since the reduction of waste will lead to this result. So in many ways IEs should be lean experts. As labor costs became an ever-smaller portion of total product cost companies felt that their IEs were no longer needed and the work could be done by nondegreed workers.

The second reason, I believe, is that the college and university curriculum for IEs has changed. As a regular participant in the Institute of Industrial Engineering Annual Conference, I see undergraduate and graduate IE students that are not equipped with what I will call the "grunt" skills to be an effective IE. It seems that they also lack the desire. They are more interested in using sophisticated products and software to solve problems. The Japanese term *genchi genbutsu* means to go to the activity that is performing the work and to observe and study it for several hours. Direct observation is necessary. I do not see the young college graduates willing to do this type of engineering analysis. They would rather sit by the computer screen and run models.

We need a return of the IE that was produced in the 1960s and 1970s with the computer smarts of those in the 21st century.

STEPS TO BEGIN TARGET COSTING

The first key step in beginning the target costing journey is to have top leadership 100% on board with the decision. There is no doubt that to embark on the implementation of a target costing system will be a major and arduous task. An organization needs to do some "soul searching" up front to make sure it is really ready to proceed. The process will take several years, so having a fully committed and dedicated leadership team is necessary. The company will be rewarded with benefits along this journey, but the greatest benefits obviously will not result until a mature process is used and in place. A warning: Target costing is not a smorgasbord line where you can pick and choose just the items you like. It's a full-course meal and you have to participate in all the courses. Once the entire executive team is on board and committed, a corporate policy must be developed and communicated to the organization.

A distinct disadvantage for Western world companies to begin implementation is that the Japanese culture and academic institutions that teach target costing concepts do not exist. We are literally 40 years behind in developing the infrastructure that makes implementation and institutionalization of target costing easier to accomplish.

That infrastructure includes the academic environment. Most business universities in Japan now teach target costing, cost management, and value engineering. PhD students have been working for years in developing and doing research that supports target costing concepts. Price and cost algorithms have been developed in the universities. Corporations then have the opportunity to take advantage of these studies and research to use in their business. The students are better prepared to enter the workforce already knowing these skills and techniques. Japanese companies also have the advantage of bringing in academic faculty who are well versed in target costing concepts to assist in the initiation of their target costing system. Dr. Masayasu Tanaka has worked with almost every major corporation in Japan in some way or another. This is a huge disadvantage for Western world companies to overcome. Some have already coerced Japanese managers to work for them. It is my opinion that the best Japanese workers are most loyal to their original employer and are reluctant to leave for another company, even within Japan. The United States really needs a university to set up and make a fully dedicated effort to begin teaching target costing. This will not happen until the corporations demand that undergraduate and graduate students have this knowledge, and it will not happen until academic faculty really learn and know what and how to teach this discipline. My guess is that it will take government intervention to make this happen. Certainly some university could apply for and be issued a grant to begin this curriculum.

KNOWING WHAT TO DO

So with that said, for now it is up to the corporate leadership to do this on their own. They need to play the role of the academic institution. Corporate leadership then must somehow get fully trained themselves because they are the people to do the initial training for the rest of the organization. Just the fact that the company will see the top leadership out there doing

the training themselves will surely indicate that this is something really different from the past. It is in the Toyota system that every leader, regardless of their level in the company, is a trainer first, with the responsibility to teach their subordinates the proper methods and techniques that need to be followed. There are a few ways to accomplish this, and perhaps the result would be a combination of several of them. Not in any particular order they are:

- Join CAM-I (Consortium of Advanced Manufacturing International).
- Use grant money to bring a university on board to work with them.
- Benchmark Japanese companies.
- Hire/steal a competent Japanese expert.
- Hire consultants that have worked to learn some or all of the target costing concepts.
- Conduct on-the-job training.

The Consortium of Advanced Manufacturing International is a nonprofit organization headquartered in Dallas, Texas. It can be found on the Internet at www.cam-i.org. Founded in 1972, CAM-I is an international consortium of manufacturing and service companies, government organizations, consultancies, and academic and professional bodies who have elected to work cooperatively in a precompetitive environment to solve management problems and critical business issues that are common to the group. CAM-I's collaborative model produces value for members through participative research, targeted intellectual efforts, and human networks. Target costing is one of several special interest groups within CAM-I. Its members meet every quarter for the benefit of its members. The target costing group at CAM-I has existed since the early 1990s.

Using grant money to bring a university on board to work with you can pay dividends for your company. Through careful selection of a university and academic staff and through dedicated supervision from someone within your company, you can direct the university resources via a grant. Using undergraduate interns and graduate students for research, you can spread your investment dollars across a greater spectrum. Several years ago we learned that John Deere authorized considerable research related to target costing to the University of Illinois. Without this joint activity the generated result to John Deere would not have happened or would have taken considerably longer to obtain.

As discussed on rung 4 of the ladder to global survival and success, it is important to benchmark. The only companies as of this writing worthy of benchmarking the target costing concepts are in Japan. I sincerely hope that will change in the near future, as some U.S.-based companies have already started on this journey. If they can sustain this effort, in a couple of years they will be worthy of investigation as well. So the question remains: How does one get into different Japanese companies to see and learn more about what they do and how they do it? My company, the Advanced Value Group, has over the years led groups to visit several Japanese companies. Since 1999, I have visited the following Japanese companies:

- Toyota (twice)
- Denso
- Aisen Seiki
- Nissan (twice)
- Canon (twice)
- Omron
- IHI
- Yokogama Electric Company
- Isuzu (three times)
- Zexel Corporation
- Hitachi Construction Machinery Company

Repeated visits and visiting companies from different industries and market segments helps in getting a broader range of ideas that you might be able to use. While it can be said that none of these companies practice target costing and value engineering in exactly the same way, nor are they organized in an identical manner, I can say that the framework and major structure of their systems and processes is constant and consistent. Most of the whats that they do is identical, it's the how-tos that are different, but not that much. In all cases the result is essentially the same: the highest levels of profitability within their market segment.

Some companies in the United States have been successful in hiring American people that have worked for Japanese companies. I am not aware of any U.S. company that has actually hired a high-level Japanese employee to bring the target costing activity inside. I suspect it will happen at some point, as this has already been done with lean manufacturing techniques. As soon as companies realize that lean will only take them so far and

they need to climb the ladder, then perhaps we will begin to see a trend of attempting to bring in target costing experts from Japan.

Hiring consultants from either Japan or the United States will be an issue for most companies. First, there are only a couple of competent Japanese consultants that are worth hiring. Since they are so few in number, they are extremely busy working for companies in Japan. On the U.S. side, there may be many consultants that claim to know and have extensive experience in target costing, but in reality there are only a couple that are competent and have enough experience and knowledge to make it worthwhile for your company. This is so because, if you think about it, where would they get the required knowledge and experience? Few companies have made the efforts to study, learn, and benchmark the greatest target costing companies in the world. To hire a consulting firm to help you initiate target costing should be handled very carefully.

What that leaves is on-the-job training for most companies. Here again, you may need to bring in an experienced consultant to help get the process launched. Certainly reading this book is an excellent start, but you will need much more learning to be successful in target costing. The trials and errors will be numerous. It will take enormous patience and perseverance to keep the activity alive and growing. These lessons learned need to be just that. What mistake was made? What did we learn from it? What should we do instead? As mentioned earlier, it needs to be top leadership doing much of this learning. Top leadership normally has an aura that it is flawless. No one is flawless, so let's not pretend that we are. Leadership's constant involvement, knowing that mistakes will occur, shows the organization that they are human after all. How they treat and learn from those mistakes is what will be the difference between a leader and a great leader.

So how does leadership get the training that they need? How do they know if they are making a mistake? As previously mentioned, Western world companies are at a severe disadvantage in getting started. What I hope is that this book will spur the need for several companies to begin the proper path to complete the target costing journey. As more and more companies begin the journey to the top of the ladder, I believe the infrastructure will take shape on its own. For example, when Jack Welch, the famous CEO of General Electric, starting promoting six sigma, all of a sudden there were all kinds of training programs developed to teach,

train, and certify in six sigma. I hesitate to use that as an example, since in my opinion six sigma in many companies is not used properly. But it does show what can happen when a well-recognized CEO from a major corporation starts promoting a corporate trend.

FORM COST PLANNING GROUP

The next major task is to begin the formation of the cost planning or cost management group. The cost planning group must have a very strong and extremely credible leader within the organization. Many Japanese corporate CEOs, COOs, and presidents are former cost planning group managers. The care to select this person is critical to its successful launch. This group is described in more detail in the following chapter.

CONDUCT CURRENT STATE ASSESSMENT

The next most logical step is to find out where you are, where you are going, and how are you going to get there. The few people in your new cost planning department will be able to perform a detailed assessment of your business policies, practices, procedures, organization, etc. The previously mentioned CAM-I organization has a book titled *Hitting the Mark* by Ansari et al. (2005). Portions of this book that implement target costing can be used as an aid. The book comes with assessment tools. Rather than reinvent another assessment tool, it is my recommendation to use the work that has already proven itself and has existed for a long period of time.

When David Schwendeman was a VP of finance at Boeing and a director for CAM-I, he developed the target costing diagnostic model in the appendix of the book mentioned above. This tool has three major areas: culture and infrastructure, principles, and processes and tools.

Culture and infrastructure

- Leadership
- Performance metrics

- Empowerment and risk tolerance
- Project management
- Multifunctional training
- Knowledge

In the culture and infrastructure area, it is my opinion that leadership and performance metrics are the most important. It should seem simple to realize that without the proper leadership, nothing great will happen. The leadership traits discussed in Chapter 2 should be followed.

The other main element in the culture and infrastructure category is performance metrics. I have always believed that you get what you expect and what you measure. Employees whose compensation and job depend on a certain set of criteria will certainly tend to follow those criteria. Thus, it is extremely critical to establish the best set of performance metrics to obtain the behavior and results that can be achieved in a target costing system. Most certainly these will be different than the performance metrics that are currently being used.

Principles

- Customer focus
- Life cycle cost reduction
- Price-led costing
- Focus on design
- Value chain management
- Cross-functional teams

Without a doubt, the most important element in the principles area is customer focus. This is why it appears as a key element on the rails of the ladder. Every benchmarked company that has excelled in target costing has an across-the-board customer first attitude. Producing product/functions that the customer is not willing to pay for will not lead to success as I define it. The customer viewpoint and perception must be known and satisfied.

Focus on design is the second most important criteria in the principles area. Almost all the cost in a product is created during the design development of the product life cycle. As the design engineer adds features, dimensions, tolerances, etc., the product cost is established. Thus,

it is most imperative to control and manage the cost at this stage of the product design.

Processes and tools

- Product-focused financial systems
- Value engineering
- Voice of the customer
- Decision analysis
- Benchmarking/cost driver analysis
- Product estimating

In the processes and tools area the two most important criteria are product estimating and value engineering. The product cost estimation tools are the cost tables that are a key subject of this book. It is so important that it received rung 9 all to itself. It is these tools that you need to determine what cost you are creating during product design. Then as you learn what costs are created, it is almost certain that there will be a negative gap between the cost estimate and the cost target. Value engineering is by far the best and most common tool used to eliminate the gap.

MISSION AND VISION STATEMENT

Once the assessment has been completed you need to determine where you are going. What is your mission? You will need to carefully plan and word your mission. The mission should be simple to understand.

Some examples of a mission statement are:

- Manage all cost for profit.
- We will manage our business so all cost leads to profitability.
- We will manage our business to be the ruthless competitor in our industry.
- We will become a truly excellent global company.
- We will be the best in our industry for the next 200 years.

From the 2008 annual report, Canon Chairman and CEO Fujio Mitarai wrote:

> Finally, in order to become a truly excellent global company that sustains growth and continues to thrive for 100 or even 200 years, it is essential that we develop our management resources. Canon will pass on its DNA—respect for human dignity, an emphasis on technology, and an enterprising spirit—to the next generation of managers and implement practical human resource development training that will also apply to its executive officer system. Canon will also redouble its efforts to contribute to society. The presence of a truly excellent global company must be welcome—even in fields outside of its direct business activities. Therefore, we will fulfill our social responsibilities as a good corporate citizen.

A vision, or what I call a future state model, needs to be prepared with the detail to support the mission.

An example of a future state model is:

> Our corporate leadership is forever dedicated to ensure that our company will be here for our employees, their children, and future generations of their children. Every day we will strive to be the best company in the world. Every day we will focus our full attention on making money, preserving the environment, and taking care of our employees. Our plan is that all future leadership will continue to follow the path that has been established, to continue to benchmark the other best companies of the world, and to do whatever is legally and morally necessary to keep our company number one in the world.

EMPLOYEE TRAINING

To again quote from Canon's 2008 Annual Report:

> For Canon to become a company that flourishes far into the future, it is vital that the company's corporate culture is passed down to new generations of employees. Therefore, we further strengthen the cultivation of management and general employees to pass on Canon's accumulated corporate DNA—respect for human dignity, an emphasis on technology,

> and an enterprising spirit. Specifically, Canon carries out various kinds of management training for managers and communicates the Canon corporate DNA.

I have quoted Canon in both sections to show the connection between their mission and their training philosophy. This is true at all ruthless competitor companies: Everything they do and all of their actions lead to their business model and mission. So the training you need to have must be in concert with the future direction of your company. In addition, there needs to be specialized training for every employee. As you can see from the Canon example, passing on your company's culture (assuming you have one) and teaching the necessary and important methodologies both need to become a part of an excellent training program.

THE PROCESS OF TEAM BUILDING

For target costing to flourish, a cross-functional sense of teamwork needs to be instituted at all levels of the company. I have seen too many "fights" within a company that pit one part of the organization against the other. I forget who said, "I have met the enemy and it is us." Global competition is too rigorous today to have internal battles. Internally the company needs to act and be like one solid team.

A team begins as a group of people having the same objectives and expectations, where the successful completion of the task supersedes any individual team member's personal aspirations. The chances of optimum success are compromised without proper team development and team building. Therefore, special consideration must be given to the causes of successful teams.

Corporate leadership can learn much about team building from successful sports teams. It is often said in the "winner's circle" that our team won because we believed in ourselves and each other; we all get along with each other; we have a special chemistry on our team; and it is even said that we are like a family to each other. How does leadership build on this knowledge and use it in a practical way? How does leadership accomplish this mentality throughout the organization? We all want our teams to be in the winner's circle, don't we?

Teams allow us to achieve things far beyond our own ability, while at the same time keeping us humble. Team members must put team goals first. The team goals must take priority over any individual goals. It is only when this truly occurs that the team has the best chance for success. When individual objectives take priority, the team is normally not a winner.

Throughout Blanchard's book, *High Five*, team building is described as being created by:

1. Developing team goals and objectives (common values) and purpose
2. Developing individual goals that directly relate to the team goals
3. Giving the team an identity
4. Empowering the team to accomplish its objective
5. Giving the team skills to accomplish its objective
6. Unleashing the team's past experiences and knowledge for the good of the team
7. Leveling the playing field and encouraging equal participation
8. Providing constant feedback and recognition

Let's examine each of these points:

1. Developing team goals and objectives (common values) and purpose. Most texts on team building agree that for a team to survive and be successful it must have an achievable goal and objective. This is why I have stressed in this book that cost targets need to be difficult but achievable. This critical step starts before the team members are selected and ends with all team members knowing, understanding, and committing to their objective. A part of developing teams is to create a mission or objective for the team. What is the desired end result that will determine if the team is successful? Teams that do not have a clear and concise objective can never be successful. How would they know? By having very clear, specific goals and objectives team members know exactly what they must do. When management defines a team goal, however, the team itself must buy in to that objective. That is why the team needs the opportunity to review and rewrite their objectives. Just because management says that the objective must be "this" does not mean that every member of the team agrees with "this." Thus, the team needs to have the right and

responsibility to participate and negotiate team objectives. By allowing this to occur, the team is agreeing on the objective and making a commitment to achieve that objective. Without the team commitment up-front to the objective, success cannot be guaranteed.

2. Developing individual goals that directly relate to the team goals. Each person on the team as an individual must be able to identify with the team objective. In a way the team objective must become personal. Most of the time it is easy for a team member to directly identify with a team objective, but there are some situations in which additional facilitating is required. For example, let's say that the team objective is to improve the level of quality of a product design by 18%. There may be a purchasing expert on the team that may not feel directly committed to that goal. One can then ask this person:

   "Why do we need to improve quality by 18%?"
   An acceptable response may be, "So that we can become more competitive."
   "Why do we need to become more competitive?"
   The reply may be, "So we can maintain and improve our sales."
   "Why do we need to maintain and improve our sales?"
   This question might result in a response such as "So we can improve our position in the marketplace and make an acceptable profit."
   "Why do we improve our position in the marketplace and make an acceptable profit?"
   The person might say, "So that we stay in business."

   You see, you keep asking the question *why* and eventually the person will realize that his or her job and the comfortable life he or she is living becomes jeopardized without the team objective being achieved. It ultimately becomes personal.

3. Giving the team an identity. Every athletic team, whether it is "little league" or professional sports, has a team name. They have an identity. Many companies have a slogan, like Nike's "Just Do It" or SAVE International's "The Value Society." Team names, slogans, logos, cheers, and even a uniform all work to give a team an identity. Most Japanese companies believe in uniforms. Some companies

differentiate positions by color, and others prefer little or no differentiation. Leadership and workers essentially wear the same uniform.

4. Empowering the team to accomplish its objective. Teams that are not empowered and held accountable suffer a huge handicap. It is like a runner in a marathon using crutches. Management must allow the team to utilize their specific skills, knowledge, and experience to accomplish the assigned mission. Once a team has accepted and pledged commitment to the objective, management must trust its ability to select projects and suitable team members to accomplish its targets. Yes, it is important for management to be present throughout the process to show support and encourage, but never to take away the ultimate responsibility for the team members.
5. Giving the team skills to accomplish its objective. Having the critical skill set that matches the team objectives is essential. Proper team member selection using prelearned skills and experiences solves most of this issue. It may certainly become necessary that more specific skills be taught to ensure that the team is able to accomplish its mission. This is most often evident when new technology is introduced into your business. It may be necessary to search the job market and hire people with the missing skill sets.
6. Unleashing their past experiences and knowledge for the good of the team. It is one thing to select the most appropriate team members, but it is another to get everyone to fully participate. It is said that you can lead a horse to water, but you cannot make it drink. The analogy is that you can pick the best team members for their skills and experiences, but you cannot force them to contribute their knowledge and experience to the rest of the team. Establishing mutual trust and respect will go a long way in getting all team members to be open and up-front with what they know. Actually, to accomplish this point is probably the most important reason for team building.
7. Leveling the playing field and encouraging equal participation. Usually leveling the playing field is only a problem when one or two senior leaders are part of a team. Other team members may feel intimidated because of their presence. It is best to discuss this possibility with those leaders and ask them to not denominate the team and to encourage others to participate and contribute. Equal participation, or at least having everyone contribute in some manner, is critical to

team success. Everyone can contribute to the objective. Excluding the talents of any one individual can have a negative dramatic impact on the team. Imagine a rowing team. Everyone must pull simultaneously in the same direction for the team to be effective. If one person pulls harder than the rest, the boat will not go straight. Equal participation is very important in creativity and innovation. Teams need to learn that each member can make a significant contribution to the team. Whether someone is shy, boisterous, forceful, or reserved has nothing to do with the quality of his or her ideas and contribution to the team. However, people who are shy and do not even take themselves seriously or pursue an important contribution hurt themselves and the team. Quite the opposite, strong and dominant team members need special handling as well. Strong individuals, when placed on a team, may feel that their power is diminished. The truth is that individual power is strengthened when working on a good team. Getting and allowing everyone to contribute ideas will enhance the results that the team achieves.

8. Providing constant feedback and recognition. The responsibility for feedback and especially recognition is widespread. Certainly each team member has a responsibility to encourage and be positive to his or her teammates. Leadership must stay positive and give recognition during the entire project to keep the team motivated and working toward the objectives. It is easy for a team to get discouraged when they encounter roadblocks and obstacles during implementation. Team members need to "pump" each other up. Leaders must also give the team positive feedback to maintain and improve their motivation to overcome any obstacles.

TEAM PERFORMANCE

When you tie together the above elements you begin to have a positive effect on team performance. Team performance (TP) is a function of its combined ability (A) and its combined motivation (M).

$$TP = f(A)*(M)$$

Ability depends on education, experience, and training. Obviously, these are long and slow processes. However, having this background information about people will make team member selection more effective. On the other hand, motivation can be improved quickly. It is corporate management's responsibility to use positive reinforcement, effective discipline, treatment of people, and satisfying human needs to improve each team member's motivation.

SUMMARY

Like any tough job or assignment, target costing is difficult to get started. This is especially true in Western world regions where a target costing environment and infrastructure do not exist. It is necessary for academic institutions to get on board to teach the concepts and necessary ingredients, not primarily to students, but initially to corporate leaders. There are some small pockets of target costing activity in U.S.-based companies, but none as detailed and institutionalized as in Japan. Any serious target costing benchmarking must occur in Japan.

Developing mission statements that are integrated throughout all other organizational staff area missions and objectives makes the company move forward as a single entity. A successful company will have successfully achieved the ability to develop and form well-functioning, excellent teams, driving decision making to the lowest levels of the organization.

6

The Cost Planning/Cost Management Group

Warning: Do not let the brevity of this chapter affect your opinion of its importance.

WHAT IS THE COST PLANNING GROUP?

The cost planning group is the conductor of the target costing activity. Without a cost planning function a firm cannot successfully implement target costing. The first decision that needs to be made is where in the organization this new department should be placed. For most excellent Japanese companies this is a separate department reporting directly to the company president. In a study performed several years ago, it was determined that approximately 50% of the Japanese companies queried had cost planning as a separate department. Another 40% had it as part of the engineering department. Other locations were purchasing and finance.

In Figure 6.1 is a typical organizational structure with the cost planning department reporting directly to the company president. I have found very similar reporting relationships in other Japanese companies, such as Canon, Sharp, and Denso. Companies like Toyota and Nissan have the cost planning department as part of the engineering organization. In 2008, during my third visit to Isuzu since 1999, I observed that their cost planning department had moved from within engineering to the purchasing department. When I questioned the group leader about this reorganization, he responded that it was a top leadership decision to make the change.

FIGURE 6.1
Example of cost planning organizational placement.

My strong recommendation for Western world companies is to have this as a separate group, reporting to the president, or have a reporting relationship to the product design/engineering organization. If the latter is selected, the importance of such a department must be understood, as well as how the working relationship with engineering is properly conducted. See Figure 6.2 for a centrally organized cost planning department.

If your cost planning department is going to be held accountable to manage cost and achieve your desired profitability goals, it must have this type of central organization prowess.

MISSION OF COST PLANNING GROUP

Mission 1, shown in Figure 6.3, focuses on the achievement of the cost target. Mission 2 focuses on the development of the infrastructure needed and required to successfully meet mission 1. There must be constant interaction and integration of the two missions.

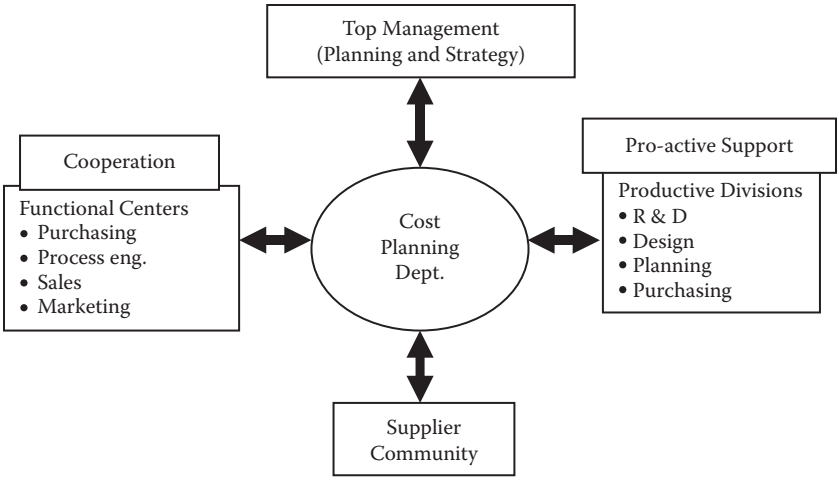


FIGURE 6.2
Centrally located and supported cost planning department.

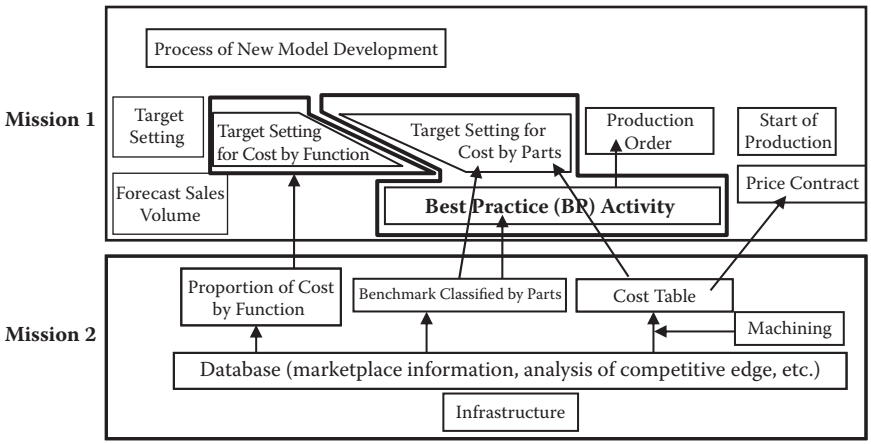


FIGURE 6.3
Mission of cost planning department.

At a minimum, the cost planning department needs to have the following set of roles and responsibilities. Since this department is centrally located in the company, it pulls critical information and data from many other functional groups of the company, like strategic planning, sales, marketing, procurement, research and development, engineering, and finance.

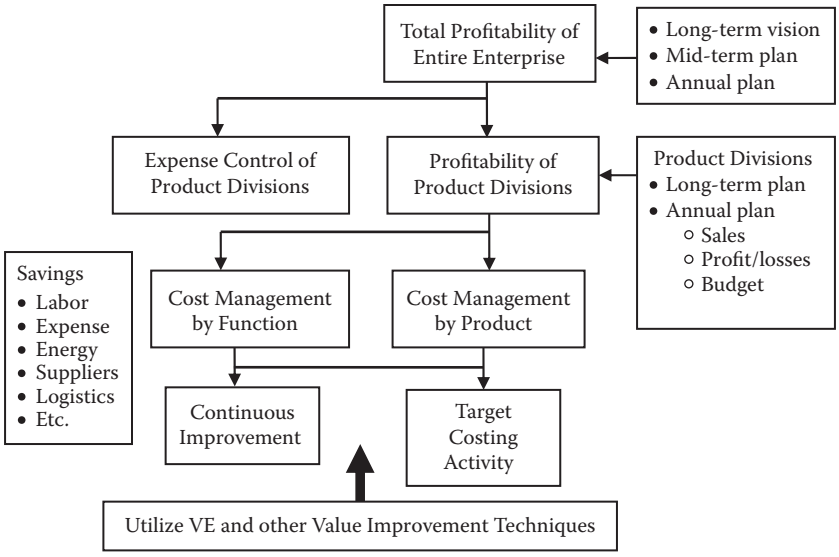


FIGURE 6.4
Profit management system and approach.

Strategic planning provides at the enterprise level the strategic profit plan. In most companies that I have visited there are three profit plans: long term, mid-term, and short term. The cost planning group will use this information to determine a specific profit plan for each new product, being careful to ensure that the overall strategic profit plan is adhered to. Figure 6.4 looks at the flow of profit planning orchestrated by the cost planning group.

From marketing, information about consumer preferences is maintained. This information needs to include the consumer preferences as well as the value they place on those preferences. To determine an accurate sales price, both are required.

Sales will supply forecasted volume data. Sales will need to correlate their information with marketing, as varying sale prices will cause different volume forecasts. The cost planning group can help coordinate this activity because they need to also play what I call "what if" games with profit margins to ensure the maximum profit is obtained. There are trade-offs between higher margins and forecast volumes, and these must be sorted out.

The cost planning group will work with the remaining mentioned organizations to establish and allocate the target cost. The cost planning group

will need to perform all the cost estimates and compare those estimates to the allocated target costs. Wherever there is a gap, they will direct the value engineering and teardown activity to remove the gap. In all cases they will develop, maintain, and implement the action plan to close the gaps. The cost is managed throughout the life of the product.

To ensure that cost estimates of future products are accurate, the cost planning department will be controlling and maintaining the cost table database.

The skills necessary to fill positions within the cost planning department are difficult to come by. Selecting the leader of this department is one of the most important decisions for senior management to make.

The ideal person would have strong product knowledge about a specific system or subsystem of the products being developed. That same person needs to be knowledgeable of the manufacturing processes used to make the components and should have detailed cost estimating skills on particular parts or processes. Finding a person that has all three skills, while ideal, is rare in most situations. So perhaps to begin, a blend of people with these skills may be all you can expect, and then over time, with experience and training, develop the talents and skills of these people and others that become candidates for future positions in this department. This group needs to start out small. Depending on the size of the company, the initial number should be between five and ten people. Usually these people are already within the organization and have demonstrated that they have the skills and experience necessary for the challenges of this position. However, regardless of their skills and experience, those that do not have the desire to be a part of this organization should not be included. Only fully dedicated and driven people are needed to start a cost planning department. I would also like to warn leadership about not just picking available bodies. As previously mentioned, every top company leader I have met in Japan has worked in this department. The leader of this group needs to be a person that you may hope will someday be the top leader in your company.

SUMMARY

The cost planning department, because of its overall responsibilities, consists of some of the brightest people in the company. Essentially the cost planning department is responsible for the overall profitability of

the company. What can be more important to achieve long-term success? The department should report directly to the company president; however, it needs to be thought of as a centrally located department in that it needs to receive input from and provide output to every other department in the company.

If you were to think of a NASCAR race car team, the cost planning department is the driver. Without the driver, the crew chief, the pit crew, the engine builders, etc., are not necessary. Another way to think of this department is as the conductor of an orchestra. The conductor's role is to keep all musicians in total integration with each other. The cost planning department must keep all data and communication of that data to the appropriate elements of the company and maintain cohesiveness and integration.

7

What Costs Should You Establish Targets For?

All major manufacturing companies need to have detailed goals, objectives, and targets for:

- Performance and quality
- Development (functionality) and design schedule (timing)
- Cost

WHAT IS MOST IMPORTANT: QUALITY, FUNCTION, OR PRICE?

While all three may be important, it is imperative to realize that one is more important than the others at any given time. This importance depends on the current nature of the company's product offerings and their perception in the marketplace by the end users. Since end users compare competitors' products in their buying decision, it is only their opinion that matters.

For example, in the late 1960s and early 1970s Japanese products sold in the United States were considered junk. These products had inferior performance and quality. Thus, in the automotive industry, especially for Toyota, Japan needed to focus on performance and quality, especially the latter. This does not mean that development and design schedule and cost were not important, but they were less important than performance and quality. The only way for their products to be recognized as a good value in the U.S. marketplace was for them to improve their performance and

TABLE 7.1

Area of Importance to Japanese Companies

	1983	1992	2000	2004
Performance	42%	41%	36%	36%
Schedule	30%	28%	20%	19%
Cost	28%	31%	44%	45%
Total	100%	100%	100%	100%

quality. History tells us that Toyota was successful in achieving a radical improvement in performance and quality. Performance and quality were maintained as Toyota's main focus until the year 2000, when it switched and made a major attack on product costs. Thus, cost became its number one focus. At the same time that Toyota switched from performance/quality to cost, Hyundai/Kia entered the U.S. marketplace with a vengeance. While cost-competitive, its vehicles were known to have inferior quality. It was then that Hyundai/Kia began its major marketing scheme of a 100,000-mile warranty and switched its emphasis from cost to performance and quality. So the lesson here is even in the same marketplace at the same time, different companies can have a different focus. That focus then depends on that company's products and the customer's opinion of those products.

Table 7.1 summarizes the changes of over 300 companies in Japan and what elements they deemed the most important. The chart, provided by Dr. Masayasu Tanaka, depicts that without a doubt cost is playing an increasing role for all major corporations in Japan. Thus, the next few chapters will deal with cost and the best methods to manage it.

Based on firsthand experience and knowledge of large Japanese companies, I have learned that every major company in Japan utilizes target costing to manage and control its material, subcontract, and conversion costs. Of these same companies, more than 75% use cost management techniques for their development and design costs, equipment and tooling costs, and indirect/burden costs. What may surprise many people is that in almost all cases Japanese companies have been doing this for over 30 years. For such a detailed cost management system to survive more than 30 years tells us a few of important points:

1. The cost management system is institutionalized in the company. The leadership supports all the elements on the rails and practices everything on all the rungs of the ladder every day.

2. The leadership has had a constant and consistent mission to achieve and maintain the discipline required to do this.
3. It works.

Other areas of the business that utilize target costing and cost management include logistics to predict and plan distribution costs and usage costs for the users once the product gets into the field. Usage costs include energy requirements, ongoing maintenance, and major repairs. A fairly new area that is currently getting much attention in Japan is managing costs at the product's end of life. Cost management here includes savage costs, recycle costs, and reuse costs.

It probably goes without saying, but I will anyway: The cost management practice discussed in this chapter is almost exclusively done early in and then throughout the product development process.

COST MANAGEMENT FOR PURCHASED PARTS

Generally, in Japan, most companies began to utilize cost management for purchased parts. For them, as for most U.S.-based companies, the purchased material cost represents the most significant portion of the final product cost, with most companies having a material cost of around 50%, and some as high as 70%.

The best way to demonstrate the importance of cost management for purchased parts is through the following comparison illustration. The supplier always has superior data compared to the assembler. In Japan, target costing's earliest application was in the reduction of purchasing costs by forcing suppliers to make their real cost drivers transparent. Negotiating teams of parts suppliers are professionals who deal with parts production on a daily basis. It is absolutely necessary for purchasers and assemblers to be able to relate to them on the same level of technical area expertise, and it would be quite impossible to "convince" suppliers of the validity of the cost estimates if they were not based on verifiable facts.

In the United States buyers are in constant negotiation with their supply base. When a supplier for a new design is required, most U.S. companies send out the statement of work (SOW) or the design to numerous suppliers for a quote. For an automotive company this new design can be as simple

as a steel bracket or as complicated as a complete seat or fuel system. Once all the quotations are received, the suppliers are invited to present their design concept, how they will manage the development process, where they will manufacture the product, and what their investment and piece part cost will be. The engineering community gets to see the technical portion of the presentation to ensure that each supplier's design concept is technically feasible. For each supplier that has a technically feasible design, the buyer lines up the price quotes and begins the narrowing process. Part of that process is to take the lowest quote and reduce it by a certain percentage and send it back out to the remaining suppliers vying for this business as the target cost. Thus, as you can see, the target cost is only based on the supplier quotes that were received and on how much the buyer thinks he or she can get the supplier to come down on its price. These steps may be repeated several times before a supplier is selected and awarded the business. The buyer appears satisfied because he or she received all the credit for awarding the business at a much lower price than the original quoted. What the company and buyer fail to take into consideration is that once this process has been used for a year or two, the suppliers learn that if they start with an inflated quote, it will get reduced to a price that they would have quoted prior to this game playing.

The Japanese buyer uses a much different system. First, he or she may not have to quote many different suppliers for a new design, as they already have one or two key suppliers established in their system. The other key difference is that the Japanese buyer is armed with detailed cost data that are used to determine what the price should be for the new design. Since the detailed cost management data have built into it the lowest possible cost to manufacture the design, the buyer now has firm data to deal with the supply chain. The buyer compares his or her data with those of the supplier to identify any difference. The differences are worked out and a final price is agreed upon. This process is not a game, but a real way to negotiate the final price based on data and facts. After talking to a buyer of injection-molded parts from a Toyota plant, I learned that the buyer has a detailed cost table for any molded component. Using the part drawing and an understanding of the component part, the buyer can look at the size, shape, and features of the designed part. The buyer also knows the dimensions, tolerances, surface finish, resin, and color of the resin needed. Finally, they know the quantity needed. Armed with this information, they can precisely predict the manufactured cost of the

component part. By adding an acceptable SG&A (selling, general, and administrative) and profit for the supplier, they can pretty much demand what price they will pay for the part. The more sophisticated models determine the equipment that optimizes cycle time and equipment running costs. Also, based on the volume, they can predict the cost of a mold and how many cavities it needs to have.

WHERE TO BEGIN COLLECTING COST INFORMATION

Based on decades of experience in Japan, it has been determined that target costing needs to start out with the more simple cost elements and grow and improve over time. Thus, I recommend that you begin target costing/cost management in the following areas of cost first:

Direct material cost: Some companies only think of material cost as the purchase price of the components they buy. However, using activity-based costing concepts, this cost could also include incoming freight costs, purchasing labor costs, and finance costs associated with purchase orders, tracking material, invoices, and renewing purchase contracts. Over the years I have observed that most companies use a standard percentage to apply to the purchased material cost for incoming freight. This method is far from accurate, and in fact can cause erroneous decisions to be made. If an average percent is applied, the buyer does not care if the part is purchased from across the street or across the ocean. They do not care if the freight is based on a full truckload of parts vs. a small container. Assuming that a truckload of foam is the same price as a small box of platinum in an average freight costing system, they would have identical freight costs. That simply is not true. Thus, when we indicate the material cost should include incoming freight cost, we mean the actual incoming freight cost for each individual part number. While it may seem to be a stretch for most financial people to consider, the material cost could also include people in the procurement department and in the finance department that directly support direct material purchases. It does make sense to track those costs at a part number level, or at least at a commodity level, as a direct material cost.

Direct conversion cost: Many companies only consider direct labor as direct conversion cost. Yet the best companies in the world track many other costs on a process or part number level. These other costs include all machine costs the component part is made on, such as maintenance, tool and die repair, machine lubricants and oils, depreciation (calculated by taking the tool cost and dividing by the total number of pieces the tool is expected to make), dedicated indirect labor like material handlers, inspectors, and quality audit personnel, material/labor scrap, material offal, and in some cases salary supervision.

Direct assembly cost: This includes essentially the same elements that are included in the direct conversion cost.

Subcontract processing cost: It is common for companies to outsource some processing operations like heat treating, plating, and painting. All costs associated with moving, storing, and the outside processing costs need to be included in this cost element.

It is highly recommended that detailed cost data be used solely on the above cost items before proceeding with the cost management of others. In fact, it may take several months, if not years, to fully master the cost management of the cost elements listed above. The objective of this cost management and control is to be able to predict future costs, not estimate existing costs. Thus, these data will be used to develop the cost tables that are described in the next chapter. It is important to note that it is imperative to maintain these cost databases. Material costs should be updated monthly. Labor standard hours should be updated no less than once per year.

After the months or years it takes to formalize the management of cost for the above elements, then you can begin to develop the same as required and necessary for the cost elements below:

Development and design costs: It is amazing with what accuracy leading companies can predict development and design costs for new product programs. In 2001, I met with Dr. Tanaka and cost planning leaders from Aisen Seiki, Mr. Noda from Canon, and Mr. Ariga. At this time I was still with General Motors (GM) working in its vehicle development process. GM was starting to outsource its design work to key automotive suppliers. Unfortunately, it was discovered that

GM engineering finance did not know what GM was paying to do its own development. As a result, GM paid suppliers many millions of dollars more than it cost them to do the same work. I believe this issue is not unique and believe most companies have no idea what their actual costs are to design and develop new products, much less have the ability to predict future costs. What was learned from Aisen Seiki and Canon is that both companies track their development and design costs in small time increments and have been doing so for over 30 years. Armed with detailed historical data, they can easily predict development costs and timing with a high level of accuracy.

Packaging costs: Too many companies treat packaging cost as an expense item, rather than as a part number cost. However, we also see many companies that include packaging on the costed bill of materials, which is where it should be.

Die and jig cost: The best that most companies can do is to compare competing quotes of tool and die suppliers to see if they are getting the best price and value. The best companies in the world retain in-house a portion of their tool and die building so that they can develop and maintain all costs associated with building dies and jigs. Having detailed accurate in-house costs of die materials and the machining time it should take to make the die ensures that they have better control in managing this expensive investment.

Exclusive machine cost: Many best-in-class companies manufacture some of their own specialty machines, like dies and jigs. By doing this, they are better able to ensure that this potentially high-cost element is managed properly. Another reason for keeping exclusive machine building in-house is that if the machine offers a competitive advantage, you would not want an outside equipment manufacturer offering the same to your competitors.

Ownership cost: Ownership costs vary from product to product. Some simple products may not have ownership costs, or they are so insignificant that they do not need to be managed. Ownership costs include costs incurred by the owner. If similar products from two different companies perform the same functions and have the same selling price, the one with the lowest overall cost of ownership will be the preferred product to own.

After sales cost: Managing after sales costs can be difficult. Most companies do not plan to sell defective products on purpose, knowing

that they will incur warranty, field returns, or maybe even a market recall. All of these can be very expensive, especially when replacement parts or full products must be shipped to replace defective ones in the field. In any event, using detailed historical costs, it is possible to predict with a certain amount of accuracy what these costs will be over a given time period.

Environmental conversation cost: Today in Japan there is special attention paid to ensuring products sold are easily recyclable. Some products must have recyclable ratings. These ratings are used to charge an up-front fee to the purchaser. An owner of a product with a better recyclable rating will pay a lower fee than one with a lower rating. Thus, the best companies are redesigning their products with the cost and ease of recyclability and disposal in mind. Managing these costs will become a bigger and greater concern in the future, as more and more countries and consumers pay attention to saving our environment.

Physical distribution cost: Distribution and logistics costs are very important to track on a part-by-part basis. This is especially true for a global company with many manufacturing and distribution facilities around the globe. Using this cost detail, a company can simulate different manufacturing locations for new products. When distribution costs are integrated with other managed costs, such as conversion costs, material costs, and duty costs, better decisions can be made as to the most cost-effective location to manufacture a new product.

As previously mentioned, it is not important how fast a company expands the type of costs that it is managing on a detailed level. It is much more important to know that the costs you are measuring are accurate and timely. This means that once the system is set up to track and manage these costs, it must be maintained regularly.

SUMMARY

The key importance of target costing is to ensure constant, consistent, acceptable, and predictable levels of profitability. To ensure that this happens, it is absolutely necessary to manage costs before they are created.

To begin target costing, care should be taken to decide which costs your company can manage effectively. Many companies begin with purchased components, and others begin with manufactured products. However, it is recommended that you begin with a combination of both. Knowing and understanding your costs and what goes into those costs by detail has to be documented. Giving this information in the correct format so that designers that create cost can use it becomes the subject of the next chapter.

8

The Development of Cost Tables

As shown on the ladder to global survival and success, cost tables have rung 9 to themselves. Cost tables are the engine that makes target costing work. Since target costing works to predict or forecast costs before they are incurred, so that cost can be an input to the product design rather than an output, the company needs a system in place that will do exactly that—predict future costs. Cost tables thus become the secret ingredient to target costing. The main purpose of cost tables is to predict future expenses. It may take years for a company to develop this level of capability with cost tables. Tanaka's definition of cost tables (*Cost Management*, p. 88), is that "the cost table approach is to shift the emphasis from past costs for existing products to future costs for new or redesigned products."

SHIFT IN FINANCIAL THINKING

For the cost table effort to be fully utilized, a shift in financial thinking within your business must occur. Typically, most finance departments become involved in tracking product costs well after the initial design is completed. "In contrast, Japanese management accountants and cost estimators have very detailed cost tables or cost databases which provide most of the costing information for new products. Furthermore, with their cost tables Japanese management accountants can quickly provide answers to 'what if' questions relating to product design alterations. This ability has helped the Japanese management accountant to become an integral part of the design team even at the planning stage of a new product (Tanaka, p. 87)." The cost table approach has been widely used in Japan since the

mid-1960s. Ryo Sato wrote *Cost Table* in 1965. Sato's book received widespread publicity. Sato's original work was enhanced to include cost tables for all forms of product design estimation (Tanaka, p. 88).

The traditional approach to cost estimation is to complete the product design, send prints and, or specifications to the supplier community, and wait for the returned quotes to arrive. Then by manipulating the suppliers one against the other, the final cost of the individual components is determined. When this task is completed for all the components in the design, they are totaled to determine the total product cost. Too often this total cost exceeds the original cost estimates that your company had forecasted. Since this process takes place essentially after the design is almost complete, there is no time available to change the product to reduce the cost to the desirable levels, and thus the product is launched with uncompetitive costs and perhaps uncompetitive prices. Besides this obvious problem, other problems with the traditional cost estimation approach include the following:

1. Design engineers typically are not concerned with the cost of their design. They are only evaluated on the technical capability of their design to meet product specifications. Thus, they rarely know what costs they create and, in many cases, do not care, as long as the product design works.
2. Traditional methods do not allow for estimating costs early in the design process. No systems or procedures have been put in place to determine costs at this stage of product development.
3. Because costs are not known until the design is almost complete, engineering changes and design alternatives are expensive. In most situations tooling and equipment have already been ordered. Depending on the complexity of the tooling and equipment, the cost of change may prohibit a lower-cost alternative from being implemented.
4. When costs are estimated they are only done at the part number level and never at the functional level.

The target costing approach is predicated on determining product costs before the design is even started. Designers need to design to a given set of design and cost parameters. To do this, a different system and cost management structure needs to be put in place.

THREE MAJOR REQUIREMENTS FOR COST TABLES

There are three major requirements for cost tables:

- Ensure that costs are accurate.
- Provide for swift cost estimation.
- Make cost estimates easy.

The level of accuracy depends on the development and design stages of cost estimation. Each individual organization is unique in what level of accuracy is needed at the different stages of product development. For sure, those with short product development times of six months or less need to be very accurate during the product concept stage, where products that can take several years to develop do not need to have as high a level of accuracy. Cost tables are the most useful tools to measure the technical planning of the new product by monetary value, and they should serve as a yardstick or criterion for evaluation.

Human productivity is just as important as accurate cost estimation. In the case of cost tables for each manufacturing operation or process, such as stamping or milling, even a cost estimation specialist would spend about 15 minutes to estimate the cost for one manufacturing operation or process. If a part has 10 manufacturing operations or processes, its cost estimation time would be several hours. In the beginning the estimation time will be longer; however, as experience with and the level of sophistication of the cost tables grow, the estimation time can be significantly reduced. Eventually, with a computer-based system, the actual estimation time can be reduced to seconds.

To get engineers to want to use the cost table system, we need to make it easy to use. Simplification and acceleration of estimating procedures are now executed through computer-based cost tables in many Japanese companies. Cost tables that are easy to use can assist the design community to make intelligent business decisions. "What if" scenarios can be played out to determine which of several design options offers the greatest benefit to the customer and the company.

Cost tables should be used for areas where maintenance is ensured, so making cost tables are premised on their continuous maintenance. According to an actual survey conducted in 2000, more than 40% of

Japan's biggest companies who answered said that the ratio at which a cost estimation can be done by cost tables was over 80%. This tells us that the cost tables in those enterprises are well established and used properly.

COST TABLE SOPHISTICATION

The level of cost table sophistication largely depends on the company's actual experience in developing and using them. The first level is that most of the cost estimation is performed by individual cost estimators, typically using Excel spreadsheets that are stored on their personal computers. From individual to individual there is little or no commonization of the methods or the data on the spreadsheets. Most, if not all, of the data on the spreadsheet are tribal knowledge of the person that entered it, meaning that if that person were to leave the company tomorrow, the basis of the data would be gone. Since several individuals work in a vacuum, the possibility of redundant effort is high. Another issue is that there may be different answers to the same question regarding what the costs are. Of course, the cost estimation is highly dependent on the professional skills of the estimator.

During the second level of cost estimation the development of cost tables starts to become standardized and common throughout the company. Although the estimation methods begin to be standardized, they are still largely dependent on the professional skills of cost estimators. There is still excessive time spent on cost estimation. Practice and experience will lead to improved results. Individual variability in the result of a cost estimation has been reduced as well as redundant efforts.

In the third level of cost estimation, cost tables are developed throughout the organization, and standardization of the cost estimation data is essentially complete. Methods and standardizations of cost estimation are significantly improved. Even an individual without profound professional skill is able to estimate cost. There is little individual variability in the result of cost estimation. At this level general cost estimation can be easily performed by the designer. The quality and accuracy of the data are improved at this level as well.

At the fourth level of cost estimation, the scope of making cost tables is greatly expanded and the standardization of cost estimation data, criteria, and methods is completed. Moreover, cost tables for parts and products manufactured by group enterprises and offshore products are developed and used in common throughout the enterprise. As cost estimation is conducted by use of an interactive computer system, estimation time has been greatly reduced and cost simulation of products can be performed, including offshore products. There is little need to have professional skills in cost estimation, and very little individual variability. The CAD (computer-aided design) system works in conjunction with the cost estimation system and cost estimation can be automatically done in conjunction with the determination of specifications.

The fifth and highest level of cost estimation shows that not only the cost tables for within the enterprise, but also those for group enterprises and offshore products, are systematically maintained for use, and enable a broad range of global cost comparison. As the cost information of group enterprises and global cost information are maintained in the host computer, the cost estimation linked with a CAD/CAM (computer-aided manufacturing) system based on the information in the host computer can be performed anywhere within the group enterprise. In other words, cost estimation and basic physical unit estimation by the 3D-CAD system during the design process can be done regardless of location. Cost simulation that leads to changes in specifications can be easily done. As designers can estimate costs worldwide in an extremely short time, design assuming the best manufacturing place can be developed. Cost-oriented development and design issues increase. In other words, the costs of a number of products with similar functions and features worldwide can be easily searched online, and then information such as recommended parts, suggested functions, restrictions, etc., is shown. By using this system, design with stable quality and low cost is possible in a short time.

As was mentioned earlier in this book, since design engineers create cost, they need to know how much cost they are creating when they create it. It is only through the third level of sophistication and above that this can occur. Levels 4 and 5 offer the designer the ultimate in cost estimation capability. I refer to this as the checkout counter. When we buy something at the store, we generally know what our total bill will be when we arrive at the checkout counter. Then, as the cashier adds up our

purchases, we know exactly what the total bill is and, if we desire, we can make changes before we make the final payment. I often ask companies that I work with, when or where is your checkout counter in the product development process? For many, it is after the start of production. Not knowing your costs until the product is in production, or even if they are known at the end of the design phase, is still too late for making the necessary changes to fix a cost issue. That also means that you do not know if you have met your target cost and profitability objectives. Thus, the designers having and knowing what cost they have created when they create it is the ideal situation to ensure the product design is on course to meet the profit goals.

MATERIAL COST TABLE DEVELOPMENT

Since purchased material is usually the highest percentage of your total product cost, it is necessary to create a material cost table. As discussed previously, without such a database you will be at a disadvantage in negotiating pricing with your supply base. There are two types of material cost tables: direct raw material and purchased components.

Assuming your organization performs some type of fabrication, such as machining, stamping, composite molding, rubber molding, casting, and forging, you purchase raw material for these operations. One of the main objectives in developing your raw material cost table is to include as much overhead cost as possible in the cost table. All costs associated with the purchase, transport, and use of the raw material should be included.

Using the example of coiled steel in a stamping press operation, the following internal costs should be considered for inclusion in the cost table:

- Net part
- Offal generated as a result, from the blank size to the finished part
- Beginning and end of coil waste that results from changing coils
- Material waste generated from part number changeovers
- Defect work and scrap
- Losses that occur from destructive tests
- Material used to try out new tools

This information should be readily available, assuming you have accurate capacity models for your equipment.

Additional overhead costs to be seriously considered for inclusion are:

- Transportation costs (incoming freight)
- Handling costs in your facility
- Insurance costs for the material
- Purchasing department costs
- Finance costs
- Audit inspection and quality control costs
- Storage costs

The idea is to include these costs to the part number level so that you can accurately predict your costs using this raw material on future designs. It will also give you the baseline costs from which you can measure and make continuous improvements.

DIRECT CONVERSION COST TABLES

It is necessary to determine which costs should be controlled in product development, design, and manufacturing preparation. Designers need to know what costs they are creating and, more importantly, be held accountable and responsible for creating to a specific cost, including conversion costs. If this is done, then it is important to make the design engineers only accountable for those costs that they have an impact on. Making them accountable for costs outside of their control would defeat the purpose. Usually these are direct manufacturing costs and not indirect manufacturing costs. Remember to take a wide viewpoint of costs that are considered direct. Many costs that most companies track as indirect can be managed and controlled at a part number level. Direct manufacturing costs are those that can be controlled by the designers in the development and design phases of product development. Generally, true indirect costs should not be set as a target, since these costs cannot be controlled by the design community. Big Japanese enterprises set direct manufacturing cost as a target cost in their introduction and beginning stages of target costing.

TABLE 8.1

Example List of Costs to Begin Conversion Cost Table

Direct labor	Overtime premiums
Shift premiums	Maintenance supplies
Area energy usage	Material handling
Equipment depreciation	Quality control
Equipment energy usage	Reoperation
Expense tooling	Scrap
Lubricants and oils	Subcontract processing
Maintenance labor	Tool and die repair
Labor healthcare	Labor disability
Labor training	Union representation costs

The next decision to be made is which exact costs should be used to initiate this process. To do this, the company needs to list all the cost elements that could possibly be controlled and predicted. An example of this list is in Table 8.1.

This is a good place to mention that many Japanese companies have two sets of cost accounting methods. The first is the traditional financial accounting that most of you are familiar with. The other is managerial accounting, which depicts some costs slightly differently. If you have a managerial accounting system, this is the system that you use to make your business decisions.

Manufacturing cost is changed according to the manufacturing volume. Large or small volume determines the manufacturing process and method, make or buy decision, and so on. So volume is a very important cost driver, and proper volume forecasts are very critical. This information for most companies is developed at the beginning of the product development process. The forecasted volume is used in the development of the business case to decide if there is a sufficient market for the product. I wish more companies would take this number more seriously. It seems that this number is significantly inflated to justify the program. That is the first bad decision most companies make. When that inflated volume forecast is used for design, process, location of manufacturing, and equipment and tooling capacity decisions, real and unnecessary cost gets created.

It is recommended that the direct material and conversion cost tables be perfected before moving to other, more advanced cost table databases.

PRODUCT DEVELOPMENT COST TABLES

These cost tables should include the costs of design time, prototype parts, validation, and equipment and tooling. Knowing your product development costs is especially important if you begin to outsource any of this work to your key suppliers. When working at GM, in 2000 we began to outsource development efforts. The engineering director that I reported to had his budget reduced for every dollar of design work that was being outsourced from his area. It soon became obvious that his budget would disappear before the work, because suppliers were getting paid more for the same work. In actuality, the suppliers were getting rich with this new work because the financial people that were awarding these contracts did not know what GM's internal costs for development were. Chapter 7 discussed my meeting with Tanaka, Noda, and Ariga, and that their companies collected detail time and cost data for their development processes. GM had data that predicted labor hours for each of its designs, but the methods used to develop those times and costs were not detailed enough to be used to outsource this work. The GM system was used to develop departmental budgets, so it was believed that it was in the engineering manager's best interest to "pad" the estimate to ensure a higher budget. Finance took these padded numbers as real and used them to award supplier contracts for the work. Without accurate data of your development costs, it is essentially impossible to create cost tables for product development activity.

COST TABLES BY PROCESS

Most successful companies in Japan create and use cost tables that are developed by various processes. For example, detailed cost algorithms are developed for injection-molded parts, machined parts, stamped parts, etc. Tables 8.2 to 8.5 include the type of data that is collected and maintained to create the algorithms for injection molding. Note that these data are dated, use Japanese material codes, and are in Japanese yen.

Data in Table 8.6 help to make the proper equipment selection to achieve the most cost-efficient result.

TABLE 8.2

Specific Gravity Chart

Resin Material	Specific Gravity
PP (polypropylene)	0.90
ABS	1.06
PF (phenol-formaldehyde)	1.01
PMMA (acryl)	1.17
POM (polyacetal)	1.41

TABLE 8.3

Material Piece Price (yen/kg)

Material	Grade	Natural	Paint	Black	Color
PP	Normal	Base: 150		+20	+50
	Compound			+50	+80
ABS	Normal	Base: 290	+5	+25	+35
	Heat resistant		+25	+45	+55
PF	Normal	Base: 250			
PMMA	Normal	Base: 280	+20		+35
POM	Normal	Base: 440		+15	

TABLE 8.4

Extra Coefficient of Tooling Loss

	Extra Coefficient			
Product Volume/Mo.	**<500**	**500 < 1,000**	**1,000 < 2,000**	**>2,000**
Product Weight				
<0.1 kg	0.08	0.04	0.02	0.01
0.1 < 0.5 kg	0.04	0.02	0.01	0.005
0.5 < 1.0 kg	0.03	0.02	0.005	0.005
>1.0 kg	0.02	0.01	0.005	0.005

TABLE 8.5

Weight of Sprue, Runner, and Gate

Product Weight	Weight of Sprue, Runner, Gate
<0.5 kg	0.01 kg
0.5–1.0 kg	0.03 kg
>1.0 kg	5% of product weight

TABLE 8.6

Specification List of Injection Machine

Locking Pressure (ton)	Injection Weight (ton)	Maximum Product Size (mm)	Mold Time (min)	Setup Time (min)	Machine Rate (yen/min)
50	56	150 × 150 or 230 × 100	0.6	3.0	6.0
80	140	200 × 200 or 300 × 130	0.7	3.0	8.0
125	280	320 × 320 or 480 × 210	0.8	3.0	9.0
200	560	400 × 400 or 600 × 260	1.0	5.0	14.0
300	840	460 × 460 or 700 × 310	1.2	5.0	19.0
530	1,400	590 × 590 or 880 × 390	1.4	5.0	31.0
800	2,800	810 × 810 or 1,200 × 540	1.5	7.0	50.0
1,250	4,200	900 × 900 or 1,350 × 600	1.7	7.0	84.0
2,500	6,160	1,020 × 1,020 or 1,530 × 680	2.0	9.0	130.0

Note: Labor rate = 40 yen/min.

Information used for Table 8.6 included:

1. Required injection weight (g) = Mold weight (kg)/1,000
2. Required locking pressure (ton) is a result of

Product projected area (cm^2) × Required pressure (kg/cm^2)/1,000

The required pressure is noted as:

PP, PE	350
ABS PA6	400
PMMA, POM	500
Others	400

Additional cost charts can be created for secondary operations such as paint or coating processes and tool and die costs that estimate the number of needed cavities based on production volumes.

SUMMARY

Cost tables are necessary to predict future costs since cost is created by the designer. Traditional cost estimation techniques typically determine

product costs after it is timely or cost-effective to make design changes. In many Japanese companies the design engineer that creates the cost, via the use of easy-to-use cost tables, can determine what costs he or she has created as the design is being created. Design decisions early in the product development process can be made using function-based cost tables. Engineering changes, if necessary, can be easily estimated using cost tables. The most important concept to take away is that **the cost table approach is to shift the emphasis of looking and using past costs for existing products to future costs for new or redesigned products. Such a change in attitude underlies a contemporary cost management philosophy.**

9

How to Set the Target Cost

There is a strict rule in the application of target costing: The target cost cannot be exceeded. Since it is a violation of this rule to move forward with a product development that is not at or below the planned target cost, to maintain the integrity of the target costing system, that program needs to be abandoned or at least put on hold until it is determined that the target cost can be achieved. You may ask, what is the need for such a strict rule? Why delay a good program? Why not proceed and fix the cost later? This rule is in place to ensure that you meet your profitability objectives. Failure to meet the profitability objectives, unfortunately, is business as usual for too many companies. It is not a good program if you cannot meet your profit goal. It is not a good program if you need to spend money later and make changes to the design to make money. With that said, the most important element of target costing then is to establish a proper target cost. There is a fine line between a target cost that is too high and one that is too low. A target cost that is too high and easy to accomplish does not challenge the organization and does not lead to being the best in the world. Setting a target cost too low will impose demands on your organization that are impossible to achieve. It is human nature to be given a known impossible objective and give up before you get started. Entering into a task that cannot be accomplished does no one at the company any good. The effort gets distracted from a positive work environment with everyone working to accomplish the objective to one where people cheat, lie, and have the proverbial CYA attitude so that they do not get blamed when the objective is not achieved.

SUBTRACTION METHOD

The simple formula to develop the target cost is

Price – (Sales and general management cost + Expected profit)
= Target manufacturing cost

This formula is often called the subtraction method in Japan. While it may be simple, most companies cannot use the simple approach when getting started. In Japan this method is the most common; however, most companies in Japan have been doing target costing for more than 30 years. You need to be very careful in using this method, especially if you are trying to establish a target cost for engineering that may include costs that engineers have little or no control over. Since most companies in Japan have extensive experience with target costing and have extensive cost table information available to them, many target the entire manufactured cost. I strongly suggest that as you initiate this process, you look at and target only the controllable portion of cost. In Chapter 8 you should have decided all the controllable costs that you can include.

ADDITION METHOD

The addition method works very well. For the moment this method disregards the simple formula just described, because in most situations the target cost calculated via that method cannot be obtained. Yes, that means you are not yet cost-competitive, which is why you need to work overtime to get to the simple method of target cost development. As mentioned at the beginning of this chapter, to maintain the integrity of the target costing system, you cannot exceed the target cost. Thus, you need to establish what we call a product level target cost that is based on information that already exists in your business.

If you rely only on the data collected from the marketplace on customer preferences and price expectations as well as information about your competitors, it is very possible that the target cost you establish will not be

realistic or achievable by the organization. It is recommended that you follow these steps initially:

1. Pick an existing product or subsystems of existing products that are the most similar to the new product you are about to develop.
2. Collect the detailed current costs (material, incoming freight, and all controllable conversion costs) of the components from the existing chosen product.
3. Determine with no changes what the lowest cost is of the existing product.
4. Collect all known new ideas that could be incorporated into the new design that are not in the existing design.
5. Get information from your own R&D organization on proven new materials, technologies, equipment, processes, etc., and determine, if they are incorporated into the design, what the new cost would be.
6. Obtain the same type of information from your key suppliers.
7. Estimate the cost savings from all the items identified from steps 4 to 6.
8. Subtract that number from the cost determined in step 3.
9. Determine a difficult but realistic additional savings to challenge your engineering team to accomplish. Not all systems and subsystems should receive the same cost reduction target. A broad-brush approach of an across-the-board 8% is not how this is done. The program leader needs to understand what systems are undergoing the greatest change and where the greatest opportunities lie for cost reduction. In fact, some systems may require adding cost because of increased functionality, as noted in step 16.
10. Subtract step 9 from step 8.
11. Determine if there is any new functionality that the new design will include that is not in any of your existing products.
12. Estimate the cost of that new functionality.
13. Adjust costs for predicted volumes. Normally higher volumes offer lower costs.
14. Adjust costs if a different manufacturing location is being considered.
15. Adjust costs for material/commodity escalation and inflation or deflation.
16. Add or subtract the net result of steps 11 to 15 from the result of step 10. This new cost level is the target cost that your product development team will be held accountable to achieve.

17. Allocate the total product cost to systems, subsystems, and component parts. Remember, there is only one target cost for a product.
18. Negotiate and secure agreement and commitment from the design and supplier community. It is critical to get buy-in from the engineering department and suppliers that their allocation of the cost target is achievable. Without their agreement they may not feel as though the cost allocation is possible. By involving them, a firm is more likely to achieve its profit goals.

When performing step 7, the following areas of cost need to be considered:

- Consider benchmark data that normally come from the competitive teardown method described in rung 6. It behooves your company to take advantage of any way to perform a function, even if it is a lower-cost method than one of your competitor's. If this teardown method is performed properly and performed over an extended period of time, you should be able to predict your competitor's future design changes before they hit the marketplace.
- Once you have developed a "best of best" level cost, e.g., the lowest cost in manufacturing industries from anywhere in the world, you can use this to help establish the target cost. Having a best-in-class cost database by function is especially beneficial and can be used early in the target costing and design phases.
- New technology, especially in electronics, offers a significant cost improvement potential. It is not uncommon that savings in excess of 50% can be achieved by the organization.
- If commodity prices have been significantly changed from the base product that is selected, then different material considerations need to be addressed. The combinations of potential material changes to consider are significant.

SETTING TARGET COSTS BY FUNCTION

Being able to assign costs at the part number level is important. This level of detail and focus will enable your organization to understand your costs at a level of detail that was not previously obtained. Having this

knowledge will prove to be invaluable in reducing costs of current and future designs. However, best-in-class companies are also able to perform cost analysis and target setting by function. Function-based target costs are effective since they can be used very early in the concept development phase to create designs that perform the functions. This is possible since function-based thinking is not part specific and encourages creativity to arrive at new solutions to perform the function.

The importance of functional thinking is what drives value engineering to be an integral element of target costing. Value engineering concepts, as discussed here, are used to set cost targets. But also and just as important, if not more so, VE is used to close any gaps between the estimated cost of a product, subsystem, or component part and its portion of the target cost allocation.

As an example, think of the function "transfer fluid." Hundreds if not thousands of products perform this function. Some products that come to mind are garden hoses, ink pens, kitchen faucets, medical tubes for intravenous feeding, tubes for printing devices, handheld shower sprayers, water pipes in your home, sprinkler systems, and devices that deliver coolant in machining operations.

For a moment let's use a simple example of the garden hose. If you created a FAST diagram of a garden hose the critical path functions would be to receive fluid, transfer fluid, and deliver fluid. It may have some other user-friendly functions, such as prevent kinking, resist environment, and enable coiling. However, the most basic and most expensive function of a garden hose is to transfer fluid. If I have maintained detailed cost information on all the different garden hoses there are by shape, length, diameter, wall thickness, and various materials, I could develop a cost algorithm based on these main cost drivers. Basically, all I would need to know to develop a fairly accurate cost for a garden hose is the volume of fluid and the distance I want to transmit the fluid. My algorithm could be a chart that told me for any given fluid volume requirement what my cost per unit length should be. The algorithm could be enhanced to include different materials, connectors, and UV and other environmental protection requirements. Armed with this information, I could very accurately predict the final cost of a garden hose before the design was started.

Now think of the function "transmit torque." Make your own list of all the products that need this function. To get you started, a simple one is a screwdriver. A screwdriver receives torque from the user in the handle, transmits torque through the shaft, and delivers torque at the tip or point.

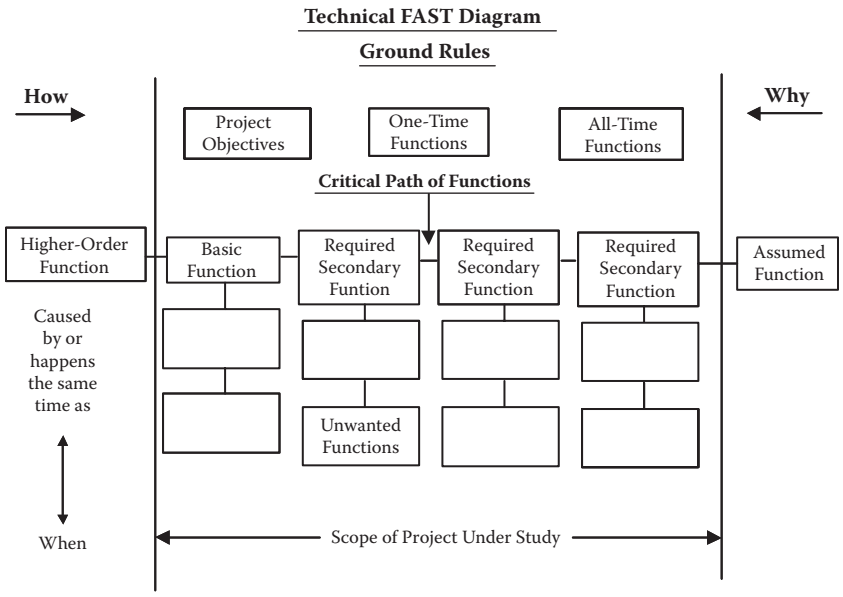


FIGURE 9.1
Technical FAST diagram.

I could create a similar cost algorithm for the function transmit torque as I did for transfer fluid.

The key to create cost table algorithms and use them to set target costs is to perform value engineering for an extended period of time and use the cost-to-function allocations as your basis.

To help you better understand how this works, you will need to understand FAST diagrams or what some people call function logic diagrams. Once the FAST diagram is complete, the cost-to-function allocation takes place. There are two main formats that are used. The first to be described is technical FAST (Figure 9.1), and the second is customer-oriented FAST (Figure 9.2).

Knowing how to develop the proper verb–noun combinations to create the functions, and then their proper placement on a FAST diagram, takes considerable skill, experience, and practice. Using this model and the functions listed above for a garden hose, the completed technical FAST diagram is shown in Figure 9.3. The customer-oriented FAST diagram for the garden hose is shown in Figure 9.4.

The assumed function is supply fluid. It becomes the input to the garden hose. If you were a garden hose, you would assume that you would be hooked up to a water outlet and water would be supplied to you. The

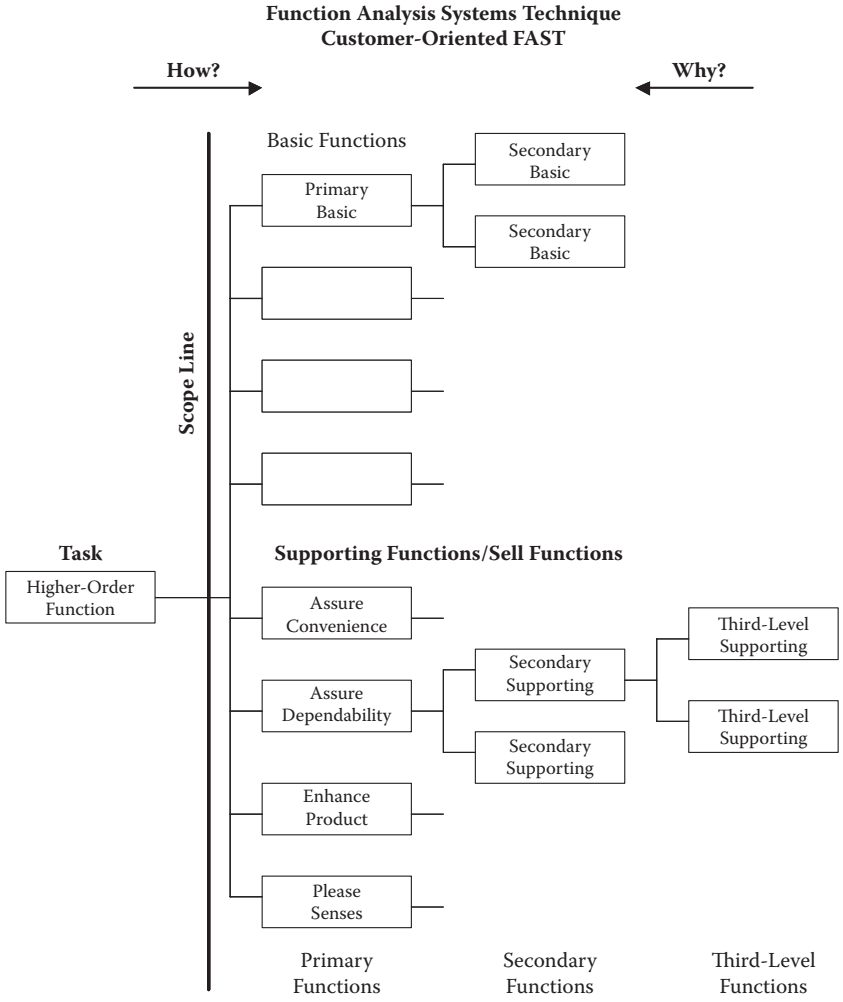


FIGURE 9.2
Customer-oriented FAST diagram.

higher-order function, water flowers, is what the owner wants the hose to do. It is essentially the purpose for buying the garden hose. There are other ways to water flowers, but in this situation a garden hose was selected. Other ways to water flowers would be to use a bucket or watering can. That would require the user to carry the water, perhaps a long distance, and make several trips, depending on the area of flowers that need to be watered. All the functions between the two vertical lines are in the scope of our project. These are the actual functions that the garden hose performs.

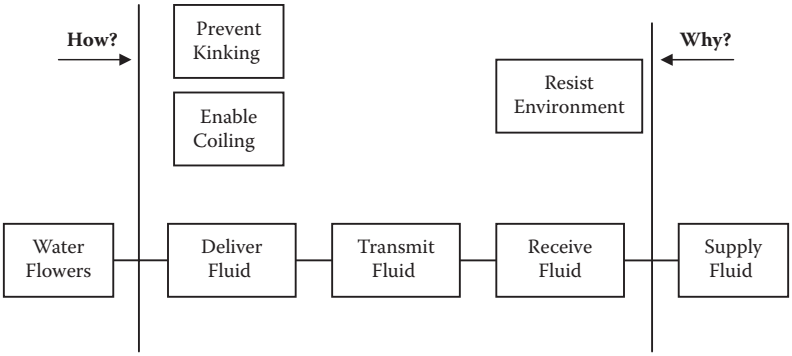


FIGURE 9.3
Simplified technical FAST diagram for a garden hose.

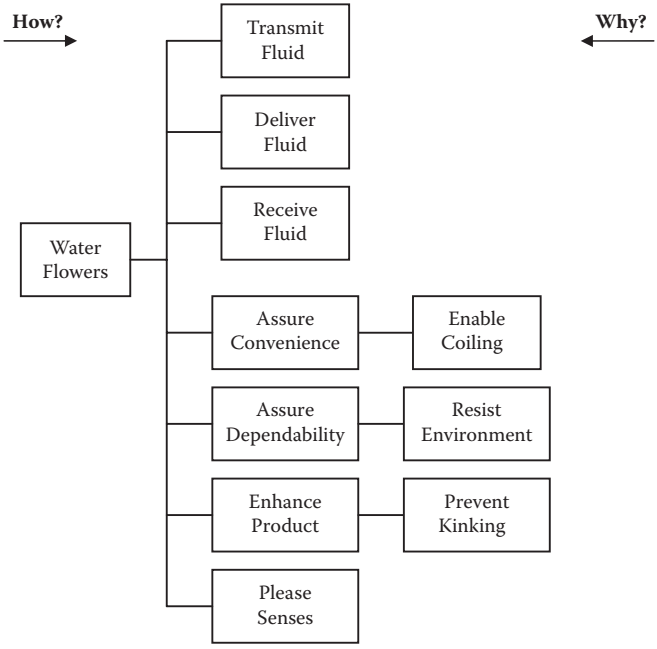


FIGURE 9.4
Simplified customer-oriented FAST diagram for a garden hose.

In the cost-to-function allocation one lists all the component parts and associated costs of the garden hose. Again, keeping the example simple, the bill of materials is shown in Table 9.1.

The next step is to allocate the cost of each component part to the functions that each part performs. It is critical to perform this task properly.

TABLE 9.1

Costed Bill of Materials for Garden Hose

Component Part	Direct Cost	Units per Assembly	Total Cost
Rubber hose (75 feet)	$7.83	1	$7.83
Input connector	$.30	1	$.30
Output connector	$.25	1	$.25
Flat washer	$.11	2	$.22
Assembly labor	$1.25	1	$1.25

Many people feel that if a function is important, then it receives most of the cost. That thought process is incorrect. What is really needed to be known is how much actual cost is going into the part to perform the function. Table 9.2 is an example of a cost-to-function work sheet for the garden hose.

Table 9.2 depicts the function "transmit fluid" to represent over 56% of the total cost. The cost of the attachments represents another 21%; thus, not needing to know anything else, one can predict well over 75% of the final cost when this type of data is collected and maintained properly. Essentially this table would look the same whether the technical FAST or the customer-oriented FAST diagram method was used. The customer-oriented FAST may work better, as it is most likely that the primary basic functions would be the key cost-driving functions for your product.

The method of allocating cost to functional areas is incorporated in those products where it is necessary to conduct function analysis with original thinking in the development and design stages. Function analysis is the main ingredient that makes value engineering special and powerful. This method assigns the target manufacturing cost to each functional area of the new product by use of the functional importance rate (functional value evaluated by potential customers). This method is useful for both introduction and growing stages products. Once this method is developed, it is very useful and easy to maintain. This is based on the functional evaluation by customers; however, when the evaluation value is not obtained, it will be replaced with the customer-oriented functional evaluation conducted by manufacturers. Even though the value of functional evaluation is obtained, in many cases the evaluation is not appropriately done in terms of safety and government regulations. Therefore, the evaluation value of customers should be adjusted by manufacturers, and then assigned to each functional area.

It is also possible to assign target costs to subsystems. The following points are important to note in allocating costs to subsystems. The greater

TABLE 9.2

Cost Function Allocation of Garden Hose

Component Part	Total Cost	Deliver Fluid	Transmit Fluid	Receive Fluid	Prevent Kinking	Enable Coiling	Resist Environment
Rubber hose (75 feet)	$7.83	$.02	$5.55	$.02	$.63	$.63	$.98
Input connector	$.30			$.30			
Output connector	$.25	$.25					
Flat washer	$.22	$.11		$.11			
Assembly labor	$1.26	$.63		$.63			
Totals	$9.86	$1.01	$5.55	$1.06	$.63	$.63	$.98

the new product is large-scaled and complicated, or unprecedented for designers, the greater need there is to work out design alternatives, going back to the starting point of its concept. Generally, this method is adopted as an assigning method of the target manufacturing cost for each functional area. In other words, in case that the above reason is not so important or time constraints are tight, you can directly assign the target manufacturing cost to the main subsystems of new products without doing so for each function area. This is a simplified method, and it is convenient to use in the development and design stages of new products whose subsystems are mostly determined.

It would be ideal to combine both methods of assigning target costs to functional areas and subsystems. This method is applied after, having conducted a thorough function analysis, a reasonable allocation of the target manufacturing cost is realized, no matter if the product is unprecedented or not. In this method, the allocation to large-size function areas based on original thinking is applied in the early and middle stages of development and design, then the allocation to subsystems is done in the later stage, after the main components and manufacturing methods have almost been through the concept development phase of product development.

CONTINGENCY COST ALLOCATION

It is normal for companies to allocate a portion of the cost to a contingency fund. This should be between 3% and 7% of the total cost. Only the project manager in conjunction with the cost planning department should have authority to use the contingency fund and where and how it should be used. The need to use the contingency fund would most likely vary depending on the project, but the most common reasons are:

- An unexpected higher material commodity cost
- Required customer-requested functionality that was not expected
- Target cost allocation to a portion of the product was too aggressive
- Expected new cost reduction efforts were not realized

Every effort should be made to meet the allocated cost for each area of the product without using the contingency fund. Continued practice

using these allocation techniques will offer lessons learned for future product developments.

SPECIAL SITUATIONS

It was previously mentioned that the target cost must be realistic. Thus, there may be special circumstances and situations that need to be factored when setting the target cost. For example, if an abnormally short product development time is planned and scheduled that prohibits the normal abilities of the organization to perform all cost control and management tasks, then of course a less severe target needs to be set. Another special consideration is the background and experience of the design team. Especially when you are just starting to integrate these methods into your product development process, consideration must be given to the inexperience of your design team. Another consideration, regardless of development time or team experience, is if the new product being developed includes functions that are new to your product portfolio and, in essence, no one has extensive design experience to effectively design those functions and perhaps new technology.

The target cost established using this technique may not get you to the desired profit levels that you desire, but using this method will result in an attainable product level target cost. The addition method is more of an internal look, where the subtraction method is based on market-driven forces and data. Thus, the method is not optimal; it does allow your company to put in place a credible target costing process. It will, however, help your business enjoy greater levels of profitability. Several years of experience and practice will lead your company to be more market driven in setting the target cost.

EXCEEDING THE TARGET COST

The organization needs to have the attitude that this target cost level must be reached or the product will not be launched, as the rule for target costing is that the target cost cannot be exceeded. Despite the pressure to relax

the rule, leadership needs to be firm. Relaxing the rule will cause the credibility of the system to deteriorate. Relaxing the rule may be needed under extreme product offering situations, but it is essential that this is a rare exception. Without a credible system in place, there can be no hope of achieving world-class competitiveness.

Survey information collected over many years in Japan indicates that the greater the maturity of your target costing system, the less tolerance there is to exceed the target cost. The data collected in 1983 stated that only 42% of the products developed were stopped during the product development phase when the target cost was not met. Data collected in 2004 with about 300 companies surveyed indicate that over 79% of the new product programs were not allowed to proceed. This means that only slightly more than 20% of the programs were allowed to continue. Keep in mind that these data are taken from a very wide cross section of many manufacturing organizations in Japan, all at different levels of target costing adoption.

Some of the reasons for failure to obtain the target cost are:

- Cost increase due to an addition to the product specifications or functions
- Insufficient study of cost at the time of development and design because the development and design project time was too short
- Changes in the market (exchange rate, commodity prices, etc.)
- Insufficient management by development and design engineers to achieve the target cost
- Target cost was set too low
- Target cost was not allocated properly

ALLOCATION OF THE TARGET COST

Once the product level target cost is established there is a need to allocate the target cost to systems, subsystems, and component parts. It is the responsibility of the cost planning department to manage and control the cost allocations. The allocation will only get better with trial and error. Perhaps the first few times this is attempted allocated costs will have to be shifted from one area of the product to the other. This should not be

treated as a failure, but as a learning experience from which it will only get better during the next product development cycle. This repeated and constant improvement is one of the main reasons for the large gap between rungs 8 and 10 on the ladder. It just takes time, patience, and practice to perfect this system.

While the cost planning department is responsible for allocating the target cost, it is the engineering department that is responsible for creating the designs to meet the target cost. Thus, it is very important that these two groups work closely together. In many situations the cost planning and engineering department will need to negotiate the allocated cost for each system, subsystem, and component part. For the target costing system to work there must be a commitment from the design community to obtain the target cost. This commitment can only come via their buy-in to their cost number. For target costing to be effective it should motivate the design community and the supply base. Thus, difficult but realistic targets need to be established. If the target is set too high, then the people required to meet it may lose their motivation and give up. By the same token, a target set that is too easy will also fail to properly motivate the workforce. Based on the motivational and behavioral implications of target cost setting, Dr. Tanaka feels that it is as much of an art as it is a science. To make this process easier, companies that are target costing novices may benefit from setting target cost ranges rather than specific cost targets. At each successive development cycle the range can be continually reduced until the experience gives you the ability to set specific targets. This process will get better over time and with practice. Thus, perseverance over a long period of time is paramount. Failures need to be reacted to as something to learn from. Assigning blame or installing disciplinary measures should not be a result of this learning experience.

When subsystems or components are to be designed by suppliers the same approach is used. It is required to gain a negotiated price from the supplier for its contribution to the product design target cost. Negotiating prices with suppliers is much easier when you use detailed cost table data. These will be developed over time and, in many cases, need the cooperation of your key supply base to develop them.

As previously mentioned, since the target manufacturing cost, once established, must be achieved, it is necessary to set it so that it can be accomplished. It is important to note that each product entering the development process has only one target cost. That target cost must be allocated

to systems, subsystems, functional groups, and even to the part number level. This is accomplished using various techniques. Below are the most typical methods of allocating the target manufacturing cost.

ADVANCED APPLICATIONS OF TARGET COSTING CONCEPTS

It is amazing to see the breadth of the application of target costing across the organizations in Japan. In Chapter 6 the different types of cost models were described, which included product development costs, equipment and tooling costs, and others.

Statistics collected by Dr. Tanaka and presented at the 2009 SAVE International Conference for the areas within a business to establish cost targets in the large Japanese companies are shown in Table 9.3. All percentages shown are the survey results of use during the product development introduction stages of companies that have been using target costing for over 20 years.

The expansion into other areas will differ from company to company. Certainly where design costs are significant and extreme, a company would want to maintain cost control in the development and design stage costs. Companies that produce products that have high usage costs in the

TABLE 9.3

Survey Results of Japanese Companies' Use of Assigning Target Costs

Area of Cost Target	2000	2004–2005
Development and design cost	76%	87%
Direct material costs	98%	98%
Direct conversion cost	97%	96%
Dies/molds/tooling cost	83%	90%
Manufacturing overhead cost	72%	81%
Quality assurance and customer support cost	Not reported	54%
Maintenance cost of product in use	32%	44%
Running cost of product in use	36%	37%
Reuse cost	8%	12%
Recycle cost	10%	25%
Disposal cost	12%	15%
Environmental preservation cost	Not reported	23%

field would want to begin to use target costing concepts in this area. The environmental areas listed at the bottom of Table 9.3 will need to continue to grow over the next couple of decades. International policies will dictate this to happen. Companies that are not equipped to deal with these costs when they need to will be caught off guard. The companies that are prepared will be the survivors, winners, and achieve the ultimate success.

SUMMARY

To begin your target costing activity, the best method to utilize is the addition method. This method ensures that the most realistic product target cost is determined, even though it may not be the most market competitive. It is more important to have a realistic product level target cost than to have one that is too aggressive and cannot be obtained. Using unattainable product level target costs will severely damage the credibility of the target costing process. Setting target costs by function is a very popular method deployed in Japan. The value engineering methodology is the key ingredient to develop costs by function. Most product level target costs include a contingency cost allocation. If during product development the target cost is exceeded and there is no known technique to obtain the target cost, then a strategic decision must be made. To proceed with an unfavorable cost will hurt your profitability objectives and harm the target costing system credibility. To cancel or hold the project could do the same. There is no set answer to this dilemma, except that if the answer is to always move forward with the project regardless of the negative to target cost, you are not doing target costing. Do not move forward to the advanced applications of target costing until the most elementary are fully utilized and institutionalized.

10

Alpha Brain

My purpose for this chapter is to give the reader some detailed information about cost tables, what they look like and how they work. All the companies that I have visited in Japan regard their cost table data as sacred information. This information represents a competitive advantage for most companies, so this information is guarded and treated as confidential. Thus, my second purpose of including the information in this chapter is for a company to learn what it is going to take to become the ruthless competitor that will win the business war.

ALPHA BRAIN BACKGROUND

My first exposure to Alpha Brain was in 1999, when I attended the Third Annual Target Costing Conference cosponsored by CAM-I and the University of Akron. A representative from Alpha Brain attended the conference. By 1999 Alpha Brain had been collating data for more than 15 years. Alpha Brain's original founder, Hirokatsu Hibino, used to work as the top consultant for JEMCO Nihon Keiei, the originator of the original Japanese cost tables. He was on the team that developed the first cost tables for Toyota, Mitsubishi, Toshiba, etc. With the rise of the cheap personal computers starting from the late 1980s, Alpha Brain's customers demanded that the old paper-based cost tables be converted into a PC-friendly format. As time went by, these companies also started to appreciate Alpha Brain's unique role as a data clearinghouse where a neutral arbiter of data could compare cost data and offer best-practice-based benchmarking. The Alpha System had feedback loop mechanisms wherein Alpha Brain clients were

continuously informed of Alpha Brain's new benchmarks, calculations, data mistakes, and improvements. Like classic cost tables, Alpha Brain's calculation engines deal with numerous combinations of physical attributes, material or component substitutions, manufacturing methods, functions, and parts used. As a systematized and extended next-generation form of cost tables, the Alpha System was designed to support process (operational) costing, component cost analysis, feature-to-function costing, benchmarking, teardown analysis, and continuous improvement.

After working with many companies seriously considering or already undertaking target costing deployment, Alpha Brain learned that one of the biggest problems plaguing the companies was the lack of good and reliable target costing tools. Cost tables had been the traditional cost management tool in Japan, and cost data/tools in Japan had traditionally been in the form of cost tables. Cost tables can be formulated in three ways: time motion study, actual plant floor benchmarks, and statistically derived parametric estimation or regression techniques—or a combination of all. Cost tables present costs as the product of multiple combinations of different physical attributes, material or component substitutions, manufacturing methods, functions, and parts used. However, the need for constant updating is the biggest problem plaguing cost tables. Furthermore, cost tables' black-box nature was increasingly being criticized. The Alpha System solved this by essentially reorganizing cost table data, information, and knowledge into an easily configurable cost database and running calculation engines on top of them.

For years, Mr. Hibino sold his cost table database to many different Japanese companies. The companies actually purchased a software CD that they loaded onto their computers. Then when any improvements, software changes, or new data were required, new CDs had to be delivered and loaded on the different PCs that ran the system. By the late 1990s this method of software distribution was outdated. This is about the same time a joint venture company named Compass made a major investment in Alpha Brain and took leadership control of the company. Their plan was to sell the database on the Internet. Thus, all a customer needed to do was to go to the Alpha Brain user Web site, enter its identification and password, and then enjoy access to the latest version of the software and its database. This change in distribution required vast and extensive programming changes. Alpha Brain hired a chief technology officer that was a software specialist and contracted with Wipro to make the programming changes.

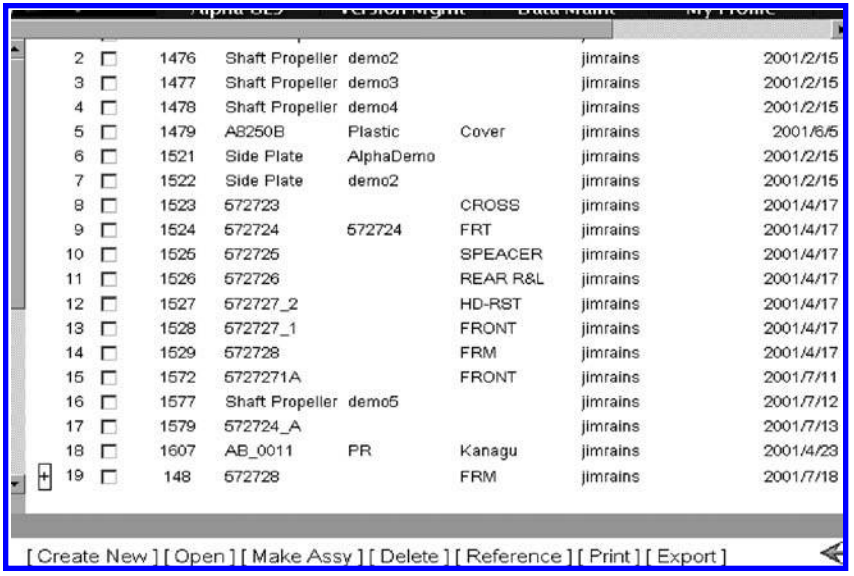
Two days after my retirement from General Motors in May 2001, I was on a plane to Tokyo as an Alpha Brain sales representative for North America. Two other men from the United States and myself were to be the sole sales representatives for Alpha Brain in North America. Because of my intense interest in target costing and knowing the need to be excellent in target costing, and that such a database is necessary, I was very excited to be a part of this new venture. By this time I had many associates in Japan, and I learned that Mr. Hibino was a well-respected individual in his field, so that helped me feel assured that this company and its product were worthwhile.

You may recall the Internet bubble of 2000 to 2001. The biggest player of funding Internet start-up companies was Softbank. It seemed Softbank had major investments in almost every "dot-com" company. Since Alpha Brain fell into this category, Softbank became the major investor of Alpha Brain and thus took management control of the company. Mr. Hibino, the man that created the company, was essentially no longer involved. I am sad to report that as the dot-com Internet industry crashed, so did Alpha Brain. It simply ran out of funding before the product was finished and marketable. I worked hard to make the English version of the product acceptable for the North American market, but was let go before the work was done.

This background does not mean that the product was bad. Quite the contrary. In fact, it was fantastic. The cost database that it had was extensive. By inputting information to the various screens that popped up, one could determine the best cost, or what we called the "should cost," of any particular component. The system had all of the major processes completed, such as machining, injection molding, and stamping. The level of detail was extraordinary. So let's take a look at some of this detail. The message of showing this detail and system is not to see the graphics or use the data, but to see how an actual system could be set up and used. You should pay particular attention to the type of information that is included so that you can determine the information that you will need to collect and maintain for your own cost database.

THE ALPHA BRAIN SYSTEM: AN EXAMPLE

Once it is set up, your system will have a large library of component parts included. You should be able go to a screen similar to the one in Figure 10.1



2	☐	1476	Shaft Propeller	demo2		jimrains	2001/2/15
3	☐	1477	Shaft Propeller	demo3		jimrains	2001/2/15
4	☐	1478	Shaft Propeller	demo4		jimrains	2001/2/15
5	☐	1479	A8250B	Plastic	Cover	jimrains	2001/6/5
6	☐	1521	Side Plate	AlphaDemo		jimrains	2001/2/15
7	☐	1522	Side Plate	demo2		jimrains	2001/2/15
8	☐	1523	572723		CROSS	jimrains	2001/4/17
9	☐	1524	572724	572724	FRT	jimrains	2001/4/17
10	☐	1525	572725		SPEACER	jimrains	2001/4/17
11	☐	1526	572726		REAR R&L	jimrains	2001/4/17
12	☐	1527	572727_2		HD-RST	jimrains	2001/4/17
13	☐	1528	572727_1		FRONT	jimrains	2001/4/17
14	☐	1529	572728		FRM	jimrains	2001/4/17
15	☐	1572	5727271A		FRONT	jimrains	2001/7/11
16	☐	1577	Shaft Propeller	demo5		jimrains	2001/7/12
17	☐	1579	572724_A			jimrains	2001/7/13
18	☐	1607	AB_0011	PR	Kanagu	jimrains	2001/4/23
19	☐	148	572728		FRM	jimrains	2001/7/18

[Create New] [Open] [Make Assy] [Delete] [Reference] [Print] [Export]

FIGURE 10.1
Menu screen.

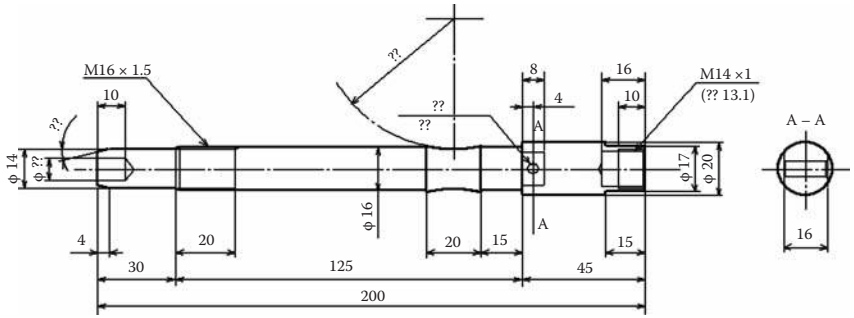


FIGURE 10.2
Drawing of shaft propeller.

to select a part that you need to update or use to create an entry for a similar new part.

The part that we will analyze is a shaft propeller, shown in Figure 10.2.

In Figure 10.3 one can see the preliminary information that is required for each part number entered into the system. The initial information relates to production volume. This is used to determine the setup costs for each process that is used in the manufacture of the shaft. Next, we select which overhead cost database we want to use. For example, if you

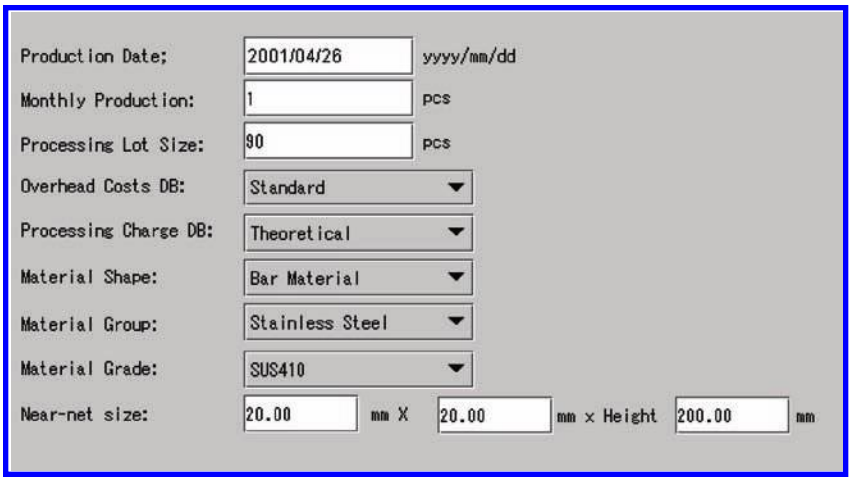
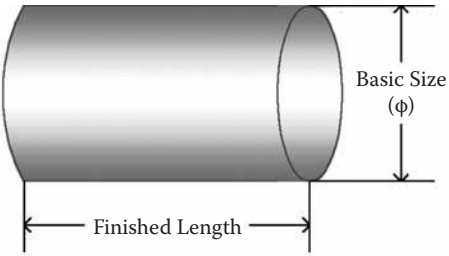


FIGURE 10.3
Preliminary part information.

have several different plants that you can make this part in, and each has different overhead expenses, you can select the different databases that you have created to determine the best location to make the part. The processing charge is asking which processing cost database you want to use. You can select the theoretical lowest-cost database or any other that you have established in the system. Next are some basic part information, the part shape, the specific material and grade of the part, and the part's basic shape and size.

Depending on what information is entered on the screen below, the system selects the next most appropriate screen for additional data entry. For example, if I would have selected customized sheet stock instead of bar stock in the material shape block, the next screen would be different. The initial information relates to production volume. This is used to determine the setup costs for each process that is used in the manufacture of the shaft. Next, we select which overhead cost database we want to use.

In Figure 10.4 the first field is looking for the bar stock diameter. The user either selects the bar diameter from the pull-down menu or directly inputs the value in the field. Based on this input, the chucking method and equipment size are determined. After the user inputs the finished length, the database calculates the optimal material sizing. A manual override is possible. This selection further narrows the list of possible equipment that can be used to make the part. The final entry on this screen is to input



Basic size (selection)	D 50.00			
(input)	D 20.00			
Purchased Sizing	Scale Mat...			
Finished Length	200.00	mm		
Length	203.00	mm +	24.27	mm
Standardized Size	2.5m		4.5m	
Number of pcs.	0	Pcs	11	Pcs
Weight of material	0.000000	kg	0.569771	
Weight of finished goods	0.000000	kg	0.501398	
Scrap weight	0.000000	kg	0.007521	
Weight of edge material	0.000000	kg	0.060852	
Material Cost	420.00	Y/kg	70.00	Y/kg
Scrap unit price	0.00	Y/kg	0.00	Y/kg
Edge Cost	0.00	Y/kg	0.00	Y/kg
Part Cost	0.00	Y/pc	246.48	Y/pc
	↑(Manual override)		↑(recommended)	

Leave the Left input value at 0.0 to use the Recommended value (Right)

FIGURE 10.4
Bar stock detail information.

presized material or select a standard-size material. In the Alpha Brain system, if the user selected the standard-size material, the system would select equipment to cut and size the material. The material weights are calculated by the system.

Figure 10.5 is the macrolevel process filter for bar-shaped parts. The user selects the item that is the most similar to the part specified on the drawing. While looking at the drawing, the user enters the number of features and enters that number in the space provided above each representation on the screen.

This particular shaft required two secondary operations. Thus, the process plan screen shown in Figure 10.6 was opened to input the specific information. Here we begin to enter a process plan. Two machines

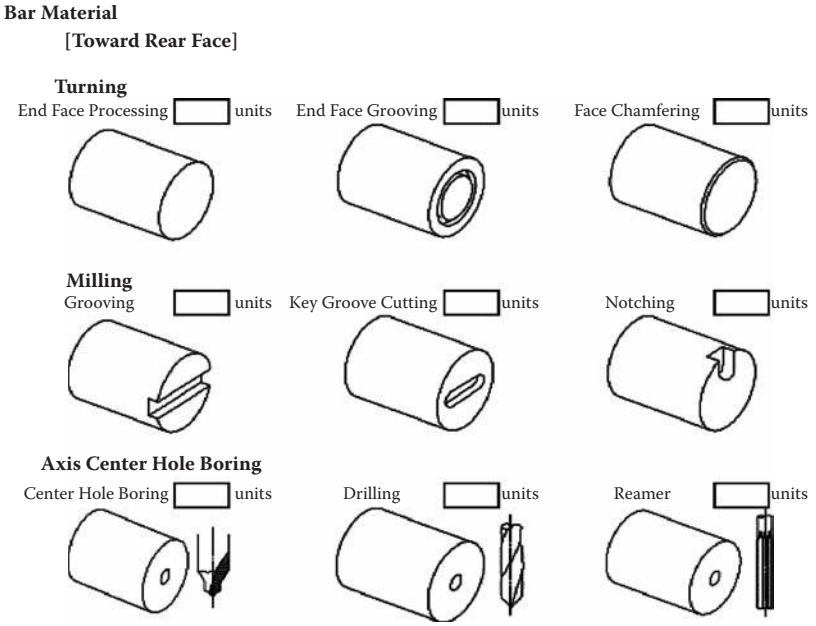


FIGURE 10.5
Macrolevel process filter.

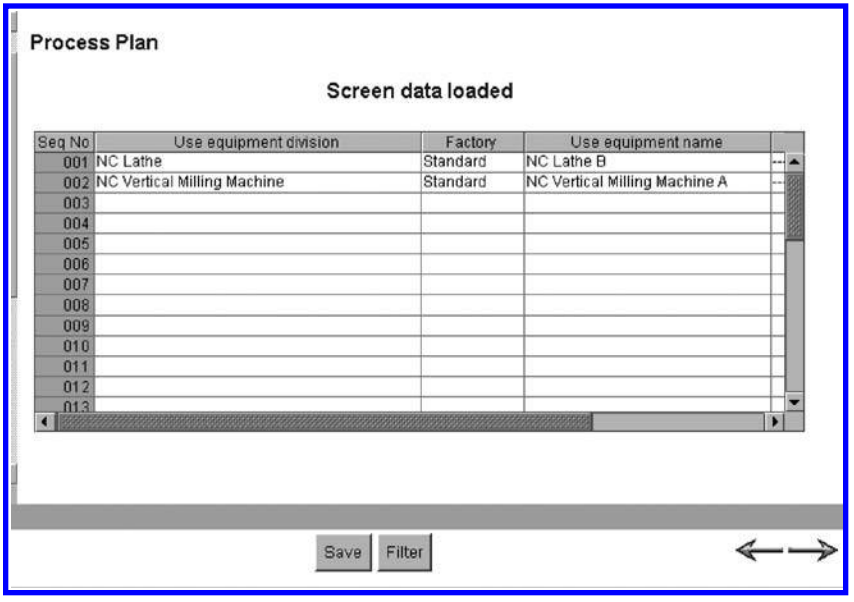


FIGURE 10.6
Process plan screen.

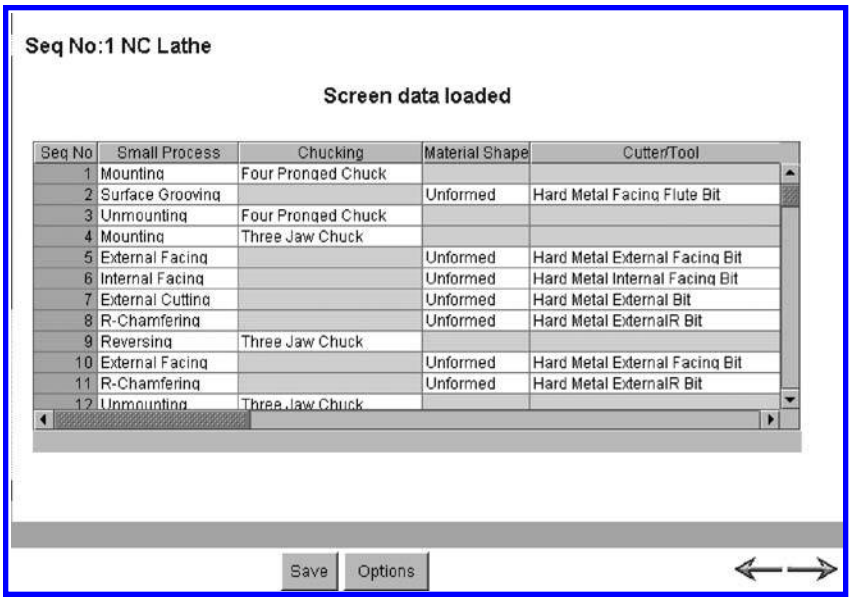


FIGURE 10.7
NC lathe detail.

were selected: a NC (numerical control) lathe and a NC vertical milling machine. These, as most field options, are taken from drop-down menus.

The NC lathe detail is shown in Figure 10.7.

As you can see, this NC lathe had several steps that it was to perform, such as mount the part, groove the surface, release the part, etc. For each step, where applicable, the type of chucking was entered, as was the material shape and the type of cutter or tool that is used. All boxes have drop-down menus, to make it easy to select an entry. Depending on the small process selected, the system knows and prompts the user for which fields/parameters require data. Note that this screen capture is incomplete. There is a horizontal scroll bar that will now move to the right, as shown in Figure 10.8.

As a specific parameter for a listed process is selected, the column heading changes. For example, the second operation, as noted in the screen in Figure 10.7, is surface grooving, so when the column under parameter 1 is selected, the system automatically prompts to input the outside diameter of the shaft. Continuing to scroll to the right (see Figure 10.9), one can complete the data input for the NC lathe.

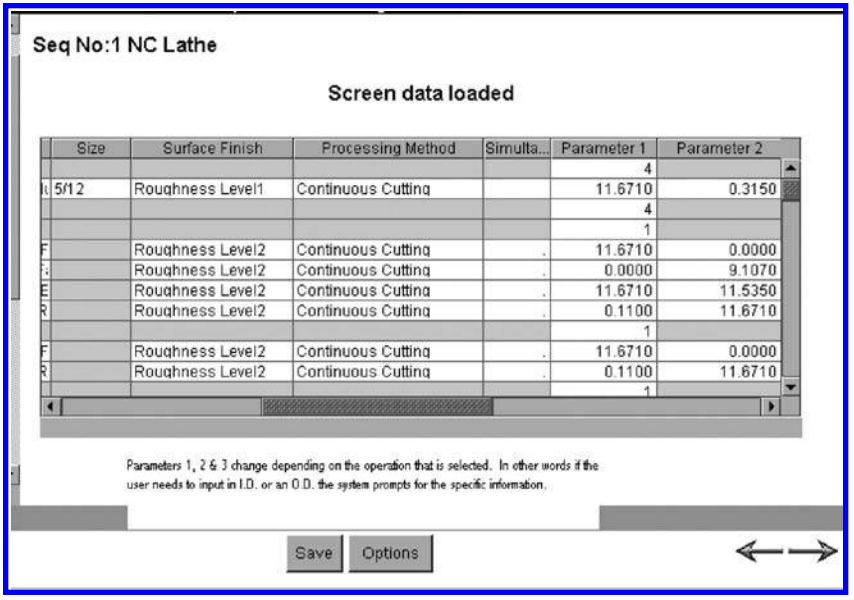


FIGURE 10.8
NC lathe additional detail.

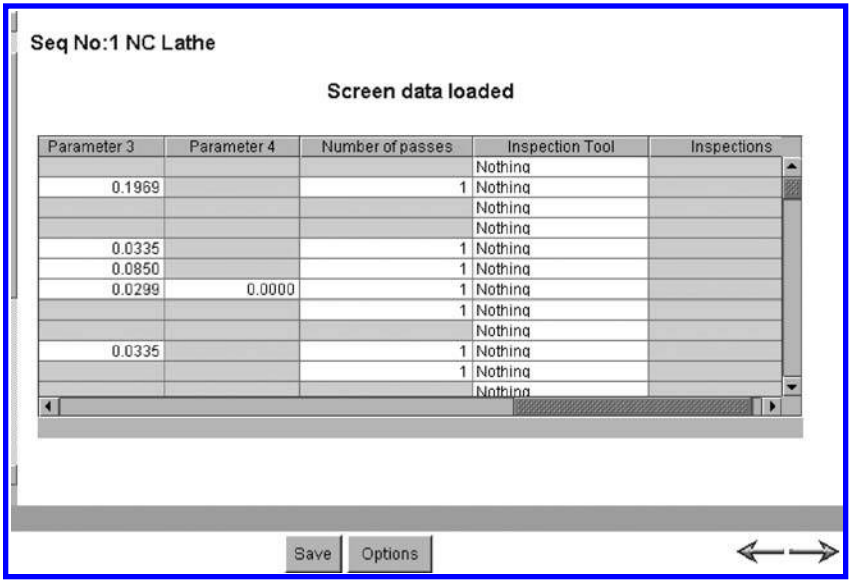


FIGURE 10.9
NC lathe additional detail.

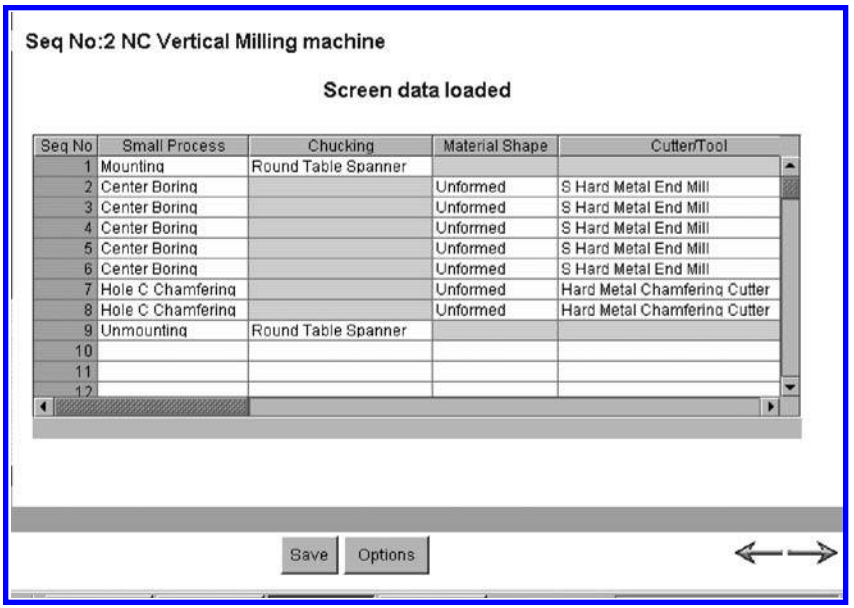


FIGURE 10.10
Detail for NC vertical milling machine.

Here additional parameter information can be inserted if required. Then the system prompts us for inspection operations, like micrometers, calipers, etc., and the frequency of inspection occurrences.

In a similar fashion data are input into the system for the vertical milling machine (Figures 10.10 to 10.12).

The detailed unit time sheet is shown in Figure 10.13. In this case, the times listed in the report are the "should-cost" times that have been based on numerous data collections over many years and included from many different businesses and equipment.

The final report appears in Figure 10.14.

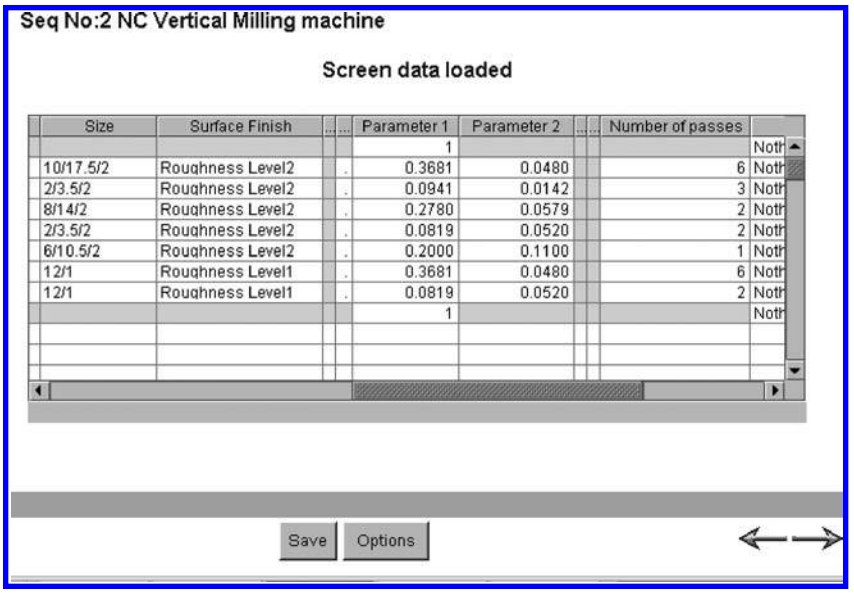


FIGURE 10.11
NC vertical milling machine additional detail.

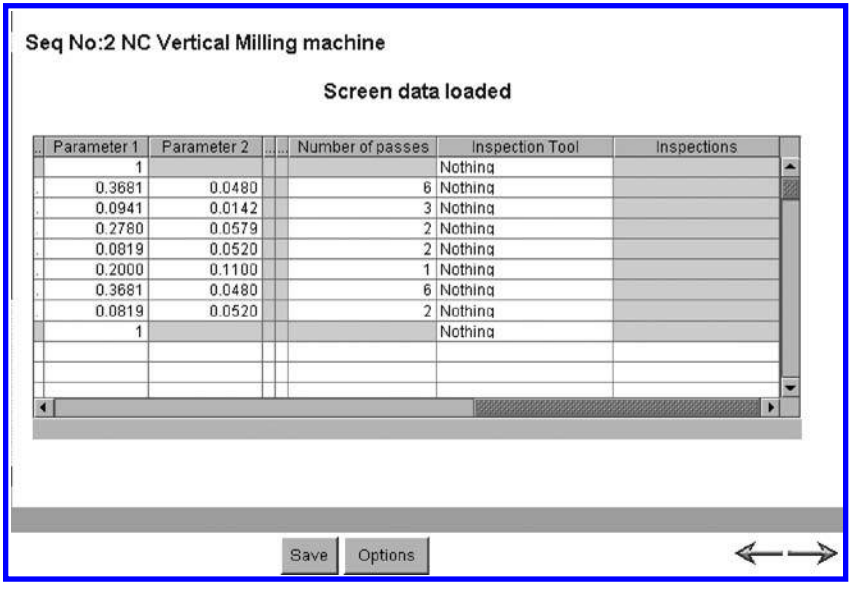


FIGURE 10.12
NC vertical milling machine additional detail.

Time Sheet Page 1 of 2

BRAIN

Date : 2001/12/12

Unit Time Statement

Approval	Check	Estimator

Product Name		Material	SUS304
Part Name	DISK	Lot Size	200
Part Number	J-0020-02416	.	
Sub-Part Number		.	

No.	Procedure	Machine	Operation	Handling Time	Machine Time	Setup Time
1	NC Lathe	NC Lathe B	1 . Mounting	0.479	0.000	0.000
2	"	"	2 . Surface Grooving	0.000	0.956	0.000
3	"	"	.. Tool return	0.000	0.022	0.000
4	"	"	3 . Unmounting	0.479	0.000	0.000
5	"	"	4 . Mounting	0.312	0.000	0.000
6	"	"	5 . External Facing	0.000	9.645	0.000
7	"	"	.. Tool return	0.000	0.031	0.000
8	"	"	.. Exchange Tool	0.000	0.011	0.000
9	"	"	6 . Internal Facing	0.000	15.213	0.000
10	"	"	.. Tool return	0.000	0.035	0.000
11	"	"	.. Exchange Tool	0.000	0.011	0.000
12	"	"	7 . External Cutting	0.000	0.409	0.000
13	"	"	.. Tool return	0.000	0.023	0.000
14	"	"	.. Exchange Tool	0.000	0.011	0.000
15	"	"	8 . R-Chamfering	0.000	0.646	0.000
16	"	"	.. Tool return	0.000	0.023	0.000
17	"	"	.. Exchange Tool	0.000	0.011	0.000
18	"	"	9 . Reversing	0.602	0.000	0.000
19	"	"	10 . External Facing	0.000	9.645	0.000
20	"	"	.. Tool return	0.000	0.031	0.000
21	"	"	.. Exchange Tool	0.000	0.011	0.000
22	"	"	11 . R-Chamfering	0.000	0.646	0.000
23	"	"	.. Tool return	0.000	0.023	0.000
24	"	"	.. Exchange Tool	0.000	0.011	0.000
25	"	"	12 . Unmounting	0.312	0.000	0.000
26	"	"	.. Setup Time	0.000	0.000	0.200
27	"	"	Sub total	2.184	37.414	0.200
28	NC Vertical Milling Machine	NC Vertical Milling Machine A	1 . Mounting	0.479	0.000	0.000
29	"	"	2 . Center Boring	0.000	0.150	0.000
30	"	"	.. Tool return	0.000	0.135	0.000
31	"	"	.. Exchange Tool	0.000	0.056	0.000
32	"	"	3 . Center Boring	0.000	0.012	0.000

FIGURE 10.13
Unit time sheet.

Cost Sheet — Page 1 of 1

BRAIN
Date : 2001/12/12

Unit Cost Statement
(Press·Sheet Metal Working·Machining)

Approval	Check	Estimator

Administration

Part Number	J-0020-02416
Sub-Part Number	
Part Name	DISK
Product Name	
Lot Size	200
Flat size X	12.4in x 12.4in
Material	SUS304

Material

Material width (in)	12.647613
Material pitch (in)	12.9921
Thickness (in)	0.31496

	Weight	Unit Price	Cost
Product (lb)	13.879592	0.00	0.00
Material (lb)	14.829011	0.961616	14.26
Setup / Piece (lb)	0	0.961616	0.00
Scrap/Piece (lb)	0.949419	0	0.00
Insert Cost (US$)	–	–	0.0
Adm. Cost (%)	3.0	–	0.43
Material Cost	–	–	14.69

No.	Process	Machine	RPM	Pcs	Machines / worker	Processing Time	Processing Rate (US$/min)	Processing Cost	Setup Time	Setup Expense	Total
1	NC Lathe	NC Lathe B	0.000000	1	4.0	39.598000	0.20	8.02	0.20	0.09	8.11
2	NC Vertical Milling Machine	NC Vertical Milling Machine A	0.000000	1	1.0	2.271000	0.41	0.94	0.20	0.08	1.02
					–	Processing Expense Subtotal			–		9.14
					–	Overhead			15.0%		1.37
					–	Profit			5%		0.53

Cost Breakdown	2001/12/12 Cost	–	–	–	–
Material Cost	14.69				
Process Cost	11.03				
Packaging Cost	0.00				
Transport Cost	0.00				
Other Costs	0.00				
Total	25.72				

FIGURE 10.14
Final report.

THE MODEL FACTORY

It was while working for Alpha Brain that I learned of the model factory concept. It seems that several companies collaborated to determine what is an optimum factory. The model factory concept was developed by researching hundreds of factories of specific types and sizes. Through the efforts of huge amounts of cost data collection the model factory concept depicts the optimum size, capacity, pieces of equipment, manning for direct and indirect labor, and best practice costs of each. For example, a stamping plant would be optimized by the number of presses and the types of presses. The same optimization study for an injection molding business or a machine shop business was developed.

During one of my visits to Nissan, I met with a product development manager. I was very impressed that he was able to describe and explain to me the optimum jobs per hour in a vehicle assembly plant and why. This is the beginning of the model factory concept. In actuality, the model factory concept has significantly more detail and is much more comprehensive.

METAL-FORMING FACTORY

Table 10.1 details the number of employees for the facility. Note that there are different rates for men and women for the time frame when this chart was developed. I also find it interesting to learn that the tool and die makers are paid more than the sales workforce. The actual labor values are not what is important. What is important is that the manning of an optimized facility would have this detail.

Table 10.2 gets into even more detail regarding the equipment necessary to run and support the plant. One can see that the total factory cost goes into levels of detail that companies in the United States just do not have. Again, the model factory concept looks to optimize the entire system, not suboptimize the component areas, as we often do.

Additional charts include information such as the area requirements for common spaces like offices, reception room, rest rooms, and cafeteria, and the number and size of the presses that are needed.

TABLE 10.1

Detailed Employee Head Count for Model Factory for Stamping

Description of Operation	Number of Employees	Salary per Month	Total
Section head	4	¥320,000	¥1,280,000
Skilled labor	10	¥290,000	¥2,900,000
General worker (male)	26	¥230,000	¥5,980,000
General worker (female)	10	¥170,000	¥1,700,000
Contract labor	5	¥120,000	¥600,000
Section chief	2	¥400,000	¥800,000
Clerical support	2	¥170,000	¥340,000
Plant manager	1	¥450,000	¥450,000
Tool and die maker	3	¥320,000	¥960,000
Salespeople	4	¥300,000	¥1,200,000
President	1	¥850,000	¥850,000
Total	68		¥17,060,000

TABLE 10.2

Equipment Detail for Stamping Model Factory

Common Equipment	Quantity	Unit Cost (JPY 1,000)	Depreciation (years)	Subtotal (JPY 1,000)	Total (JPY/h)
Pallet	80	12	3	320	82
Crane	2	550	4	275	70
Compressor	1	1,000	10	100	26
Truck	1	2,000	5	400	102
Light van	2	1,500	6	500	128
Incinerator	1	200	3	67	17
NC tape producer	2	470	10	94	24
Conveyor set	1	2,480	4	620	158
Metal mold/tool shelf	1	1,000	15	67	17
Material storage shelf	1	1,000	15	67	17
Product storage shelf	1	1,000	15	67	17
Heating and cooling	1	1,000	10	200	51
Ventilator	1	440	9	49	13
Substation equipment	1	30,000	15	2,000	510

Table 10.3 is a sample of such a table for an optimum machining plant. The sample shown is not the complete list of equipment. Additional equipment includes NC machining centers, grinders, and drills.

Other factory costs, such as incidental labor costs, that need to be included are as follows:

- Bonuses
- Employee health insurance
- Disability insurance
- Health and welfare pensions
- Employee allowances
- Training costs

Finally, the list of other costs that make up the optimum factory are:

- Depreciation cost for machinery
- Machinery tax and insurance
- Factory building tax and insurance
- Equipment repair cost

TABLE 10.3

Detailed Equipment List for Machining Model Factory

Process	Size	Quantity Needed	Required People	Space Needed	Machine Cost (JPY 1,000)	Total Machine Cost
Lathe	Center lathe A	2	2	2	2,136	4,272
	Center lathe B	2	2	6.6	4,080	8,160
NC lathe	NC lathe A	1	1	9.2	9,200	9,200
	NC lathe B	1	1	8.9	9,520	9,520
	NC lathe C	1	1	7.2	14,800	14,800
	NC lathe D	1	1	11.5	17,440	17,440
	Combined lathe A	1	0.5	15.7	11,304	11,304
	Combined lathe B	1	0.5	20	22,240	22,240
	NC automatic A	1	0.5	2.6	11,200	11,200
	NC automatic B	1	0.5	4.6	16,000	16,000
Milling	Vertical milling A	3	3	9.6	4,848	14,544
	Vertical milling B	3	3	10.5	5,064	15,192
	Horizontal milling	1	1	1.2	11,700	11,700

- Consumable tool costs
- Indirect material costs
- Electricity consumption costs

SUMMARY

As previously stated, my objective of including this chapter and the information in it is to give you an idea of the level of detail that in the end is necessary for you to become the best-in-class company. In the beginning, companies start with a manual cost table system. Over an extended period of time, as more and more data get input into the tables, one should begin to develop a computer-based system to ease the data collection and maintenance of the data. This will lead to the eventual CAD workstation integration to make it very simple for design engineers to know what cost they create, when they create it. The model factory concept is a valuable weapon to have in the fight for global survival and success. To be armed with this type of information, management decisions based on cost are more prevalent and accurate.

11

Benchmarking Japanese Companies

Since 1999 I have made several trips to various Japanese companies. Since 2003 I have escorted others to make these visits with me. The most critical decision is to decide which companies to visit. I am sincerely grateful to the leaders and officers of the Society of Japanese Value Engineering (SJVE) for their assistance in arranging the company visits. Over the years SJVE and I have established a reciprocal visitation relationship. Every year there is a SJVE delegation that attends the SAVE International Conference in the United States. For several years I arranged for the delegation to visit U.S.-based companies to learn more about the practices in value engineering. These have been in both manufacturing- and construction-oriented business sectors. Thus, SJVE has been extremely helpful to set up visits to the many Japanese companies that excel in target costing and value engineering. Without their help, guidance, and contacts, it would have been virtually impossible for me to have successful visits at these companies.

The objective of the visits is to learn and better understand how value engineering and target costing are being employed by various companies in different industries. Seeing the end result is not what these visits are about. The objective is to learn how they actually perform the steps and activities to get the end results. Thus, the meetings need to be set up with key upper management corporate leaders. In almost every company visited, we met with the head of the cost planning or cost management department. These are the people that are held accountable and responsible for cost management and, in many companies, the profitability. The following information is only the highlights for the various company visits. Describing too many details in this book would violate the trust and confidentiality of the companies visited. Note that even with meetings with executive leadership

people, it is difficult to learn everything that you really want to. In every situation a translator is required. English is not a common language in Japan, so to communicate we needed to hire a translator. Since everything is translated, a four-hour meeting essentially contains slightly more than two hours of information. Not all information noted below is current. The information in this chapter is taken from notes and conversations that occurred at the time of the visits.

ISUZU (1999, 2003, 2008)

My first visit to Isuzu in 1999 was very exciting. I was an employee of General Motors and GM still had a financial interest in Isuzu. My visit was set up by Mr. Yoshihiko Sato. A very full day of meetings was prepared for me. I learned about many of their value improvement techniques, including value engineering, competitive teardown, symbiosis research system, value target method, design for assembly, checklist method, one-day cost reduction, unit-cost method, and mass/unit price method. Some of these were developed by Isuzu. They also explained, using an actual bumper system of a new vehicle design, how these different techniques were used.

My main hosts for 2003 and 2008 were Akihiro Hosoya, Executive, Engineering Division; Yoshitoshi Watanabe, CVS Manager, VE TD Group, Cost Planning Department; and Mamoru Adachi, CVS Manager, Cost Planning Department.

Value engineering was introduced to Isuzu in 1959 and the first value engineering (VE) workshop was conducted in 1963. In 1979 they formed their first VE group. VE training, depending on the people being trained, goes from 2 to 12 days.

It was very interesting to tour the manufacturing facility. I was surprised to see that the facility and equipment were old. The main plant in Fujisawa was built in 1962. Besides stamping, component assembly, and vehicle assembly the site incorporates research engineering facilities and proving ground. In 1999, the site employed 7,122 people and was 606,038 square meters.

The cost planning department at Isuzu consists of 60 engineers. They are responsible for:

- Analyzing market price, value, and volume
- Establishing the target profit for a new vehicle
- Developing the target cost for a new product
- Breaking down and allocating the target cost
- Reviewing rough cost estimation, including variable and fixed costs, and investments
- Creating an action plan to achieve target and executing the plan
- Constantly evaluating and maintaining cost status
- Encouraging cost reduction activity for current vehicles
- Studying the cost structure
- Developing new cost reduction techniques and being responsible to train employees

Isuzu makes extensive use of cost tables. For more than a couple of decades they have been adding information to their database. The information comes from suppliers, "cost fairs," vehicle teardown spreadsheets, and years of experience in product costing.

The Isuzu cost planning department performs the following activities during the product development process:

- Concept proposal: Benchmarking, teardown, value valuation, and zero-look VE. This stage of development is defined as the best stage to implement cost reduction.
- Planning stage: First-look VE, design for assembly (DFA), design for manufacturability (DFM), design for environment (DFE), design for serviceability (DFS), and investment estimate.
- Development and product preparation: Second-look VE, benchmarking.
- Development and production sales and preparation: VE on processes, teardown, and mini VE.
- Production sales (includes first and second pilot and SOP): One-day cost reduction, price table.

It must be noted that throughout this entire process the achievement of the target cost is everyone's objective. An effort is made to understand at all times the cost estimate of each vehicle program. Ruthless efforts to reduce the actual estimated cost to the target cost are constant.

The vehicle teardown area was certainly one of the highlights of the tour. The intense effort that goes into the teardown and the follow-up analysis is very impressive.

Torn-down components are displayed differently at Isuzu than in the United States. The smaller disassembled truck components are sorted by commodity, so that all similar components are readily available to an observer. Competitive products are disassembled, weighted, costed, and analyzed. Then half of the vehicle is reassembled by the design-responsible engineering team. This activity by the engineering people promotes better understanding of the competitor's products.

A Dyna truck cab, when analyzed via teardown five years ago, was determined to be an inferior product. When a newer model had been analyzed it was determined that the Dyna product had closed the gap to Isuzu and in some areas gone ahead. An example of this finding is in the frame. Prior to disassembly the vehicle was tested on the test track for various performance characteristics, including rigidity. Through testing and analysis of the frame and chassis components, it was determined that the latest Dyna vehicle had drastically improved rigidity and surpassed that of Isuzu. Further analysis shows how this improved rigidity was accomplished. The Dyna unit is considerably heavier than the Isuzu frame, and at the time of my visit they were in the process of determining why Dyna feels that extra weight is necessary: crash worthiness or other performance attributes. Other Dyna vehicles were being tested at the Hokkaido proving grounds in an effort to answer that question.

The competitive vehicles are cost analyzed by Isuzu cost experts. The experts cost analyze each component part of the competitor's product. Every competitor piece is tagged with weight and name of the part. The cost is not on display, but is entered into a computer database and compared to other vehicle data. It is interesting to note that in conjunction with the performance testing, Isuzu also performs a cost-to-performance matrix. These data are extremely important to the target costing process utilized by all major Japanese companies.

Another example of vehicle comparison is that the Isuzu and Dyna base metal cabs weighed the same, but the Dyna cab had 80% less zinc plating material as a coating. Eighty percent less zinc plating equates to approximately $30 to $50 per vehicle. The next logical question to be asked is: Why can Dyna get by with less plating material and still meet the same corrosion specification? By analyzing the designs of the two vehicles the answer

appears to be very simple. Analysis found that water entry inside the Isuzu cab is very easy compared to in the Dyna cab. The Dyna cab had a superior design to prevent water entry, which minimizes the corrosion protection required on the inside of the cab sheet metal. Isuzu is now looking at a redesign of their cab, which will not only reduce plating cost, but also remove extra parts and assembly labor. The Isuzu design has a repair hole in the bottom of the cab, which is placed there to improve serviceability. It has been determined, however, that this hole is never used, and thus it is an unnecessary expense. It cost extra money to form the hole and also form a fancy cover and locking device to seal the hole. All of this can be eliminated, and still save the zinc plating cost.

During subsequent trips to Isuzu in 2003 and 2008 one could see the maturation of their target costing, value engineering, and teardown activities. The scope of value engineering was extended to what is called soft VE, which applies VE to nonproductive material. The teardown activity has been expanded to calculate a value index that is used to compare Isuzu with its competitors on individual components and subassemblies.

In the development of Isuzu's new small truck, the Elf, a major VE and teardown exercise was performed. The assembly line process was also carefully designed to implement numerous lean techniques that minimize waste.

ZEXEL CORPORATION (1999)

General Information

As a supplier to Isuzu, this visit was set up for me by the people at Isuzu. Robert Bosch has a major financial interest in Zexel and is its primary owner. Zexel's primary customers are Isuzu and Nissan; however, it supplies to all Japanese auto companies. Zexel was founded in 1939 and was formerly owned by Isuzu. Zexel is a major supplier of component parts to the automobile industry, as well as heating and cooling devices for the home and outdoors (product brochure available). Zexel has six major manufacturing locations. My visit was to the Higashi-Matsuyama plant, which is 1½ hours by train from Tokyo. The main product of this plant is fuel injection pumps.

Machining Center

Ninety percent or more of the pieces that traveled in the plant were in a lot size of four. Only very tiny washers and screws were found to violate this. Everything was in a small lot container. Parts were delivered from the suppliers in these containers, and movement from machining center to machining center to final assembly was done in small lots, and again in a lot size of four pieces. All containers were placed on Creform racks on wheels. The containers were manually handled, but because of the low lot size, the containers are very light. It was not evident to me if the material handlers were part of production or material handling. They used small quad-steer trailers to move numerous small lot containers between departments. In this facility it was required to take off your shoes and wear slippers, which were provided. They did not want dirt and dust contamination to get on the oily, close tolerance pump components. Lab coats were also provided to wear. Observed in a subassembly area were a lot size of four and approximately ninety different part numbers being manufactured. Every lot of four had its own kanban card, with appropriate information.

One subassembly area demonstrated a very unique kitting method. In a kanban card holder there were approximately 100 kit numbers on kanban cards. A picture of what was included in that kit was on the card. When an order for a kit was provided to this station, the operator pulled the appropriate card and scanned the bar code on the card. The components of each particular kit were displayed on the computer screen. Also, at the same time the doors of the small component bins (parts were very small, like small wire leads) opened. This was an error-proofing method that allowed only the operator to place the correct parts in each kit. Guess what? The lot size pulled from the bins for each part was four.

Zexel won a planned maintenance award. The equipment in the plant was making tight tolerance components and subassemblies. They had in place sophisticated testing stations. It was apparent that quality was a priority, and despite this, the average uptime on all of their equipment was 93%.

In the final assembly area, wire-guided automated guided carts (AGCs) are used to deliver material. These AGCs are rather small (approximately $3 \times 2 \times 2.5$ feet). When an AGC arrives at a using location, a computer screen acknowledges that it arrived, and displays what material is on the cart and what material needs to be delivered at that location. The screen also displays the cart number and what time it arrived.

Zexel gets a 15-day order from Isuzu, plus a schedule once per week. Zexel then gives its suppliers a four-day lead time. Most supplier components are delivered to a kit area. The material is then sequenced and delivered to the final assembly line. The assembly line is very sophisticated, with 25 stations (about 75 feet long). The line produces 80 units per hour. This assembly line was designed and made in-house. The uptime on this assembly line is 93%. The assembly line does not run in batch. Several different part numbers are produced in sequence per the customer order.

Cost and Value Engineering Discussion

I had an opportunity to discuss cost reduction methods with Mr. Masato Miyazaki, manager of purchasing, and Mr. Kameo Satou, currently employed in the quality department. Both men recently worked in the VE promotion group and are familiar with the cost reduction activities performed.

It is interesting to note that, like GM, Zexel abandoned value engineering and used DFM/DFA instead. However, after only three years, they determined this to be a mistake and went back to VE. They are currently performing a massive VE study on their entire logistics system. I would call this a nontraditional application of VE and was surprised that they offered this information.

TOYOTA MOTOMACHI VEHICLE ASSEMBLY PLANT (1999, 2005)

My hosts for the first trip to Toyota were Mr. Minoru Kamiya, Project General Manager, Administrative Division, and Mr. Toru Kuzuhara, General Manager, Final Assembly Division.

This plant produces the Crowne and the PROGRES, with the Crowne representing about 90% of the total volume. The Crowne has six airbags. There are three airbags for the driver and three for the passenger. One is in front of the occupant, one is in the seat, and the other is in the headliner by the door. The vehicle offers a power-driven rear window shade. I tried to get the people to tell me how they determined that the cost of this feature was worthwhile. In other words, how did they know that the customer was

willing to pay for this function? After asking the same question three different ways, I did not get an answer. All that they said was that if a person was willing to spend $40,000 on a car, then it was not a problem for them to have this feature and cost added.

The total plant area is 750,000 square meters. This includes stamping, body welding, painting, assembly, machining, and plating. There are 5,000 employees at this site. Around the Motomachi plant, there are several other Toyota facilities. Assembly line tact time is 102 seconds. Morning and afternoon breaks are 10 minutes. Lunch is 60 minutes. The plant cafeteria is in another building. It appeared that all workers go to the cafeteria, but it is not mandatory. The food prices are subsidized by Toyota. When the workers exit the general assembly area for lunch, most machines and the lights are turned off.

Manufacturing Philosophy

The basic philosophy is to create a manufacturing process where workers play the leading role, and where workers are determined to be the most important asset of the manufacturing facility—achieving a manufacturing process in which anybody can work by reducing the workload. All of the effort is to motivate the workers. The line focuses on group activities, while emphasizing individual responsibility, verifying the significance and objectives of work, and creating a work environment where people can work comfortably.

This concept of motivating people is 12 years old. Reduce noise, open space, optimize airflow and comfort. The plant is air conditioned. They coordinate colors to please the senses and want to establish a feeling of warmth. The assembly conveyor is 300 meters long. The worker is more important than the plant. The plant is very comfortable, very clean, and painted white.

The plant manager stated that it is possible to automate the entire vehicle assembly process and eliminate all people, but it is a saying known within Toyota that people must have a part in the process. Thus, what I have observed is that the most physically demanding jobs are automated, and everything else is done with humans. It was also mentioned that if the line were 100% automated, it would have to be three times as long.

Assembly Process

- It appears that they try to batch colors from the paint shop. There are nine Crowne colors and eight PROGRES colors.
- Every vehicle has an ID device on the roof. The ID device contains all the detailed information about that vehicle and tracks that vehicle through the assembly process.
- No operators were observed with unusually tough work assignments; however, the motions were very fluid.
- IPs are delivered to the assembly line via overhead conveyor. They are lowered on an elevator and are loaded into the vehicle without an operator.
- Trim 1 is slightly less than 200 meters. Then it splits into the chassis. There is a five-car overhead buffer. Under the buffer is a very wide aisle. The bodies are transferred from skillets to overhead racks during this transition.
- I observed that an operator that enters the vehicle to perform work needed to sit. A padded mat was attached to his pants, eliminating the need to carry a cushion, and yet offering improved comfort to the operator.
- Tire assembly is completely a lights-off automated operation. When I arrived to this part of the line the lights were turned on over a distance of two or three job lengths. All tires are delivered from an overhead conveyor (16 and 17 inches) and placed on the vehicle. The lug nuts are loaded into a spindle and all five are spun on simultaneously. The lug nuts are fed onto a small conveyor and into the spindle sockets with a pick-and-place device. When we exited this part of the line the lights were turned off.
- The carpet install area has a sticky footwear wipe to keep dirt out of the work area. Operators in this area must remove their own shoes and put on clean ones. Whenever they leave that area for break or lunch they must change their shoes. This applies to all line workers who must enter the vehicle after the carpet is installed.
- Under the oil fill station a green carpet is placed to help with the visual control of finding oil leaks.
- Each new operator goes through a three-day training in something similar to a methods lab. Then the worker is placed on a job that correlates with the skills that he or she demonstrated he or she can handle in the training.

Material Delivery

There are receiving doors all around the plant; however, there are no docks. Everything is delivered on side unload trailers.

Engine and transmission delivery was inside the plant adjacent to the point of use. The gull wing trailers are unloaded by a fork truck and the racks are placed by the line. The distance from the truck to the line is about 50 feet. There are two engines per rack.

All kanban racks at line side are on wheels and are the same height. This offers a visually pleasant setting. It also allows for improved visual control through the entire plant for workers and management.

Material delivery from the suppliers occurs every four hours. The farthest supplier is about 200 miles away. Tuggers deliver small lot material every 25 minutes. Line-side inventory, depending on the component, is between four and eight hours.

Toyota gives its suppliers a three-month order. Then each month it gives an exact order, followed by another exact order every day. They have a closed-loop delivery system. When a driver delivers order A, he picks up the kanban cards for order D. All parts at Toyota are on kanban since all suppliers are within a 200-mile range.

Quality Andon

Quality andon with a fixed-position stop is used extensively. In the main aisle, all assembly line segments are green when running and red when down. Then over the operators for each section of the assembly process, a more detailed andon board displays which station on the line pulled the cord. This allows for quick visual control as to where the problems are and where the attention needs to be placed. The line runs until the call is cleared or until the fixed-position stop point is reached. Music is played when the line stops. The plant manager leading the tour seemed to have no problem in allowing the line to stop for an instant to demonstrate this process.

Toyota (2005)

We were hosted by Mr. Yoshitaka Abe, Toyota Auto Body Co., Project Manager—Product Planning Center, and Mr. Kosuke Ikebuchi, Senior

Advisor and Executive Advisory Engineer. It was noted that Mr. Ikebuchi had 45 years with Toyota. This visit was a large group meeting hosted by Toyota for special attendees to the SJVE conference held in Nagoya. The meeting was held at the Toyota Inabe plant. The plant's nickname is Inaty, which stands for humanity, community, and amenity.

Mr. Abe told the group of the new 21st century vision for Toyota. Toyota's goal is to be the number one automobile maker in the world. They are taking concrete steps toward reaching this ideal as well as embarking into new fields thanks to our technology and know-how. Toyota is also pursuing the challenge of furthering prosperity in domestic and overseas regions through deepening the harmony between environment, society and individuals.

They described their CCC21 program, which was a $10 billion cost savings goal over a five-year period. This was an approximate 30% cost reduction across the company. Company guidance was that the company cannot survive with traditional cost planning, that it must incorporate cost reduction in a mass production plan, that the promotion needed to be company-wide, and that no engineering specifications were sacred. The reason for this aggressive cost reduction initiative was the real concern that Japan's costs were escalating and competition from Korea and China would be in a better cost position. The very top leadership of Toyota was actively involved on a regular basis. This program was the company's only focus.

The following shows the product development cost competitiveness milestones that were presented:

- 36 months before launch: Kickoff meeting.
- 32 to 31 months: Develop target profits and cost targets.
- 27 months: Vehicle concept—constant tracking for target cost compliance.
- 23 months: Concept design—target cost must be within 70%. If not, project canceled. Cost reduction challenges to reduce 3%. VE workshop.
- 19 to 18 months: Set target value to all (include suppliers)—reduce costs by 1.3%. Target cost must be within 90%. Upper management to lead VE workshop.
- 7 to 9 months: Meeting with suppliers for confirmation. From this point until launch, monthly meetings to monitor cost goals.

The program embraced the following in its strategy:

- Reduce number of parts.
- Reduce costs by vertical integration and outsourcing.
- Incorporate in-house stamping, molding, etc., to reduce costs.
- Leverage benchmarking for supplier target costs.

Another theme for Toyota is: "Unless we develop people, excellence in manufacturing cannot happen."

AISEN SEIKI (1999)

Aisen Seiki made the arrangements for the visit to Toyota, including transportation and interpreter services. My main hosts were Mr. Yasuhiro Suzuki, Managing Director (reports to president), and Mr. Katsuyuki Noda, CVS General Manager, Cost Planning Department (reports to Mr. Suzuki).

Aisen Seiki, like almost every other automotive company, promotes its image through care and concern for the environment. It seems I have seen on most company brochures the message of being in harmony with society and nature. Aisen Seiki is no different. The corporate objectives are a society giving rise to creative values, a society that is open on a global scale, a knowledge- and information-oriented society, and a society that values people.

Aisen Seiki automotive products are interestingly described in their literature using functional terms. This functional description is a very important attitude within a company. Do they make brake systems, yes, but in the future there may be other means to stop a car. Describing what they produce in functional terms keeps then on the leading edge of technology:

Brake and chassis-related products: Better functions are pursued from various aspects, such as stopping a car safely and securely, comfortable ride, and smooth handling. Systems ensure the stable driving performance.

Drivetrain-related products: Products to efficiently transfer engine output to driving force. Electronic controls help to attain greater power and lower fuel consumption.

Engine-related products: A group of products to increase the operating efficiency of the engine and keep it in top condition.

Body-related products: Car's safety and comfort, including improvement of exterior details, are pursued and further weight reduction and high performance are advanced.

Electronic products: Provide very reliable electronic devices that are at the core of car control technologies.

Through the provided interpreter and since we had over one hour to discuss various issues while riding in a van, the following information was learned about the cost planning efforts of Aisen Seiki. Value engineering workshops are conducted in Japan the same as in the United States. They conduct preworkshop meetings and the workshop just the way we do. There is a strong commitment by engineers and cost planning employees to at least obtain the first level of Japanese certification. This certification is called value engineering leader (VEL). To obtain a VEL status a person must attend a 12-hour VE training and pass a written exam. Aisen Seiki has 141 VELs. When asked why they have so many, I was told that in Japan certification is used as a competitive advantage. There is a level of prestige for the employee as well as the company to achieve this level of certification. In Japan, as well as in the United States, the premier level of certification is certified value specialist (CVS).

It was also learned from Mr. Noda that Aisen Seiki has been using cost tables for 28 years. Mr. Noda was trained by the Japanese target costing guru, Dr. Tanaka.

HITACHI MACHINERY CONSTRUCTION COMPANY (2003)

Our gracious hosts for the meeting were Mr. Hiroshi Gomyo, General Manager, VEC Department; Mr. Manabu Nakano, Senior Engineer, VEC Department; and Mr. Takuma Oohira, International Procurement. Our meeting was supposed to last only a few hours in the afternoon, but our discussions became so interesting that the Hitachi people made dinner arrangements for us so that we could experience Japanese dining and continue with our meeting. It is interesting to note that I have met

Mr. Ryuichi Seguchi, president, chairman, and CEO, on several occasions. He is active with the Society of Japanese Value Engineering. Don Gerhardt of Ingersoll Rand and Jim Bolton from TRW Automotive attended with me. We visited the Tsuchiura plant near Tokyo.

The VE history at Hitachi is as follows:

- 1960—VA was introduced
- 1963—Ryuichi Seguchi, current president and CEO, wrote a book: *Introduction to VA*
- 1970s—Established formal structure for VE
- 1984—Hitachi won the Miles Award
- 1995—Sales and marketing VE started
- 1997—3D CAD plaza established for teams
- 1997—Service VE started
- 2002—Rental VE started
- 2003—Hitachi won the Miles Award again

The Hitachi VE philosophy is described as follows:

- Adapt VE to the circumstances.
- Constantly improve VE.
- VE is a universal management philosophy.
- VE is pursued on a daily basis.
- Integrate VE into all areas, including New Product Development (NPD), sourcing, and manufacturing.
- Integrate VE into sales, service, and rental business.
- Use IT technologies with VE.
- Use VE to improve customer satisfaction.
- Use VE to increase function, not just reduce cost.

Hitachi at this time had over seven hundred people certified in VE. All new employees receive VE training. At the time of our meeting 1,075 people were involved in VE teams. It was mentioned above that Hitachi is applying VE to service. In that light they adapted the value equation to be

$$V = (F + S)/C \times A$$

where V = value, F = function, S = service, C = cost, and A = attitude.

When Hitachi discussed their voice of the customer activity we were surprised to hear how extensively they use the system. For a recent new product undergoing development they received information from 84 different customers and identified 1,800 customer needs. The needs were prioritized and categorized by quality, reliability, serviceability, and specific special functions.

They also engage in what they call voice of the supplier. This occurs essentially on a daily basis. On a recent new product 164 new ideas were generated by various suppliers.

The use of cost tables at Hitachi is extensive. They started using cost tables over 20 years ago. Hitachi has cost tables for every part they make. We were told they have 4,000 cost tables. The cost tables are used in the up-front planning stages for NPD. The cost planning department maintains the cost tables. Cost tables are updated every time the material costs change.

SOCIETY OF JAPANESE VALUE ENGINEERING (SJVE)

All of my benchmarking trips are coordinated around the annual SJVE conference. I have attended seven SJVE conferences and have presented at every one. To date SJVE has had 42 conferences, all held in Tokyo except for one year, 2005. That year the conference was held in Nagoya, since the world fair was open in Nagoya at the same time. This location afforded the opportunity to visit companies that are located in this region of Japan. In fact, Nagoya represents the largest manufacturing region in Japan.

Every year SJVE awards excellent companies the Miles Award, named after the founder of value analysis/value engineering. This award is a competitive award, and most companies work hard to build up their VE activity to enable them to apply for it. Of course, only the best applications are approved. It is these companies that we tend to benchmark during our visits.

Attendance to the SJVE annual conference offers the opportunity to network with people from many different companies. The average attendance is one thousand high-level VE and target costing professionals. Those that have a command of the Japanese language have a huge advantage to discuss and learn from others at this conference.

OMRON (2005)

We made a very interesting visit to Omnron's Keihanna Technology Innovation Center just outside of Kyoto. This area, because of the Japanese culture that has been preserved in Kyoto, is becoming more popular for Japanese companies to use for product research and development spurred by innovation and creativity. Omron opened this facility in 2003 and called it a Sense of Wonder. Omron pursues "brilliant technologies" to create wonders for customers as one of its themes. The facility was built to be Omron's core site for global R&D collaboration strategies. This year I was joined by Miguel Sanchez of Autoliv, ISP; Don Gerhardt and Nandit Gandhi from Ingersoll Rand; Jim Bolton from TRW Automotive; Dr. Ed McMahon from the University of Tennessee; and Cecil Potters, Gary Price, and Rikuhei Nakamura from Nacom Yazaki.

The Omron hosts were Tsunehiko Kuroiwa, President, Omron Iida Co.; Koichi Imanaka, PhD, Senior General Manager of Research and Development; Masashi Kurahashi, Advisory Production Technology Engineer; and Shohei Murakami, Planning and Promotion Division.

Founded in 1933, Omron Corporation has three fundamental business fields: industrial automation, social systems, and healthcare businesses. Information from the Omron website about its business segments is noted.

Industrial automation: Omron works closely with customers manufacturing products in a variety of fields to provide advanced factory automation systems. Omron control components, systems equipment, and advanced networking technology can be found in manufacturing sites throughout the world supporting the production of vehicles, home electronics, food, and various other products that form the basis for modern life. Omron control components are used in a variety of applications to make our lives easier. Omron relays, sensors, and switches are indispensable for advanced electronics and can be found in a wide range of high-tech business equipment.

Social systems: Omron technologies work to reduce congestion and facilitate the flow of people and vehicles in today's modern cities. Omron offers systems that automate the check-in process at airports,

train stations, and display useful information for drivers on highways. Other systems include retail location point-of-sales systems.

Healthcare: Omron offers today's health-sensitive society the necessary equipment to monitor health in the home. Doctors use Omron systems to make accurate medical diagnoses.

Some of the people that attended with me were disappointed because it became clear that target costing and value engineering per se were not used during up-front innovation. It was my first visit to a major R&D center, so I felt that it was worthwhile to learn how new product and process ideas were incubated. In a way, they do use VE, but only in a broad definition of VE, because in original innovation and creativity it is best to think only in functional terms. Based on what was presented to us, I believe that is exactly what they do. Omron principal products deal with sensing. So by focusing all brainstorming and creativity on ways to sense something, they can create new products based on this technology.

In this facility Omron has several confidential cooperative rooms that are reserved for key suppliers and academic partners. Their academic partners include U.S. universities that excel in the implementation of innovation. California Berkley and Stanford were two that I became aware of. At the center of the building was a very long and wide-open corridor. The corridor joins the special task work areas and functions as a communication zone, complete with sofas for casual discussions. Aided by built-in whiteboards, these spawn lively and vibrant discussions that develop new innovations.

As part of the presentation we were shown processing improvements in detail. Omron is attempting to synchronize its assembly operations. Since 40% of its customer orders require next-day delivery, Omron must have production facilities and operations in place to meet that expectation to avoid large finished inventories.

DENSO (2005)

Denso is an amazing company. As a key supplier to Toyota, it is their pleasure to help make Toyota great. I believe it is safe to say that Toyota would

not be as good as it is without Denso at its side. My Denso hosts were Yoshimasa (Hank) Hagio, Chief Manager, Cost Management Center and Corporate Planning Department; Yoshikazu Makino, Managing Officer, Corporate Planning Department; and Takumi Hamaguchi, Jinichi Uchida, and Yoshihiko Kitaya, Managers, Cost Management Center, Corporate Planning Department.

It appears that Denso's cost planning team is relatively small when compared to several other companies. Denso has only 20 people globally in this department. I am not sure why Denso's head count focused on this effort is so much less than other companies'. My only guess is that Toyota helps leverage their effort. The cost planning people are responsible for target costing activities that include built-in target costs by product (new developed product, next-generation product) and function and kaizen by product and function (VA activities).

We learned that Denso operates from a 15- to 20-year profit plan. Denso has long-term, mid-term, and annual profit plans.

The history of target costing and VE at Denso is as follows:

1960s
- Started VE committee
- Started the development of cost tables
- Initiated education of cost and VE to employees
- Implemented VE exhibition

1970s
- Implemented VE exhibition of improvement case
- Established cost management center

1980s
- Created the target costing theme
- Made cost table manual easier to use
- Developed computerized cost table system
- Started global cost table 1990s
- Started the target costing activity committee
- Started integrating the cost tables with CAD workstations
- Started education of practical VE activity

2000s
- Started promotion of global target costing activity

The target costing activity is initiated in the beginning of the product planning phase and continues through production. Zero-look VE, first-look VE, and second-look VE are used on product designs. They call manufacturing VE, which commences at the beginning of detail design, as does procurement VE with important suppliers. The sales price and target cost are assigned at the beginning of the concept phase. Denso states that the pillar for its target costing activity is value engineering.

The CMC, or corporate planning department, is centrally located in terms of communication and information flow. It is the hub for all product-related information.

The visit included a plant tour of the Takatana plant, which makes all the stepper motors for all of Denso's global operations. There is a huge injection molding department in this plant, with approximately 50 machines. We were told that the average changeover time is less than four minutes. The machines average between 3% and 5% downtime. This plant makes over 1,600 different final assembly part numbers, yet the average finished inventory is only one day. Work-in-process inventory is up to a maximum of three days, which is caused by high customer variability in finished product demand. Numerous finished part numbers have a daily volume of 20 or less. They often produce over a thousand different final assembly part numbers every day.

The 2006 attendees with Jim Rains were W. O. Chau, Michael Sieffert, and Osamu Furukawa from Ingersoll Rand and Robert Orlean from Orlean Technical Solutions.

NISSAN (2006)

Our group was hosted by Keiji Hatanaka, General Manager, Cost Engineering Planning and Administration; Chitoshi Hoshina, General Manager, Cost Engineering Promotion; and Arihisa Masubuchi, Manager, Engineering Section 1.

There are 220 people in Nissan's cost engineering department. Nissan's effort to utilize target costing, value engineering, and teardown methods did not really begin until the early 1990s. The cost engineering department is organized as part of the R&D department.

Beginning in 2000 Nissan developed the 3-3-3 activity. The activity included:

- Three participants: supplier, purchasing, and engineering
- Three regions: Japan/Asia, Europe, and the United States
- Three years

After the first three years the activity was named:

- 2002–2005: Nissan 180
- 2005–2008: Value up

One of the mission's of cost engineering is to develop the needed cost infrastructure. A major component to this mission is what Nissan calls the best practice method, or BP. There are three stages to the BP.

- Nissan BP
- Japan BP
- World BP

They are beginning to develop a future best practice, or what they call the ideal price leader. My guess is that it is the same as what I have called the ruthless competitor. This is similar to General Motors' strategy of BUGM, or best under GM. To identify the Nissan BP, the CE group performs studies at suppliers to gather cycle times, facility costs, and other information. It is the CE group's responsibility to constantly keep up with the best practices and to measure where Nissan currently is so that the gap is under study all the time. Thus, they have developed benchmark cost tables and compare them to their own cost tables. A major effort is to minimize the cost of any technically feasible best practice found. The finance department sets the targets. The product director has responsibility for profit.

Nissan maintains two types of cost tables. It has approximately 50 process cost tables and 130 part-specific cost tables. The cost tables are computerized but not connected to a CAD workstation.

The Nissan teardown method is essentially the same as that of the other Japanese automotive companies. They reverse engineer the competitor's products and have extensive databases of competitor product information.

Nissan has four levels of training for cost engineering people:

- Education for new employees
- Beginners class
- Practice course
- Practical training

They utilize a personnel evaluation system to measure professional skill competencies. The competency skills match the roles and responsibilities of the CE employees.

This visit included a tour of one of Nissan's engine plants. If you have ever seen Harbour reports of North American vehicle assembly plants, you would know that the Nissan Smyrna, Tennessee, assembly plant has been at or near the most efficient plant for many years, as measured in labor hours per vehicle. Having viewed the engine plant in Japan, it is clear why Nissan is a leader in production efficiency. They pay very close attention to waste of motion. Saving a centimeter or less of distance to reduce the reach of an operator to get or dispose of a part is highly encouraged. Continuous improvement is constantly preached to the workforce. Labor workers are encouraged to utilize a readily available kaizen room to develop and try out simple process improvement techniques. All successful prototypes are then fully developed and implemented on the line.

CANON (2006, 2008)

Hosts in 2008 were Yasuki Takahashi, Chief of CE Headquarters; Kazufumi Kobayashi, Head of Planning & Technology Center; Koichi Kudo, General Manager, Target Costing, CE Headquarters; Tsuyoshi Waragai, General Manager, Technology, CE Headquarters; and Takafumi Matsuoka, Manager, Technology, CE Headquarters.

Canon is one of the most profitable companies in Japan every year. It is no secret that their number one commitment from top management to make profit has everything to do with their performance. Canon is known as one of the best users of target costing. Dr. Tanaka started working with Canon to develop target costing around 1981.

Consider their biggest challenge for the future is to continue to develop new ideas. I feel that it is strange that Canon would feel this way in that they have been in the top three companies filing U.S. patents for 20 years. Perhaps it is this desire to always be on the leading edge that has made them so successful. It is interesting to note that their R&D organization is actually a profit center. It earns royalties and licensing fees from its patents.

When I met with Mr. Ariga in 2001 he told me that the cost engineering (CE) department had 197 people. In 2006 Canon had 255 people, and in 2008 there were 267 people in this department. The department is divided into two major organizations: CE planning and technology center and CE promotion center. The head of this department reports to the president of Canon. Canon has long-term, mid-term, and annual profit plans.

Cost tables are integrated with the designer CAD workstations.

We were told that VE is done every day. Dr. Tanaka told me that one new product went through 18 VE efforts during product development. This effort appears to be caused by the use of a strict gated process that has a detailed cost analysis performed before the product can move to the next gate. In our meeting we were told that 100% of the projects do not exit the product planning and design phase the first time. Inspiration VE is performed during marketing planning and concept development; zero-look VE is performed during planning and design, first-look VE is performed during detailed design, and second-look VE is performed only on products that have a long life cycle. VE is an iterative process through the development process. It is necessary to meet the difficult cost targets imposed on the design team.

Three people from Danaher made the 2008 trip with me: Damon Baker, Ryan Hartz, and Keith Klotz.

Other companies visited in Japan include IHI and Yokogama Electric Company.

SUMMARY

Doing several benchmarking trips over an extended period of time allows one to see the gains made within the same company, as well as to better

understand the similarities and differences from company to company. Benchmarking is never a one-time event for the best-in-class companies. Benchmarking needs to be an ongoing and active activity to keep abreast of best practices, regardless of their nature. That is why benchmarking is such an important activity on rung 4 of the ladder to global survival and success.

References

"Activity Based Costing." Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/activity-based_costing (accessed April 12, 2010).

Andersen, Arthur. 1993. *QCT product development global best practices.* Arthur Andersen and Co.

Andersen, Arthur. 1993. *QCT cost management global best practices*. Arthur Andersen and Co.

Ansari, A., J. Bell and D. Swenson. 2005. *Hitting the mark*. Dallas: CAM-I.

Bennis, W., 2003, *On becoming a leader*. Warren Bennis, Inc.

Blanchard, K., S. Bowles, D. Carew and E. Parisi-Carew. 2001. *High five*. USA: Blanchard Family Partnership and Ode to Joy Limited.

Brundtland Commission. "Sustainability", Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/sustainability (accessed April 8, 2010).

Canon. "Group Environmental Charter". Internal publication, http://www.canon.com/environment/vision/charter.html (accessed April 12, 2010).

Chemers, M.M., "Leadership," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/leadership (accessed April 12, 2010).

Cooper, R. and R. Slagmulder. 1997. *Target costing and value engineering*. Portland: Productivity Press.

Covey, S. 1989. *The 7 habits of highly effective people*. New York: Simon & Schuster.

Fraser, R. 1984. The Value Manager As Change Agent. SAVE International Conference. Sacramento, CA.

Linker, J. and D. Meier. 2006. *The Toyota way fieldbook*. New York: McGraw-Hill.

Hewlett Packard. "Our Commitment". Internal Publication, http://www.hp.com/hpinfo/globalcitizenship/environment/#/OUR_COMMITMENT (accessed April 12, 2010).

Johnson Controls, "Our Values", http://www.johnsoncontrols.com/publish/us/en/about/our_company/vision_and_value.html (accessed April 10, 2010).

Keith, Allan, "Leadership," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/leadership (accessed April 12, 2010).

Maramaldo, D. 2010. *The complete total competitiveness theory*, Washington, D.C.: The Lawrence D. Miles Value Foundation.

Miles, L.D. 1989. *Techniques of value analysis and engineering*. Washington, D.C.: The Lawrence D. Miles Value Foundation.

Miller, F.R. and L.E. Miller, *That's customer focus*. 2007, Ray and Laura Miller.

Mitarai, Fuijo. "Canon 2008 annual report", http://canon.com/ir/annual/2008/report2008.pdf (accessed April 12, 2010).

Rains, J. 2006. Ladder to Global Survival and Success**.** SAVE International Conference Proceedings.Savannah, GA.

Rains, J. and Y. Sato. 2008. The Integration of the Japanese Tear-down Method with Design for Assembly and Value Engineering. SAVE International Conference Proceedings. Reno, NV.

Sato, Y. and J. Kaufman. 2005. *Value analysis tear-down: a new process for product development and innovation*. New York: Industrial Press, Inc.

Sobek, D. 1997. Principles that Shape Product Development Systems: A Toyota-Chrysler Comparison. PhD dissertation, University of Michigan.

Tanaka, M., T. Yoshikawa, J. Innes, and F. Mitchell. 1994. *Cost management*. UK: Chapman and Hall.

Toyota. "Sustainable mobility". internal publication. http://www.toyota.com/about/environment (accessed April 12, 2010).

Trompenaars, F., and C. Hampden-Turner. 1998. *Riding the waves of culture*. London: Nicholas Brealey Publishing.

Tzu, L. "Famous quotes", http://www.brainyquote.com/quotes/authors/1/lao_tzu_4.html (accessed April 10, 2010).

Womack, J., D. Jones and D. Roos. 1990. *The machine that changed the world*. New York: Harper Perennial.

Zaleznik, A., 1977, Managers and leaders, are they different. Harvard Business Review.

The Author

Mr. Rains has over 30 years of value engineering (VE) experience. During this time he has facilitated over 750 teams in VE, lean manufacturing, lean engineering, and competitive teardown workshops. For the past 15 years he has studied target costing from Japanese experts and believes this vital management philosophy leads to constant and consistent levels of corporate profitability. Mr. Rains is a certified value specialist (CVS) and has led numerous international corporations, architectural/engineering firms, and U.S. government DOD installations to successful results. VE studies have included product design, process improvement, procedures, weight reduction, quality improvement, organization effectiveness improvement, product development, process lead time, productivity, and throughput improvements. He has worked in many types of industries, including oil and gas companies, and with A/E firms to improve building designs and associated expenses. His VE and lean efforts have been exposed to a global network, including workshops in Austria, Australia, China, England, France, Germany, Hong Kong, Korea, Kuwait, Mexico, Qatar, Saudi Arabia, Sweden, United Arab Emirates, and the United States. Techniques and tools used in his workshops include the value engineering job plan, quality function deployment, voice of the customer, design for manufacturability/design for assembly (DFM/DFA), function analysis, creativity techniques, paired comparison, idea selection matrix, synchronous thinking, elimination of waste, and team building. Many of these workshops are SAVE International Certified Module I Workshops that just in the past four years have led to over 300 people becoming associate value specialists (AVSs) certified in value engineering. During this time he has been an advisor to three certified value specialists (CVSs). Since 1999 Jim has written and presented 13 papers that relate to VE at conferences around the globe. Jim's lean manufacturing workshops have led to process improvements of over 20% in productivity, 30% in floor space, 40% in lead time, and a reduction of 40% in inventory. Often these lean improvements were implemented during the one-week workshop. Mr. Rains has extensive expertise in studying, analyzing, and improving material handling systems for large and small manufacturing facilities. These studies result in

significant reduction of material handling labor and the associated equipment. Jim organizes an annual benchmarking trip to Japan that includes visits to companies that excel in value engineering and target costing.

Jim first learned about target costing in 1993, when the original material written in English became available. As he continued to learn more about this technique he developed the mindset that companies that fully utilized target costing were special, that these companies are a step or more ahead of their competitors. He began a rigorous study of target costing beginning in 1998, reading books and developing a regular correspondence and personal meetings with Japanese target costing experts.

Mr. Rains holds a BSIE degree from Kettering University (formally General Motors Institute) and a master's degree in industrial management from Central Michigan University.

His experience includes 32 years with General Motors, having worked in manufacturing, manufacturing engineering, value analysis, industrial engineering, and product development engineering. He performed these assignments in Rochester, New York; Dayton, Ohio; Juarez, Mexico; and Warren, Michigan.

Various assignments at GM included responsibility for improving the processes within the vehicle engineering factory and improving lead time and productivity. Value analysis and lean techniques were applied to achieve these objectives. Mr. Rains worked with advanced purchasing buyers to obtain cost-effective, quality parts from GM suppliers for future vehicle programs. GM uses a technique called supplier cost engineering (SCE) to perform this objective. SCE blends in very nicely with the concepts of the value methodology. Jim worked in the indirect labor group of the GM corporate industrial engineering organization. Here he was responsible for developing and implementing tools for GM facilities to improve the material flow in assembly plants. Using his new labor measurement software, and by implementing material handling best practices, the corporation saved over $50 million annually.

From 1991 to 1994, Mr. Rains was manager of divisional industrial engineering for the worldwide operations of the Delco chassis division of GM (now part of Delphi), in Dayton, Ohio. His department was responsible for coordinating value analysis, design for assembly, employee suggestion program, budgets, measurements, and continuous improvement. During this time frame, Mr. Rains was handpicked to lead the charge in establishing, training, and proliferating synchronous implementation workshops. These

workshops are designed to identify and reduce waste and make radical improvements in factory or office processes in a very short period of time. Measured implemented results of productivity improvements in excess of 25%, floor space reduction in excess of 30%, and inventory and lead time reductions in excess of 40% were typical. Mr. Rains was considered a corporate expert in value analysis, a leading technique to improve cost and quality, having been a manager over that activity since 1985.

Mr. Rains is active in SAVE International, a professional society, which promotes the use of the value methodology. He served on its board of directors for 5 years, including as its president/CEO and chairman of the board. He is a certified value specialist. He is a member of the board of directors and chairman for the Lawrence D. Miles Value Foundation. He was the chairman of the General Motors Corporate Value Management Committee. Mr. Rains was on the faculty at Central Michigan University from 1998 to 2001 and taught an accredited course in value engineering.