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Target Costing for Effective Cost Management: Product Cost Planning at Toyota Australia

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This report was authored by Kim Langfield-Smith from La Trobe University, Australia and Peter Luckett from the University of New South Wales, Australia on behalf of the Financial and Management Accounting Committee (FMAC) of the International Federation of Accountants (IFAC).

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Director General
International Federation of Accountants
535 Fifth Avenue, 26th Floor
New York, New York 10017
U.S.A.

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TARGET COSTING FOR EFFECTIVE COST MANAGEMENT:
Product Cost Planning at Toyota Australia

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EXECUTIVE SUMMARY

1. This study analyzes the target costing (or product cost planning system) used at Toyota Motor Corporation Australia (TMCA). At TMCA, target costing forms an integral part of the design and introduction of new products, and ongoing cost management processes. By focusing on the participants in the target costing process (including personnel from accounting, engineering, purchasing and sales) the study details the techniques and processes used to manage costs in the product design stages and during production — throughout the life cycle of a product.

2. The study provides a series of contributions to our understanding of target costing systems. First, the study illustrates how target costing may be adapted to a Western "culture". Many of the existing published accounts of target costing are situated in Japanese companies. Second, it explains how target costing may still operate effectively when most of the product design is provided by an overseas parent company. While this might be expected to constrain opportunities for product cost planning, at TMCA the cost management activities are intense despite these constraints. Third, the TMCA case illustrates in detail how value engineering (VE) — an important tool used in target costing — works in practice, and the degree of creativity and innovation that underlies its operation. Fourth, the description of the product cost planning processes at TMCA demonstrates how pre-production VE techniques that focus on the design of a new product can integrate with the ongoing cost management activities of currently produced products. Fifth, this study provides a detailed example of the cross-functional nature of an effective target costing process. Finally, the TMCA case provides an illustration of how the finance function can provide an effective coordination and integrative role to focus organizational efforts towards effective cost management.

CHAPTER 1. TARGET COSTING IN A CONFRONTATIONAL ENVIRONMENT

3. During the 1990s, Western commentators and companies have shown a growing interest in various cost management techniques used by Japanese companies. It is widely believed that, in part, such techniques have been instrumental in enabling many Japanese firms achieve a competitive advantage (Cooper and Slagmulder 1997, p.xxii). Target costing is one Japanese cost management approach that has been examined in detail, and a number of case studies have been published outlining how different companies have developed and implemented these cost management systems. [See, for example, the cases documented in Cooper (1995) and Cooper and Slagmulder (1997).] Target costing focuses on searching for opportunities for cost reduction at the product planning stage, as well as providing continuous cost reductions once a product commences manufacture. This report describes the target costing system used at Toyota Motor Corporation Australia (TMCA)[1].

Confrontational Strategies

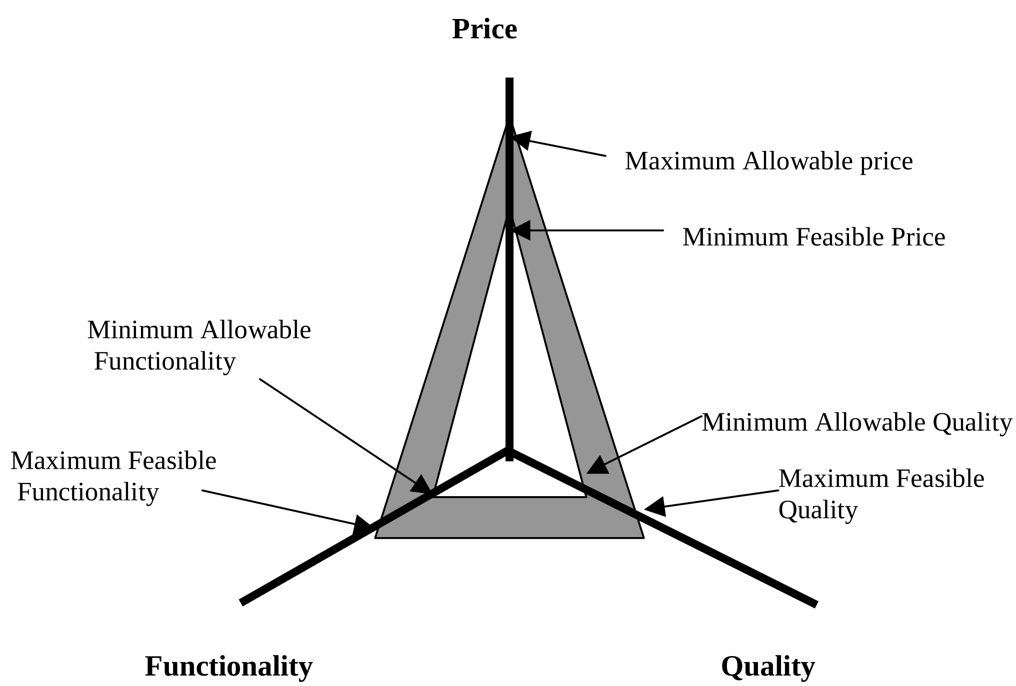
4. Cooper (1995) argues that effective cost management systems are developed in response to changing competitive conditions. Target costing is an example of such a system that has a special relevance to companies in the process and assembly industries. This contention is supported by the results of a survey conducted in Japan by Tani, Okano,

[1] Appendix 2 contains key terms and definitions, and abbreviations used within this report.

Shimizu, Iwabuchi, Fududa and Cooray (1994). In these industries, firms are no longer able to achieve a sustainable competitive advantage by pursuing either a low-cost or differentiation strategy. Rather, firms realize that any competitive advantage they achieve is likely to be short-lived as their competitors move quickly to match new product offerings at competitive prices. Moreover, competitors will often supply their new products with more advanced features, providing further challenges that require a firm to respond. Rather than attempting to create a sustainable competitive advantage based on either low cost or commanding price premiums through product differentiation, firms become involved in continual head-on competition, which has been referred to as a "confrontation strategy" (Cooper 1995).

5. A central argument underlying a confrontation strategy is that firms must compete in terms of the "survival triplet". The survival triplet consists of three strategic dimensions that characterize a product: cost/price, quality and functionality. These dimensions are illustrated in Diagram 1. When firms engage in a confrontation strategy, customers expect both high quality and functionality at low prices. To survive, a firm must meet or surpass its competitors' performance on all three dimensions. In turn, this means that as well as managing quality (for example, through total quality management programs) and functionality (for example, with innovative product design and development), firms must also become highly efficient in managing costs.

Diagram 1. The Survival Zone



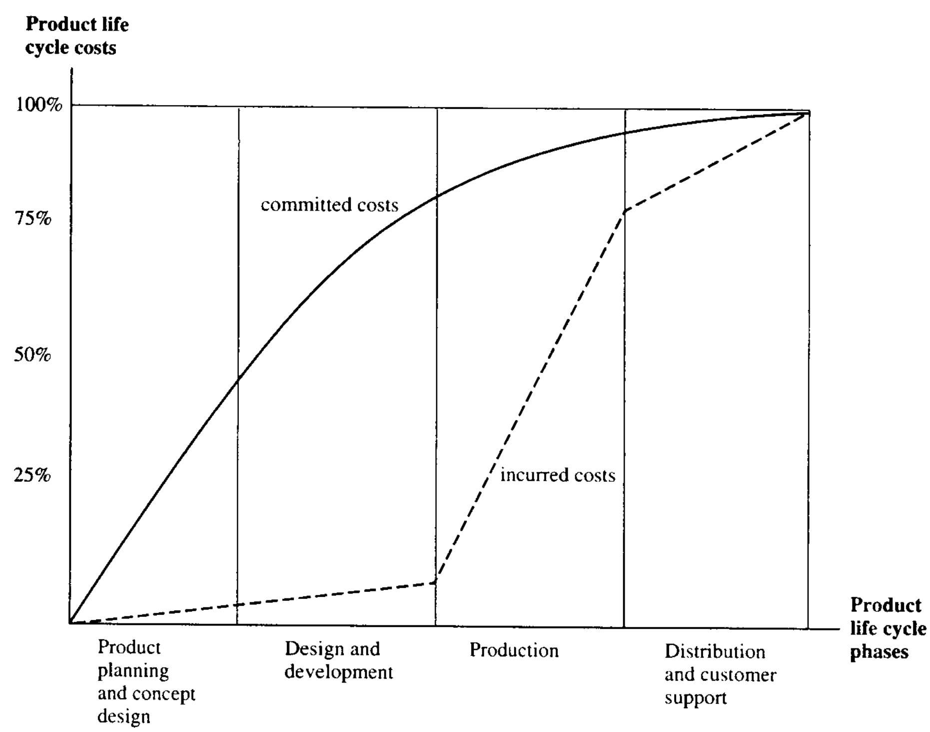
Source: Cooper 1995 p.19

6. The challenge facing a firm is to identify the nature of its "survival zone" and then operate within it. In Diagram 1, the survival zone is the shaded area and is the area bounded by the maximum allowable price/cost and the minimum feasible price/cost, and

the minimum allowable functionality and quality and the maximum feasible functionality and quality. Where the difference between the minima and maxima for each dimension is very narrow, firms must compete confrontationally if they expect to survive. For example, for a given level of quality and functionality, customers will not tolerate increased prices. In addition, further demands are placed on the firm as customers usually expect the next generation or model to have greater functionality and quality but without any increase in price (or even at a lower price). Hence, profitability (and, ultimately, survival) becomes very sensitive to the effectiveness of cost control.

7. An important element of surviving in this confrontationist world is to manage the future cost of products very effectively – this is where target costing has an important role to play. Success also depends on being able to manage the costs of existing products (e.g. through kaizen costing and continuous improvement) and harnessing the entrepreneurial spirit of the workforce (e.g., through worker empowerment, performance measurement systems and reward systems) (see Cooper and Slagmulder 1997, pp.7-8). Target costing is particularly important at the design (pre-production) stage of a product's life-cycle, as it is at this stage that there are the best opportunities for significant life-cycle cost reductions. Once the product has been designed and is in production, major cost reduction opportunities tend to be limited. Diagram 2 illustrates the major stages of the product life cycle. It has been estimated that up to 80% of the cost of a product are *committed* at the product design stage (Lorino 1995). Nevertheless, target costing can provide opportunities for effective cost reduction at both the pre-production and post-production stages.

Diagram 2. Life-cycle Costs and Cost Commitment



Source: Adapted from M.C.Burstein,op. cit., p. 261

The Origins of Target Costing[2]

8. In Japan, target costing is widely practiced, with more than 80 percent of companies in the assembly industries, and more than 60 percent of companies in processing industries adopting the practice (Kato 1993). Target costing emerged in Japan in the 1960s, as a response to difficult market conditions. A proliferation of consumer and industrial products of western firms was overcrowding the markets in Asia. Also, Japanese companies were experiencing shortages of resources and skills needed for the development of new concepts, tools and techniques, which were required to achieve parity with the toughest competitor in terms of quality, cost and productivity.

9. Many Japanese companies considered that cross-functional activities, as used by Western firms for manufacturing, could be effectively modified. They believed there were advantages in combining employees from strategy, planning, marketing, engineering, finance and production into expert teams. These teams were able to examine new methods and techniques for the design and development of new products, and aimed to enhance the degree of integration between the upstream and downstream activities of a company's operations. Target costing emerged from this environment. A range of specialized tools, including functional analysis, value engineering, value analysis and concurrent engineering were introduced to support target costing (see Appendix 2 for definitions). Target costing provided a way to link profit planning, feasibility, market surveys, value analysis, management accounting, budgetary control and financial management. This made Japanese companies particular effective in the areas of product design and development, where they were able to identify all relevant elements to formulate a holistic management approach, in order to achieve performance levels to meet the company's objectives.

10. Target costing offers a range of advantages as follows:

- It reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved, in order to achieve some competitive advantage.

- It helps to create a company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.

- It uses management control systems to support and reinforce manufacturing strategies; and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lowest cost.

11. While target costing emerged over thirty years ago, it is only in the 1990s that these systems have been documented (in both the Japanese and western literatures), and introduced into western companies. Several reasons have been suggested for this (Kato 1993). First, the popularity of the Japanese just-in-time inventory systems dominated the attention of industry in the 1980s, at the expense of target costing. Second, many Japanese companies in the 1980s and 1990s were still refining their target costing systems. Third, target costing focuses heavily on new product development activities, which are often treated with great secrecy in Japan.

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[2] In this section we are indebted for the helpful suggestions of members of the Malaysian Institute of Accountants.

An Overview of the Target Costing Approach

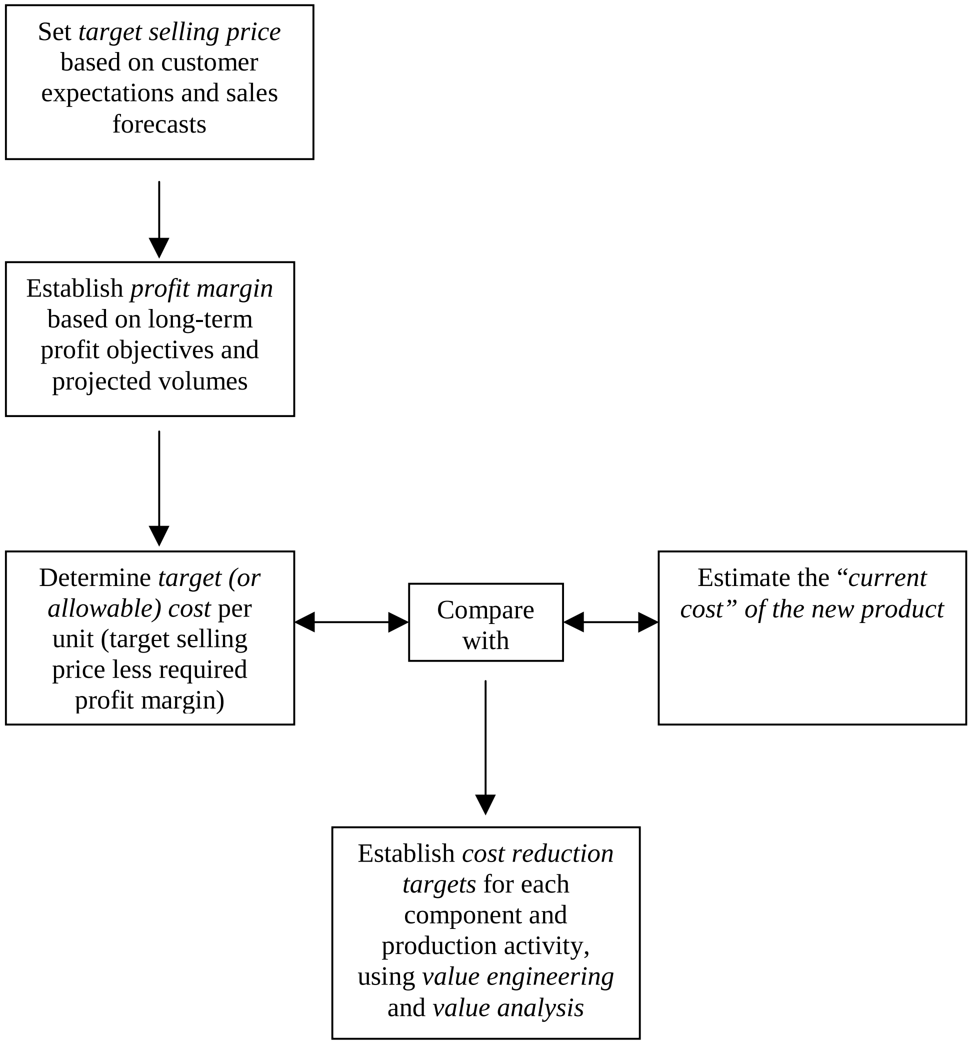
12. There are several definitions of target costing. In this report, target costing is defined as "a structured approach to determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price" (Cooper and Slagmulder 1997, p. 359). A critical aspect of this definition is that it emphasizes that target costing is much more than a management accounting technique. Rather, it is an important part of a comprehensive management process aimed at helping an organization survive in an increasingly competitive environment. In this sense the term "target costing" is a misnomer: it is not a product costing system, but rather a management technique aimed at reducing a product's life-cycle costs (Kato 1993). Several writers have described the main features of target costing systems and the way the systems operate (see Appendix 1). These descriptions are informed by the practices in a number of Japanese companies that have been the subject of detailed case studies. While some of the details may vary between companies, a general conceptualization of the process has emerged. The following discussion provides an overview of the process and introduces a series of terms used when discussing target costing. The intention is to provide a framework within which the practices observed at Toyota Motor Corporation Australia can be understood.

13. Target costing is viewed as an integral part of the design and introduction of new products. As such, it is part of an overall profit management process, rather than simply a tool for cost reduction and cost management. Diagram 3 summarizes the steps in the target costing process. The first part of the process is driven by customer, market and profitability considerations. Given that profitability is critical for survival, a target profit margin is established for all new product offerings. The target profit margin is derived from the company's long-term business plan, which incorporates its long-term strategic intent and profit margins. Each product or product line is required to earn at least the target profit margin.

14. For any given product, a target selling price is determined using various sales forecasting techniques. Critical to setting the target selling price are the design specifications (reflecting certain levels of functionality and quality) of the new product. These specifications are based on customer requirements and expectations and are often influenced by the offerings of competitors. Importantly, when setting the target selling price, competitive conditions and customers' demands for increased functionality and higher quality, without significant increases in price, are clearly recognized, as charging a price premium may not be sustainable. Hence, the target selling price is market-driven and should encompass a realistic reflection of the competitive environment.

15. Integral to setting the target selling price is the establishment of target production volumes, given the relationship between price and volume. The expected target volumes are also critical to computing unit costs, especially with respect to capacity-related costs (such as tooling costs), as product costs are dependent upon the production levels over the life cycle of the product. Once the target selling price and required profit margin have been determined, the difference between these two figures indicates the allowable cost for the product. Ideally, the allowable cost becomes the target cost for the product. However, in many cases the target cost agreed upon will exceed the allowable cost, given the realities associated with existing capacities and capabilities.

Diagram 3. Steps in the Target Costing Process



16. The next stage of the target costing process is to determine cost reduction targets. Some firms will do this by estimating the "current cost" of the new product. The current cost is based on existing technologies and components, but encompasses the functionalities and quality requirements of the new product. The difference between the current cost and the target cost indicates the required cost reduction that is needed. This amount may be divided into a target cost-reduction objective and a strategic cost-reduction challenge. The former is viewed as being achievable (yet still a very challenging target), while the latter acknowledges current inherent limitations. After analyzing the cost reduction objective, a product-level target cost is set which is the difference between the current cost and the target cost-reduction objective.

17. It should be noted that a fair degree of judgment is needed where the allowable cost and the target cost differ. As the ideal is to produce at the allowable cost, it is important that the difference is not too great. Once the product-level target cost is set, however, it generally cannot be changed, and the challenge for those involved is to meet this target.

18. Having achieved consensus about the product-level target cost, a series of intense activities commence to translate the cost challenge into reality. These activities continue throughout the design stage up until the point when the new product goes into production. Typically, the total target is broken down into its various components, each component is studied and opportunities for cost reductions are identified. These activities are often referred to as *value engineering* (VE) and *value analysis* (VA). Value engineering involves searching for opportunities to modify the design of each component or part of a product to reduce cost, but without reducing functionality or quality of the product. Value analysis entails studying the activities that are involved in producing the product to detect non-value-adding activities that may be eliminated or minimized to save costs, but without reducing the functionality or quality of the product. Where components are sourced from suppliers (which is often the case in the automotive industry), target prices are established for each part and the company's employees work with the suppliers to ensure the targets are achieved. Overall, the aim of the process is to ensure that when production commences, the total cost will meet the target, and profit goals will be achieved.

19. While the above description captures the essential features of the target costing process, it should be emphasized that successful, target costing requires careful planning, attention to detail and a strong degree of commitment from those involved. The description, however, does not provide any insights into what is entailed in implementing a target costing approach in an organization. Consequently, the aim of the current study is to provide a rich description of how Toyota Manufacturing Company Australia (TMCA) implemented a successful target costing process and "product cost planning".

Aims of this Study

20. This study presents a description and analysis of product cost planning at the Toyota Motor Company Australia (TMCA). Product cost planning (PCP) is the term used by management for the target costing system at TMCA. It is defined as "a process which aims to produce a desired financial result for a new product by a specified time by setting cost reduction and profit improvement activities". As a division of the global Toyota group, product cost planning at TMCA is based on, and strongly influenced by, the well-documented Toyota Japan target costing model (see, for example, Tanaka 1993; Kato 1993; Cooper and Slagmulder 1997; also, see Bhimani and Okano 1995, for a brief description of Toyota UK). However, the cost planning process at TMCA involves adaptations to the generic Toyota model, to suit the cultural and competitive conditions prevailing in Australia. Thus, the study provides such an example (of which there are few) as well as insights into the way in which target costing and associated management technologies can help firms manage in highly competitive environments.

21. The following chapter provides a brief description of the background of TMCA. This is followed by an overview of the product cost planning process at TMCA. Each of the major functions that play a major role in PCP is then discussed: product and sales planning, purchasing, engineering and manufacturing. The final chapter summarizes the main issues that confront TMCA as it undertakes its target costing processes.

CHAPTER 2. TMCA: MEETING THE COMPETITIVE CHALLENGES

A Brief History of Toyota in Australia

22. Toyota Motor Corporation Australia Ltd (TMCA) is a fully-owned subsidiary of Toyota Japan. The Australian operations commenced in 1959 with the import of the LandCruiser, and in 1963 a passenger car assembly plant, which initially produced the Tiara, was opened at Port Melbourne, in Victoria, Australia. The long-running Corona replaced the Tiara in 1965 and the Corolla was added in 1968. In 1987, the Camry superseded the Corona. Both the Corolla and Camry are now produced at the state-of-the-art plant at Altona (about 10 kilometers from Port Melbourne), which was commissioned on March 31, 1995. In 1996, TMCA employed some 3,800 people and, in addition, many thousands more are employed in Toyota dealerships and supplier companies. Annual turnover of TMCA approaches $4 billion per annum.

Product Range and Markets

23. In the later 1990s, the Altona plant manufactured the four and six cylinder Camry, Vienta and Corolla vehicles as well as a variety of engine and other components. In addition to its domestic sales, TMCA supplied a number of markets overseas including Japan, New Zealand, Thailand, Malaysia, South Africa, Turkey and Oceania. In 1996 new markets opened in the Middle East (Saudi Arabia, United Arab Emirates, Oman, Kuwait, Bahrain and Qatar). TMCA began producing left-hand drive Camry cars for these new markets (cars in Australia are right-hand drive). In addition, TMCA imports a wide range of vehicles from Japan, including Lexus, Celica, Paseo, Starlet, LandCruiser, Tarago, RAV4, HiLux, HiAce, Dyna and Coaster. Table 1 provides details of market share and export activities of TMCA.

TABLE 1

TMCA Production, Market Share and Export Data

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Vehicles produced	N/A	67,100	77,741	60,547	70,052	77,549	100,376
Domestic sales units	109,900	122,560	128,205	121,059	121,209	132,664	164,755
Market share	20.3%	22.1%	20.8%	18.8%	18.6%	17.5%	19.6%
Exports ($AUS m.)	$62	$109	$160	$194	$330	$404	$606

Competitors

24. TMCA competes with a number of importers from Korea (Hyundai, Kia and Daewoo), USA (Chrysler and Jeep) and Japan (Nissan, Mazda and Honda). There are many factors

that define the competitive environment of TMCA. First, the industry, worldwide, is oversupplied in terms of capacity. This has meant that a number of overseas companies have become very active in the Australian market. Second, the attractiveness of the Australian market has been enhanced by the reduction of import tariffs which in 1997 were 22.5%, and were planned to reduce by 2.5% per annum to 2000, and then drop to 10% per annum in 2005. By world standards, Australia has a very open market. Reductions in motor vehicle tariffs have assisted importers, resulting in a very competitive situation. Third, overseas competitors have been pursuing a very aggressive pricing policy, with some prices of imported motor vehicles being as low as $AUS13,990, drive away. Fourth, the Australian automotive market is very mature with the average age of passenger vehicles in Australia being extremely high (approximately 13 years). The market has grown strongly in the last two years, but this has been in the small car and commercial segments. The remaining segments are not growing at a great rate, which puts further pressure on companies such as TMCA to maintain and grow their share of the market. The combined impact of these factors, together with greater demands and expectations of consumers (such as requiring options like air conditioning and power steering as standard equipment, as well as improved fuel efficiency and safety features), has meant that achieving high levels of cost efficiency is an important priority for TMCA.

The Altona Plant

25. Toyota Japan has developed a global approach to its operations, which has resulted in 60% of its sales being produced offshore. In part, this has been driven by the impact on prices of the very strong Yen value (up to 1998), as well as advantages associated with transport costs and changing tariff regimes. TMCA is particularly well positioned in terms of location and cost structure with respect to the rapidly growing Asian, Oceania and Middle East markets. As part of Toyota's global strategy, a state-of-the-art manufacturing plant was developed at Altona, Victoria, as a key manufacturing center, with a major export role.

26. In 1988, the management of TMCA had realized that to position themselves as one of Toyota's global manufacturing and supply bases significant performance improvements were needed. Tariff reductions had created additional pressures to achieve international standards in quality, cost and delivery performance. Also, TMCA needed to develop new export markets to justify the large investment by Toyota in a new plant. Traditionally TMCA had focused on domestic sales.

27. The Altona plant was officially opened on March 31, 1995 at a cost of $AUS 420 million, with a planned capacity of 100,000 units per year. The first car, a Corolla, came off the line in July 1994 and at the end of that year the manufacture of both the Vienta and the Camry was transferred from the existing Port Melbourne plant to Altona. A unique feature of the new plant is its ability to build all three models simultaneously on the same production line, a unique achievement for Toyota manufacturing.

28. Other notable features of the Altona plant include

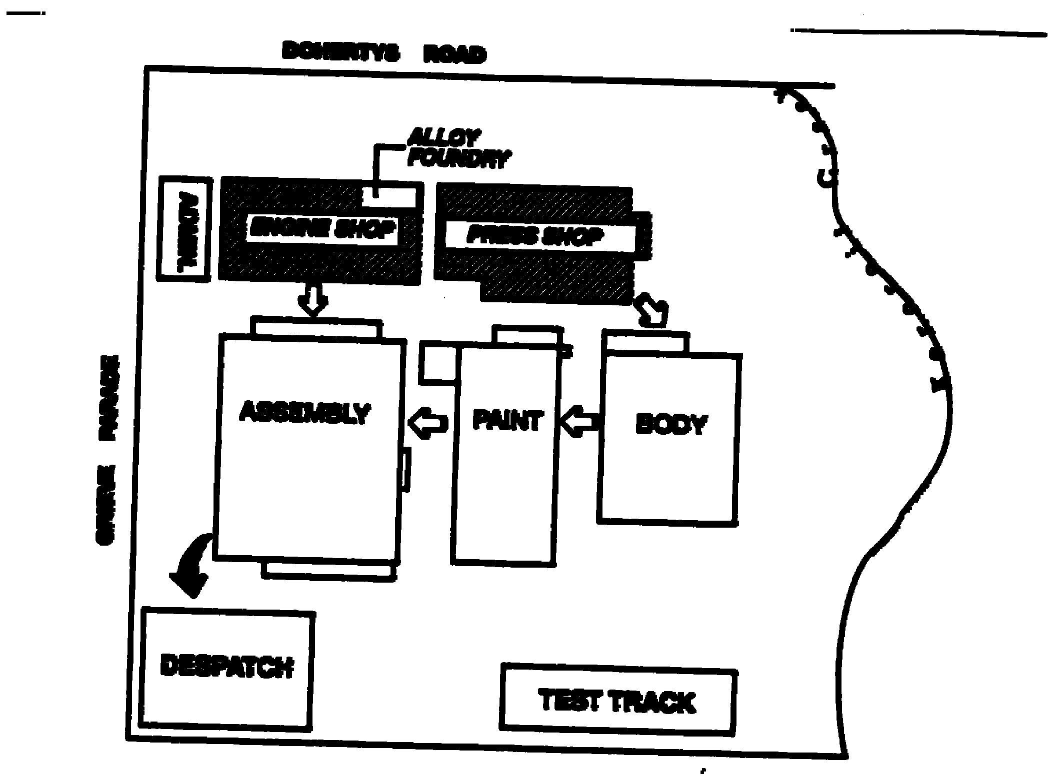
- integration of the existing engine shop, alloy foundry and press shops with new body, paint and assembly shops on the same site;

- world-class production and environmental control technology (particularly with respect to the painting process);

- a high degree of computerization and use of robotics, the use of just-in-time delivery of parts, and a strong emphasis on continuous improvement.

Diagram 4 illustrates the layout of the Altona plant.

Diagram 4. The Altona Plant



Strategic Aims: Mission, Vision and Values

29. The strategic direction at TMCA is expressed in its mission, vision and values. The mission is an explanation of why Toyota Australia exists and is stated as “a desire to be the world’s best in providing global customers, outstanding automotive products and vehicles”.

30. In turn, successful achievement of the mission is seen as promoting a profitable, growing company capable of offering employee fulfillment and contributing to the development and welfare of suppliers, dealers and the Australian community. Toyota Australia’s vision identifies where the company wants to be by 2000.

- The dominant market share in both car sales and parts
- Number one automotive exporter
- Highest rating in terms of customer satisfaction
- A profitable company

31. To achieve this success, Toyota Australia has articulated a set of values that include

- Putting the customer first
- Emphasizing roles of leaders and teamwork
- Showing respect for people
- Taking an international focus and a flexible approach
- Focusing on continuous improvement and innovation

32. In addition, for 1997, the Directors set a further four more specific goals. The first was to make the introduction of the new Camry a complete success, which meant achieving cost planning targets. Second, there was a desire to enhance "people relationships" with respect to employees through job rotation, training, use of groups or teams and responding to customer complaints. Furthermore, it was seen as important to set the framework for ensuring Toyota Australia becomes number one in 1998, and to ensure the long-term business plan profit was achieved.

33. Overarching the specific mission, vision and values of Toyota Australia is Toyota Japan's globalization strategy. By 1998, it was expected that 60% of all vehicle sales for the group would originate outside Japan. Thus, the main objective for Toyota is to manage profitability from a global viewpoint and maximize group results rather than those of individual companies. Achieving this objective, *inter alia*, involves globalized design work, sharing design and cost information among partners and developing close partnerships with overseas suppliers from an early stage of product development.

34. Directly related to this strategy is the concept of a "global car". For Toyota, this means that even though each product line (for example, the Camry and Corolla) may be manufactured in different countries, the design is essentially the same. In fact, the Japanese parent strictly controls any changes made by its overseas plants. This contrasts with attempts to build global cars by companies such as Ford and General Motors. In these companies, subsidiaries in various countries had a great deal of autonomy with respect to design parameters, which meant that these companies were not producing truly global cars. As will be illustrated in the following chapters, the global car philosophy pursued by Toyota is a critical factor influencing the practice of target costing at TMCA.

Summary

35. From the above overview of TMCA, it is clear that the company faces a very competitive market, both domestically and internationally. The company has responded in several ways, such as investing in state-of-the-art efficient plant and production technologies and clearly identifying appropriate strategic approaches. In addition, to enable it to achieve its objectives it has developed and implemented a number of management processes, including product cost planning which is the subject of further analysis in the following chapters.

CHAPTER 3. PRODUCT COST PLANNING: THE KEY TO MAINTAINING COMPETITIVENESS

36. At TMCA, cost management is considered critical to ensuring long-term viability and success. Like all companies in the Australian automotive industry, TMCA is subject to tight profit margins, and there is little scope for increasing selling prices beyond that of competitors. The level of competitiveness within the automotive industry is expected to increase in the future, due to tariff reductions and the ongoing cost improvements of competitors. Thus, TMCA's cost competitiveness must exceed that of its competitors to regain the number one position in the domestic market. In response to these pressures, TMCA has developed sophisticated cost management systems, based on the Japanese methods, which consist of the following interdependent components:

    - Product cost planning, which includes target costing
    - Regular cost reporting
    - Budgeting systems
    - Long-term business plans (LTBP)

37. Product cost planning focuses on the cost management of specific vehicle models, and extends over the entire life-cycle of the product. Regular cost reporting involves the ongoing cost management of manufacturing activities. Both of these components are linked to the budgetary control processes and long-term business plans.

Product Cost Planning

38. At TCMA, product cost planning (PCP) is defined as "… a process which aims to produce a desired financial result for a new product by a specified time by setting cost reduction and profit improvement activities". PCP is used to assess future model viability, to focus on reducing product-related costs prior to those costs being committed, and to continue to seek cost savings after the manufacture of that model has commenced. The PCP system recognizes that there is greater scope for achieving effective cost reduction activities before the design and tooling of a model are locked in. Prior to the start of volume production of a new motor vehicle (which is referred to as SVP by TMCA personnel), major cost reductions arise from value engineering (VE), creative sourcing and manufacturing process changes. Value analysis (VA) is used to achieve cost savings after SVP - mainly through labor savings and improved assembly practices. (Note, managers at TMCA use the term "VE/VA" to refer to both pre- and post-SVP cost reduction activities.)

39. Product development cycles may extend to 30 months, and control of activities through budgets is not sufficient to achieve necessary cost reductions. TMCA has designed its PCP system to focus on achieving cost savings in minute detail.

40. The PCP Committee controls the process. Since 1989, the Finance Division has coordinated the cost planning process. Prior to that it was run by the engineers. The change in coordination brought about a change in emphasis, extending the analysis beyond the direct costs of a model, to include all cost and revenues related to future models. In 1992, the PCP process began to track model profitability over the entire life cycle. Before that, costs were only tracked up to SVP.

41. The outcomes of PCP are the estimated future model costs and future targets. These are fed into budgets and the LTBP, so there is consistency between the various cost control techniques used within the firm.

Determining the Cost Targets

42. As there are potentially hundreds of variations of a new car model, a representative model forms the focus of target costing in order to keep the process manageable. The starting point is for the Sales Planning and Distribution Division, together with the Product Management Division to determine the target retail price for the representative model (this is described in detail in Chapter 4). Attention then turns to determining cost targets, in two stages. In the first stage, a detailed cost and profit analysis is undertaken for the current model, which is compared to projected costs and profits of the representative new model. The new model costs are based on an agreed set of assumptions and parameters. This process requires close cooperation between the engineering and purchasing divisions to establish detailed design and specification variations, and hence costs for each component of the new model. Suppliers must only provide the extra cost of achieving a "design variance" in the part.

43. The *minimum* target for the new model is calculated as the difference between the profit from the current model, and the profit from the new model. While the features of the new model are always an improvement on the current model, customers do not expect to pay any more for these improvements. Therefore any improvements need to be accommodated within the same, or better level of costs. The only additional charges that can be made for new models relate to "specification" items; for example, ABS braking systems and cruise control. The Sales Planning and Distribution Division undertake market research to determine how much customers are prepared to pay for a particular specification item. This is not based on cost; it is determined in relation to competitors' prices.

44. Unlike its Japanese parent, in determining target profit, and hence target cost, TMCA tracks full vehicle profitability, not just direct costs. That is, all manufacturing costs are included, as well as non-manufacturing costs, including marketing and distributions costs, over the entire life cycle of the vehicle.

45. In the second stage of the target setting, the target may be modified to ensure that LTBP profit projections are achieved. The allocation of the additional target is by simple apportionment to the various divisions, based on total cost and divisional ability to control cost.

The PCP Committee

46. The PCP process is controlled by a committee, which consists of representatives from each division (approximately 19 people). The main divisions and responsibilities are outlined in Table 2.

47. The PCP committee is chaired and coordinated by the Finance Division. Working groups are set up for the following three major areas:

- Material sourcing

- VE/VA
- Investment (in tooling)

Each working group has representatives from each responsible division. As indicated in Table 2, each division is given clear responsibilities for the various functions of the PCP Committee.

TABLE 2

Divisions and Responsibilities for Product Cost Planning

Division	**Items**	**Responsibilities**
Finance	Coordination of the PCP process Assumptions for representative model Profit & Loss Summary Monitoring cost planning achievements and reporting and establishing "countermeasures"	National Manager Management Accounting
Purchasing	Local material purchasing Sourcing decisions Supplier VE/VA	General Manager Purchasing Division
Engineering	Design VE/VA Specifications	General Manager Engineering Division
Manufacturing	Process Costs VE/VA Kaizen	General Manager of each production shop
Sales	Selling price Specifications Sales expenses	General Manager Sales Planning and Distribution

Performance Measurement

48. Performance measurement is an important aspect of cost control at TMCA and takes place both before and after the start of volume production (referred to as pre-SVP and post-SVP). During the pre-SVP period the emphasis is on evaluating whether each division has implemented decisions, completed tasks and made the trade-offs necessary to make sufficient progress towards the final agreed target costs. The Finance Division has responsibility for monitoring the performance of each division, and targets are assigned to each cost item. Progress in relation to major items is monitored each month (for example, material items and investment). Other manufacturing costs are investigated every second month. Other expenses (for example, advertising and fleet discount) are reviewed every six months.

49. The methodology for measuring and assigning targets is agreed upon at the start of the target costing process, during the assumption-setting stage. This is a critical aspect of the PCP process. The methodology needs to be well understood and agreed to by all PCP committee members, with responsibility established for particular items. The chair of the PCP Committee acknowledges that one of the hardest aspects of the process is selling the target to people on the committee. To gain the commitment of managers, performance targets need to be agreed to and signed off by the responsible division and the Finance Division.

50. Performance targets and measurement is by individual cost item. In the case of the Purchasing Division, cost estimates are set for the agreed list of parts - the master parts list (MPL); there are approximately 1000 local parts on the MPL. These cost estimates, called “zero stage” estimates, are set at a particular date (e.g. July 1997), to provide a base against which improvements are measured. Unfortunately this can provide an incentive for managers to delay recognizing cost improvements that occur just before that date, to allow them to report cost improvements in the early days of pre-SVP. Cost movements that occur during the pre-SVP period are often as a result of the following reasons:

- Sourcing changes — imported, local or in-house
- Policy changes — such as changes in safety requirements, durability
- Economics — vendor price requests
- Negotiation — cost reductions
- VE/VA — design and process improvements
- Additions — not an original MPL item
- Deletions — MPL items not required

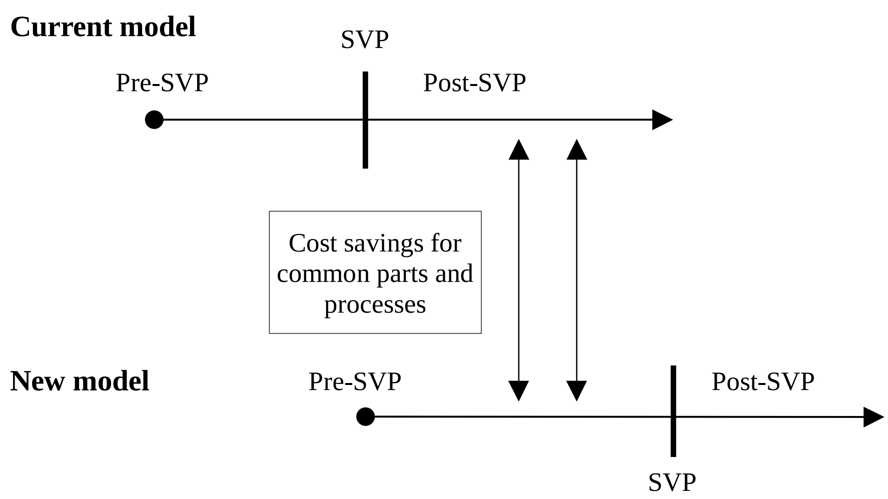
51. Changes in parts may impact on tooling investment, duty, interest, labor and other cost elements.

52. Many of the sources for cost savings arise from post-SVP production experiences and learning with the current model. It is noteworthy also that cost savings in relation to the

new model determined as part of the PCP process may also be used in the production of the current model. This two-way relationship exists, as many of the parts used in the new model as well as much of the production processes are the same as for the current model. Thus, efficiencies that are determined in the current model will be used in future models. The relationship between the various aspects of cost planning and control are outlined in Diagram 5.

53. The Finance Division reports to the PCP Committee, the Board of TMCA and Toyota Japan. In doing so, it not only provides information but also gains approval for "countermeasures". The term countermeasure is used in TMCA to describe corrective actions that may be undertaken to help achieve a certain target, when, for some reasons, the planned action cannot be carried out. For example, where a cost reduction target for a particular component cannot be met, extra cost reduction activities will need to be found to compensate. These activities are the countermeasures.

Diagram 5. Integrated Cost Savings: Current and New Models



54. An important role of the Finance Division is to ensure commitment, continued support, enthusiasm and momentum, particularly in the early stage of the PCP process. General progress reports are produced every two months. Major formal updates are made every six months.

Value Engineering/Value Analysis

55. The value engineering/value analysis process is undertaken over the entire life cycle of the motor vehicle: it begins at the start of the PCP process when the design of the new model is considered, and continues after production of the new model has commenced.

At the Pre-SVP (Pre-production) Stage

56. The pre-production period is about 30 months, but TMCA is trying to reduce this to 24 months. One reason for this planned reduction relates to the difficulty of forecasting market conditions and predicting consumer preferences so far ahead of time. The long lead-time reduces the company's flexibility to react quickly to change. By the end of 1997, TMCA had undertaken the PCP process three times, which enabled it to build up sufficient expertise to allow the process to be completed over a shorter time period.

57. In practicing VE/VA, engineers make design or process changes to bring about cost reductions. Any change must result in the product being the same in functionality, quality, and durability, so that "the customer cannot see a difference". Many changes are internal to the motor vehicle and as such are "transparent" to most customers (see Chapter 6 for further details).

58. There are many parts that are common to each model of motor vehicle, so cost savings that are achieved post-SVP relating to the current model, can be recognized in the setting of pre-SVP cost targets of the new model. The focus of the process leading up to SVP is on continuous improvement, building on the cost reductions that have already been achieved.

59. At the assembly stage there are more than 3,000 parts in a model. For the 1997 model of the Camry, there were about 1,200 suggestions to reduce costs. Some changes may result in cost savings of less than a cent per part, but these savings may be significant over the life of a model, and for the models that follow. Total savings for two of the past models were several hundreds of dollars as a result of VE/VA savings during the pre-SVP period.

60. Information sharing takes place within the Toyota group — redesigned parts and processes may be used by Toyota companies in other countries. TMCA makes performance comparisons with other Toyota companies globally, and this provides cost benchmarks for components. (See Chapter 5 for more details.)

At the Post-SVP (Post-production) Stage

61. Since 1992, cost targets have been set for the four or five years of the life of a model. These targets may be achieved using *kaizen* (continuous improvement), and consist mainly of production process changes and labor usage savings. TMCA regularly looks at sister companies overseas for ideas on how to improve. Targets are set for shops (for example, the paint shop or press shop - see Diagram 4) and departments, and are included in each year's budget, which is linked to the LTBP.

62. A Target Management Group, consisting of senior management, looks at performance on a two-monthly basis. When targets are not achieved, countermeasures must be implemented. One-off studies, which focus on particular areas (for example, the cost of a seat, or a steering column) are also used. Monthly cost reports are prepared to focus on the cost of running a shop or department, which is then broken down by particular processes within the shop or department.

Cost Control

63. “Cost control” is a technique adopted by TMCA, and was introduced in September 1996 to enable thorough cost tracking and progressive achievement of targets by identifying inefficiencies during post-SVP. It closely resembles techniques used by Toyota Japan for effective cost control by shop, process and part.

64. Under the TMCA system, cost control is achieved by monitoring particular costs in great detail, tracking them by month and finding inefficiencies. It enables major problem areas to be focused on and resolved; then, the focus moves to other problem areas. The focus for cost control is on “what is causing costs”; that is, the underlying drivers of cost. This requires a good understanding of the relationships between each cost and the activities or usage of various elements that drive it. Accordingly, measures of usage - physical measures - are reported and the cost implications are determined. Management clearly reinforces cost consciousness by visual presentations, continuous improvement and direct involvement with manufacturing staff.

65. Cost control reports are issued monthly, targeting only the major items where there are potential to save costs. A system of indicators is used to compare actual versus target performance. Performance on various items is classified as either favorable performance, “on track” performance or poor performance. Reports are customized for each shop.

66. Cost control reports are reviewed by the Manufacturing Cost Management Committee of TMCA (called the MC^2 committee). This committee consists of senior management, including two directors of manufacturing.

Summary

67. The product cost and planning system at TMCA extends cost management over the entire product life-cycle of a motor vehicle. It is a comprehensive system for managing the cost of production during the planning stage of new models of motor vehicles (pre-SVP), and throughout the production stages of the model (post-SVP). The reporting systems allow cost savings achieved for a future model to be utilized in the production of a current model. The targets that are set for new models and individual components of the model need to be consistent with the long-term business plans of TMCA. In the chapters that follow the PCP system will be explained in more detail, from the perspectives of the key divisions that are involved in the process.

CHAPTER 4. THE CHALLENGES OF DETERMINING THE TARGET PRICE AND REDUCING SELLING COSTS

68. The starting point in the PCP process is the forward model planning. The Product Management (PM) Division, in consultation with other divisions, has the responsibility for setting the forward model plan for TMCA. Two to three years before SVP, they provide a detailed view of the next model, which includes specifications of size, engine, transmission, number of variants, price, and cost. Once this plan is approved, the Sales Planning and Distribution (SPD) Division, along with the PM Division determine the target retail price.

The Target Price

69. To set the average retail price, the business mix must be estimated. This is based on the likely mix of customers for the new model, including private purchasers, large business groups, small business groups, government customers and rental customers. Each customer group may attract different levels of sales costs, such as incentives, marketing and advertising support and, hence, will generate a different level of profitability. Volumes are then estimated for each customer group.

70. The assumed grade mix also influences the average selling price structure. In the case of the Camry, the grade mix was determined by estimating the proportion of sales for basic "level 1"models of motor vehicles (such as the CSI), "level 2" cars (such as the CSX), or more luxurious "level 3" cars (such as the Grande). Higher levels tend to command higher prices, but involve lower volumes. Thus, the combination of target prices for each customer group and grade and expected volumes determines overall expected revenue. The cost targets are then developed based on revenue projections and the expected level of profitability.

71. While the target price is critical to determining the target costs and the cost reductions needed to achieve the long-term business plan, the fact that it is set early in the planning process means that changes that occur within the market can require adjustments before the new model enters production. An important function of the SPD Division is to keep the company informed throughout the cost planning exercise about the latest trends in customer preferences or competitors' prices which may be at variance with the initial assumptions.

Cost Targets

72. The SPD Division participates as a member of the PCP Committee, and is particularly active in the early stages of planning. As part of the PCP process, the SPD Division estimates the cost of advertising and launching the car, as well as distribution costs. Marketing costs are determined by looking at historical trends. The division has developed databases which relate the sales volumes and market shares that have been achieved from a certain level of expenditure on marketing . The data are quite extensive - for example, there are details of fleet incentive media costs for the past five years by product. These past data are adjusted to reflect forecasts of the competitive conditions in the Australian market in two or three year's time. Managers thus know the cost of bringing a similar vehicle to market for a given sales forecast.

73. But as the forecasts require predictions of the competitive conditions in two or three years time, this is a particularly difficult exercise. TMCA found in the late 1990s, that competitors were always more aggressive than anticipated in the planning estimates. This was partly an outcome of the global automotive industry having excess production capacity, together with the reduction of import tariffs. Progressively, Australia is becoming a relatively open market. Also, as Australia is a mature market with a high level of aging vehicle ownership it is difficult to create new market share. Thus companies like TMCA seek growth in overseas markets.

74. The SPD Division participates as part of the PCP Committee throughout the process, primarily to keep the Committee informed of the latest trends in the market, and likely changes in any of these cost items or in selling prices. During their day-to-day selling

activities, SPD managers often receive feedback which may indicate changes in consumer preferences. This information is relayed to the PM Division, which uses this data to reassess market and customer assumptions underlying production planning estimates.

75. The cost targets, for which the SPD Division is responsible, within the PCP process, include shipping costs, fleet discounts, advertising and incentives. Except for distribution costs, many of the costs for which the SPD Division is responsible tend to be "exogenous" in that they are determined by market trends. While targets are set for distribution costs, SPD argues that these costs cannot be engineered in the same way as most of the other costs during the design phase of the new model. A SPD manager explained:

> It's very hard. We use primarily road transport in Australia - nothing else is overly efficient. We tend to find savings in terms of dollars rather than tens of dollars - I struggle to actually instance something that we have done recently to actually reduce cost. Because really what we've been doing over the past couple of years is fighting cost ups. If the labor rates go up, and the petrol costs go up - yeah, it's really a struggle to keep cost at a minimum. But the purchasing people argue that it isn't any different to their own situation.

76. Where distribution costs, or other costs which are the responsibility of the SPD rise beyond original expectations during the pre-SVP period, countermeasures need to be taken to drive costs down in other areas, such as in design, purchasing or manufacturing. There have been many examples of original estimates of market conditions (made two to three years before SVP) being far too conservative. For example, in the 1990s, when the initial planning was undertaken for a new model, a price was set that took into account the competitive actions of Mitsubishi, but did not envisage the level of penetration of the Korean manufacturers into all levels of the Australian market. The Koreans were only thought to be active in the lower levels of the market (small four cylinder vehicles, not large fours or mid-size sixes). Consequently, the difficulty associated with estimating market conditions and consumer preferences several years ahead is one reason for attempting to shorten the time it takes to bring a product to market.

Involvement in VE/VA

77. At TMCA both purchasing and engineering are directly involved in the VE/VA process (this is examined in detail in Chapters 5 and 6). SPD Division personnel are involved to a lesser degree. In part, this is influenced by the nature of the marketing and sales activities, which are dependent more on competitive and economic conditions prevailing in the post-SVP period than the technical and engineering issues involved in the manufacture of the vehicle. As one manager explained:

> The difficulty we have is that from a sales and marketing viewpoint, we can't really take a lot of cost out of the vehicle until we actually bring it to the market. And we don't really know how much cost we can take out of the vehicle until we actually launch it into the competitive market conditions that prevail at that point in time.

78. Furthermore, the less tangible nature of sales and marketing activities make the notion of VE/VA more difficult to operationalize.

> Our product people, our engineering people, and our purchasing people, are actually trying to take cost out of something that they can see, feel and touch at that point in time. "There's this piece and it costs this much to produce, now do we actually get someone to do it at a cheaper rate?" But our costs are primarily with fleet discounts and advertising and incentives and shipping. Shipping, we've got a pretty good handle on. But how much does it cost in terms of selling a vehicle to the state government? Well, we really don't know that until we actually try and sell that vehicle to the state government against whatever the competitors are offering at that point in time.

79. The SPD Division does have some interaction with the engineering people performing VE/VA, especially where the proposed design changes may affect customer perceptions and acceptance. But as will be explained in Chapter 6, the aim of VE/VA is to achieve cost savings in ways that are invisible to the customer, and the product management and engineering personnel usually make these judgments. In some cases, the SPD Division may be consulted:

> Sometimes we're asked whether we believe this will be accepted in the market place - whether this will be appropriate or not. If it's a borderline situation I believe we're asked. I couldn't instance an occasion where we weren't asked where I thought it was appropriate we should have been.

Summary

80. An important role of the Sales Planning and Distribution Division in the PCP process is in setting the market price for the new models. The difficulty in arriving at an accurate price, up to thirty months ahead of the launch of the model, has led to the move to reduce the pre-SVP lead time, to twenty-four months. Any reassessment of the selling price will obviously impact on the planned profit margin and target cost. Whereas purchasing, engineering and production personnel strive to achieve savings through the sourcing decisions and VE/VA processes, these achievements can easily be overtaken by revisions in planned selling prices.

81. On the other hand, the SPD Division has less direct involvement in cost reduction activities. While reductions in costs such as transportation are pursued, the amounts are small relative to those achieved by engineering and purchasing.

CHAPTER 5. MANAGING SUPPLIER RELATIONSHIPS TO ACHIEVE COST TARGETS

82. The Purchasing Department plays a key role in the PCP process, due to the cost savings that they can achieve through material sourcing and VE/VA. Managers and buyers in the Purchasing Department review the costs of components (or parts) on an ongoing basis. Consequently, the activities that are undertaken pre-SVP to determine the target cost of components for a future model tend to merge with current purchasing activities and targets for current models.

83. As part of the PCP process, each component of a new model is individually costed and has its own cost target. In some cases these parts are the same as those used in the current model. About 80 percent of components are a variation on the current model or are

completely new parts; nevertheless, the costs of all components are reviewed as part of the target costing process.

Sourcing the Parts

84. The starting point in determining the cost of a new part is for members of the Purchasing Division to meet with representatives of other divisions to determine whether or not a part can be produced locally. TMCA encourages local sourcing of components as part of the Toyota global strategy. Importantly, local sourcing provides the opportunity for TMCA engineers and purchasers to work closely with those suppliers. This is particularly useful when there are suggested design changes.

85. The working group compares the cost of producing the part locally with the benchmark overseas cost. The overseas cost must include import duty, freight cost and other costs of getting the product to the TMCA plant. Overseas cost benchmarks are usually available, as the new Australian model will be based on models that were developed in either Japan or the USA, and already manufactured at other Toyota plants. Modifications to existing overseas models are made to suit the preferences of Australian consumers, or to meet different environmental conditions and legislative requirements.

86. If the local cost of a part is fairly close to the in-store (landed) offshore cost, then a study may be undertaken to attempt to reduce the local cost. Such parts are called “study parts”. While the preference is to source parts locally, it is exercised only if the manufacturer has sufficient technical expertise and attention to quality. An important benefit of localization is that it allows TMCA to have a close association with the supplier and the part, which may need fine tuning.

87. TMCA follows the philosophy of its Japanese parent of working closely with suppliers over time and supporting their activities. A purchasing manager described the approach:

> We have a preferred supplier listing that looks at the quality aspect, the technical aspect, the capability, and the capacity. The Toyota philosophy is that you try and mature these suppliers, you try and grow with them, you try and support their activities as well as working with them. So we don’t just get a cost from one supplier and the next time use somebody else. We work with these suppliers, we give them a benchmark, and we give them a target. There are ongoing commodity papers drafted every year. So year on year we do an update of where the suppliers are - their quality level, their performance level, their technical capabilities, where they’re moving to, and how they’re moving. So these commodity plans are then taken around to each of our divisions who say, “Yes we agree with those comments” or they make some changes. And that may be source of this supplier getting 60% of the work and another supplier getting 40%.

88. The buyers and manufacturing personnel in the working group have considerable experience with many local Australian suppliers and, over time, have built up detailed knowledge of their technical capabilities and performance levels. This provides many advantages within the PCP process. In addition, where parts are supplied from overseas, the Japanese parent will have already worked with that supplier to improve quality and cost performance.

Determining and Achieving Targets

89. After the sourcing decision has been made, and signed off by managers from the various divisions of Toyota, the Purchasing Division releases drawings of each part to the relevant suppliers. When a part for a new model is a variation on the old model, the target cost for the new part is expressed as a “design variance” over the old part. Where there is no similar part, a “ground-up” estimation may be undertaken. International benchmark costs, developed within the global operations of Toyota, provide guidance for both the costs of new parts and design variances.

90. As part of the PCP process for a new model, cost targets are assigned to each part - whether there is a design variance or not - and are delegated to particular buyers who control a group of suppliers. TMCA employs about 32 buyers and they tend to be assigned to a particular commodity, such as rubber, steering wheel or crash pad, which may consist of many parts or components. Each buyer works with his or her suppliers to put individual plans in place to achieve cost reductions for each part. A buyer may be responsible for 160 to 180 parts. The buyer and supplier will have monthly meetings to review plans and targets for the next 12 months.

91. Suppliers are asked to provide a cost for each part. For many of the mature suppliers the cost that they supply is close to that determined by TMCA. If this is not the case, then TMCA personnel will work with the supplier to establish a plan to bring the cost in line with international benchmarks. The plan may involve material changes, and/or changes to the suppliers’ process line or plant layout.

92. A key to the supplier achieving cost targets is the implementation of countermeasure activities. Examples of countermeasures include improving the layout of the plant to minimize floor space, improving the flow on the production line, reducing the costs of raw materials supplied by the second-tier suppliers, or implementing some other aspects of the Toyota lean production system (TPS) at the supplier’s operations. The buyer and supplier may work as a team with TMCA’s engineers, working out a plan of activity and helping to implement those plans. Like the purchaser, the supplier is very aware that the cost targets have to be achieved, and progress is monitored by the PCP Committee throughout the pre-SVP period.

93. Implementing some of the countermeasures may take several months, as they can involve engineering changes and design changes, which require approval and testing. Hence, the cost reductions associated with a change often cannot be recognized for three to four months.

94. Sometimes the supplier will generate new ideas about how to change a part, and help meet cost targets. It is important that any changes to a part do not reduce the functionality of the part. Also, the engineers at TMCA are continually looking at ways to reduce the cost of a part through value engineering (see Chapter 6). Where there is no change in a part between the current and new model, there will still be a search for cost reduction opportunities. A purchasing manager explained the process.

> We are always looking at additional localization. We lay out all the parts that we may get from Japan on a big table over at Engineering, and people from quality, engineering and purchasing go over there and we call the suppliers in to have a look. And they give us a rough cost. It may be that this supplier will look at this and say we could do that for $10 because they’ve got some concept, some idea. We then put those sheets together and we

> then mark them with a triangle, circle or cross. A triangle - it needs to be looked at further, but a circle we need to look at these now and do further studies. And what we do then is get a little bit more detail, get the drawing released and get a little further detail, and it either goes to a cross or a circle again and you fine tune it. On the last two models, I think there was in excess of 80 parts or so that were localized or looked at for localization. So we look at opportunities to move parts to a local supplier based on their ability and what parts they've already picked up. It improves their overhead recovery as well as giving them an opportunity to increase their business.

95. When changes are made to the specifications of a part to reduce costs, the supplier usually does the testing of the new part. Any change to a part needs to be signed off by the Japanese parent for quality control reasons.

How Buyers Achieve Cost Targets

96. To formulate, plan and achieve individual cost targets, buyers need considerable knowledge of costs and manufacturing. While their initial training tends to be in economics, accounting or engineering, buyers undergo considerable training in costing, including design variance estimation and the full estimation of the cost of a part. Over time they also build up considerable manufacturing and engineering knowledge which assists them to identify opportunities for improvements at suppliers' plants and for meeting cost targets. TMCA purchasing staff have written various costing modules that are used to help buyers assess the impact of various improvements in supplier operations. For example, buyers can assess the cost impact of a 50 percent reduction in floor space. In most cases buyers have open access to suppliers' costs.

97. Buyers get to know individual suppliers' operations intimately, and this helps them to achieve the cost targets for their group of components:

> They should know the suppliers' processes and facilities, and they should understand the supplier, how he works, how he operates, his capacities, his ability to be able to do these parts and his timing. To suppliers, Toyota is the buyer. And he generally involves the other groups and divisions where he needs to.

98. The buyers have been very successful in meeting challenging targets, and managers at TMCA believe there are several aspects of the system that serve to motivate buyers to achieve their high performance. First, there is a strong feeling of ownership of targets among buyers. Buyers are given full responsibility for achieving targets on certain parts and are given the means for achieving the cost improvements. They have access to engineering and quality teams at TMCA, and costing modules to assist in the operation. Second, there is a fair degree of pride in achieving targets and there is shared knowledge among the buyers as to which buyers are achieving their targets. This is reinforced by the ongoing reporting of the individual performance of each buyer.

99. While cost targets can be very difficult to achieve, there is a belief among buyers that there is always an opportunity to improve. A saving of a few cents off a part can magnify into a large difference for overall costs, due to the high manufacturing volumes and because cost savings are passed on to future models. Suppliers sometimes have to be convinced by buyers that there are further opportunities for improvement. A purchasing manager explained.

> It's a good tool for the buyers to have, to be able to go to the supplier and find all these areas of improvement. Because it just isn't from working on the part, it's the wastage, it's the efficiency of the part, it's the rework, it's also the quality level of the part which comes back to again wastage, it's the storage of the part, and it's the transportation of the part itself. And also the total buy, the raw material purchase and how often you get it, and how much you're storing in your warehouse as well. So all that impacts on the unit cost and if you go through that with the supplier, in some cases they've improved workspace - well there's a few suppliers that had this much workspace and they ended up chopping it to half. Now, that might be the first or second or third or fifth step, but there must be six and seven and eight steps after that that they can improve that further.

100. There are many positive outcomes that can flow to suppliers from improving their manufacturing and cost performance. Cost savings may flow to production that is undertaken for customers other than TMCA, including other automotive customers. Also, manufacturing improvements and improved cost competitiveness has enabled some suppliers to develop export markets for their products.

Conclusion

101. The Purchasing Division is a major player in the PCP process at TMCA. The buyers work closely with engineers in actively participating in the VE/VA process, and are they responsible for driving down costs of components of new models through the close relationships that they build up with their suppliers. A major contributor to the success of the buyers in driving down costs is the high level of specialized knowledge and expertise that they have built up over time.

CHAPTER 6. VALUE ENGINEERING: CREATIVITY IN COST MANAGEMENT

102. A fundamental part of the product cost planning process undertaken by TMCA is value engineering. At TMCA, the process is generally described as VE/VA (that is value engineering and value analysis) and encompasses a number of activities performed by the engineering staff. For TMCA, value engineering (VE) is seen as preceding value analysis (VA) and the emphasis, especially in engineering, is on VE. Staff at TMCA uses the following definitions:

- Value Engineering (VE) and Value Analysis (VA) are methods of cost control that emphasise achieving a necessary function at minimum cost.
- VE, the **cost planning** activity, begins at the part's development stage and the results are implemented during the prototype phase of the part(s) development.
- VA, the **cost reduction** activity, begins at the start of production, where VE ends, and continues for the model life of the part.

103. As can be seen, the definitions here are somewhat different to those reported elsewhere (see, for example, definitions in the glossary). Consequently, what happens at TMCA is not always necessarily a reflection of textbook descriptions. As one engineer explained, "There's a lot of, I guess, philosophy involved in this type of topic and we don't necessarily walk the talk totally and we compromise a lot of our philosophic direction because of the pressure of timing and so forth".

Factors that Influence Value Engineering (VE)

104. A number of factors influence the approach and processes undertaken in value engineering at Toyota Australia. These include: the lack of responsibility for, and involvement in the initial motor vehicle design; the scale and complexity of the manufacturing plant; and local regulatory, market and environmental considerations.

Design Constraints

105. Unlike many companies that have implemented target costing systems, TMCA does not have the responsibility for the original design of its products. Rather, new vehicle designs are generated by Toyota in either Japan or the USA, and TMCA essentially implements the design. This severely limits the VE/VA activities that can be undertaken locally, as the basic design concept and parameters have already been determined. Nevertheless, there are still many opportunities for making cost improvements at TMCA. As detailed below, local engineers often find ways of improving the cost effectiveness of the original design by working with suppliers, substituting materials or manufacturing processes, and simplifying the design and assembly operations.

Scale of Operations

106. Compared with plants in Japan and the United States, TMCA is relatively small and more complex, as the plant produces both Corollas and Camrys, each with a large range of models. For example, TMCA manufactures both left- and right-hand drive versions of the Camry with different body styles (sedans and wagons) and engines (six and four cylinder). By way of contrast, in the United States, a plant may have an annual production of 400,000 units for just one model and thus reap cost advantages associated with economies of scale.

107. Engineers in Australia face a very different set of challenges. In particular, investment in tooling becomes a critical issue. While a high level of robotics provides a viable cost reduction strategy in the United States, this is not the case for TMCA. Furthermore, there are far fewer engineers employed in TMCA given the small production levels, and their task is exacerbated by the greater product line complexity they experience. To cope with the complexity, TMCA engineers develop very innovative responses when practising value engineering, as will be illustrated later in this chapter.

Local Regulatory, Market and Environmental Considerations

108. While Toyota is pursuing a “global car” concept, specific countries and markets have particular regulations and conditions. This means that modifications must be made. Such changes usually mean higher cost, though sometimes they can result in cost savings for TMCA where requirements are less stringent. Hence, an important function in the early stage of VE/VA is referred to as “verifying the design”. When details of a new model are received, engineers at TMCA must modify the world design to suit the local Australian market and the various overseas export markets serviced by TMCA. Often some development activity is needed to support the changes. For example, local Australian conditions (such as salt or heat) can affect the durability of the vehicle and it is necessary to confirm actual durability. Local regulations (such as those relating to safety standards

and the preservation of the environment) can also affect the design, and this involves regulation testing to confirm compliance and provide documentary evidence to regulatory bodies. If compliance involves design variances, then this can require development, testing and approval from Japan for the design changes.

Initial Steps for a New Model or Model Change

109. At the commencement of a new model project, the product planning function dominates the process. Information from Japan about model specifications in terms of the overall concept, as well as the model line-up (including the various grades and specification items, such as electric windows, ABS and airbags) is integrated with the requirements of local conditions and customer targets to provide a plan for the new model. As described in Chapter 4, this directly involves the sales and marketing functions. At the same time, the Engineering Division starts to compile information about product features, technology requirements and the types of materials to be processed. When the initial parts list is made available, the cost planning process begins. Importantly, as product planning is usually developed from the current model, this gives engineering an indication of the target to be achieved (as described in Chapter 3). From this point, the process becomes more focused and specific. An engineering manager described the process:

> So then we start to get the hard data, the initial information coming through which consists of technical information, drawings and parts list and so forth. The next stage is where we start to look at the development activity locally and that includes some local design and development testing. That also involves validation activity or testing in Japan. So normally the initial stage vehicle evaluation is done in Japan, plus some of the specific parts development activity, but the bulk is done locally. So we progress down to the stage when we have the first cut of the cost planning for the model. We'll typically end up having a shortfall between the retail price projection and the cost, and there'll be some shortfall or over - whichever way you look at it.

Three Types of Parts Design

110. The Engineering Division is responsible for parts, and in particular, their design, which consists of shape, material requirements and performance requirements. Tool design, on the other hand, is done generally by the supplier of the part. The parts drawings and the associated technical information are issued to purchasing, which, in turn, releases these to the parts suppliers involved (see Chapter 5).

111. In fact, there are three types of design information and drawings, which provide varying degrees of design flexibility to the supplier. An engineering manager described this in detail:

> The first type is a Japanese design, which you make exactly according to that drawing. It is a control drawing. The second one is a drawing where we have a little bit of a leeway. It may be a local drawing, it could be a Japanese drawing, but the control in that drawing is not as rigid. And the third type is what we call a black box item. Now in those instances we issue the performance requirements of the part to a supplier and the supplier develops their design according to those performance requirements. So it will define what it has to look like maybe, how it has to fit, but what goes inside it – but it's the supplier's design.

112. With respect of the first type of design, whether it is sourced locally or overseas, the part should be absolutely the same, even in terms of the material used to manufacture it. Such parts reflect the advantages of the “global car” concept practiced by the global Toyota group. Thus, with respect to the Camry, which is produced in three plants in the world, TMCA knows that the part will be exactly the same wherever it is sourced, and the objective is to source the part cost effectively.

113. The second type of design is referred to as “request for design and development parts” (RDDP) which is based on drawings from Toyota Japan but which are not too prescriptive. With these parts there are opportunities for VE by TMCA engineers, often in conjunction with suppliers. An example of this type of design is a shock absorber.

> The shock absorber is never a direct copy design off Toyota Japan, so what we will do is say, “Okay we know the spring has to go on top of it”, so we define that area. We know that it has to bolt up into the strut tower, so we define that. We define that a bearing goes on it. So we define all the parts that must have an interface with other parts. Then we say this thing must bolt in and meet all these parameters and we then set a whole framework of performance criteria so once it’s in there it must do this and this – it’s got to have an outcome.

114. Importantly, these parts give the supplier the opportunity to build-in its specific know-how. The supplier prepares the design and makes a drawing that meets the RDDP. The drawings made by the supplier, however, are highly confidential as they embody the supplier’s expertise, which, of course, is guarded very closely. These drawings would never be made available to other suppliers.

115. The third type of design, the “black box item”, is fairly rare, and was described by one engineer as “grey”, implying it was a matter of degree between these designs and the second type of design. The part may be bought directly from a supplier from its existing parts range, or, alternatively, the supplier is given a description of what the part is required to do, the durability testing criteria and so on. The remainder of the design is the supplier’s responsibility. An example of a “black box item” is an external rear-vision mirror, since all that is issued to the supplier, in effect, are details of the styling surface. In fact, an Adelaide supplier developed its own unique control mechanism, which is incorporated into the mirror. As TMCA does not see itself as an expert in mirror design, “…we tell the supplier exactly what the mirror should look like from external appearance … a styling point, and we also tell them what specifications it has to perform to, and everything else which is under the skin is their design”.

116. Once completed, the supplier submits its drawing back to TMCA for approval and validation, giving engineering some control over the final design, even though it is the supplier’s design. The supplier then specifies how the part will be made, what process will be used, and again, TMCA maintains control over these activities. Once approved, the supplier cannot technically change the design without further approval and validation.

The Cost Reduction Process

117. Once the initial steps described above are completed, discussion takes place within the PCP Committee to identify the cost targets that should be allocated to the various divisions to achieve the overall desired cost reduction (see Chapter 3). Once the

Engineering Division knows its target, it is in a position to start applying the techniques of value engineering. But at TMCA, the actual implementation takes place in number of ways that do not always exactly mirror the descriptions or conceptualizations found in the literature. As expressed by an engineer, "Now this is where sometimes the activity and the talk deviate because the process that technically we should use is VA, VE/VA or value analysis".

118. These "deviations", which can take a number of forms, are described below. In part, they appear to stem from the fact that much of the basic design choices are made when the new model is designed overseas. Nevertheless, the approaches taken at TMCA are all directed to reducing the costs of parts and/or production processes.

119. First, value engineering is usually viewed as assessing the various functions of a part and ascribing costs to those functions. Part of value engineering involves identifying the primary function of the part (or product), along with secondary or tertiary functions. An example might be a bolt with a primary function to fasten and secondary function to resist corrosion. Often it is the case that a significant proportion of the cost is associated with less important functions. Thus, rather than trying to reassign costs, the analysis by the Engineering Department focuses on whether lower level functions are actually needed and whether they could, in fact, be eliminated; thus, the primary function of the part becomes the main concern.

120. Second, material substitution or the use of different processes often achieves cost reductions. Frequently the relativities of local and overseas material prices and manufacturing processes differ, meaning that cost savings can be achieved by substitution, without affecting functionality or quality. For example, injection molding is quite cheap in Japan, but it is expensive in Australia relative to vacuum molding. Hence, parts involving injection molding are sometimes redesigned in Australia for production using vacuum molding. But to receive Japan's approval for such changes, it is critical that the functionality, quality and performance of the parts remain the same.

121. Third, cost savings can be achieved by the reduction in the number of pieces in a component. An engineer provided an example.

> You may have a part that's made out of five pieces that you need to assemble, but you may be able to make it in one or two pieces. But the process, by which you assemble those pieces, really determines the design and the cost. Now if you can say, "Let's change it to one piece", you're talking about using maybe a completely different process. You might have machines for separate pieces but to get that into one part you've got to actually cast or mould it in some special way. So that means a complete change in production and cost.

122. Of course, these types of changes involve careful considerations of cost trade-offs, as the new process may involve a high tooling cost. But when the cost is averaged across expected production volumes, redesigning to reduce parts may be very cost effective.

123. Fourth, some cost savings arise from opportunities to reduce specifications. These situations arise as the Toyota designs are based on a global car concept, with specifications that are often unnecessary to meet conditions for the Australian market and TMCA's export markets. To have these changes approved, TMCA must be able to present a strong case to Japan.

Illustrations of VE/VA in Action

124. Often a combination of factors such as the redesign for assembly, material substitution and changes to meet the requirements of the local environment are all involved when VE as applied to a specific part. The following examples describe the variety of methods used and illustrate the innovation and attention to detail that is required in this stage of the product cost planning process.

Corolla Hatchback Trunk Light: Redesign and Tool Cost Savings

125. Customers expect to have some illumination in the trunk area. Hence a courtesy lamp is fitted, which is activated when the trunk lid or hatch is opened. In the case of the Corolla hatchback, there was a plastic liner covering the trunk area and the Japanese design involved a “beautiful lamp” which was specially molded to fit on a curved section of the liner. The problem facing TMCA was the very expensive injection molding tooling required to produce the new lamp (approximately $200,000), combined with the fact that the annual production of Corolla hatchbacks was less than 12,000 units.

126. The solution here was to relocate the position of the lamp to a flat part of the liner, which enabled the use of the lamp from the current model. While the tooling for the lamp had been amortized against the current model, it was still serviceable for the new model. The change, however, had other implications that needed to be addressed. First, would the change affect the customer? As the lamp had the same output as the Japanese specification, the change was considered acceptable as functionality (the primary function) was not altered. The location and shape of the lamp were not regarded as important secondary or tertiary functions. Second, there was a question of whether the change would create difficulties (and possibly increased cost) in vehicle assembly. The new lighting position could be reached without changing the wiring harness. Third, the design of the plastic trunk liner had to be modified by relocating the hole for the replacement lamp. As the liner was locally sourced and required new tooling for the new model, fortunately the change could be made without increasing these tooling costs. Importantly, this example underlines the need to consider the implications of one design change on the design of other parts, as well as the impact on assembly costs.

Mudflaps: Reduction of Number of Parts

127. In the case of a mudflap, the Japanese design consisted of two pieces, which were assembled and then fitted to the vehicle. However, where there are two pieces that fit together and then mate to a third surface, there is a greater potential for complications, the possibility of quality problems and, hence, a greater need for precision tooling and manufacture. The suggestion was to use a one-piece design, and interestingly this idea came from the Australian supplier. Engineering implemented this change, resulting in some tooling cost savings, some assembly cost savings and improved quality as the one-piece design eliminated the issue of having two parts match perfectly.

128. This example also illustrates what the engineers at TMCA describe as the “cardinal rule of VE”, which was expressed in the following manner.

> You should never criticize the original design decision because you weren't there at the time that it was designed, and therefore, if weren't there, you don't understand the parameters that existed at the time that caused that design to have ended up like that. So you never criticize the decision. But you ask right now, here in time, can we do better?

129. Accordingly, the objective when doing VE is to explore what can be adapted or what might have to be changed. In the case of the mudflap, the two-piece design made sense in Japan, as part of the mudflap was painted to match the car for high series models (that is, more expensive versions of the vehicle). A design with two pieces avoided the need to mask the mudflap prior to painting (an expensive process). In Australia, however, the very low volumes of higher series vehicles meant that, overall, it was cheaper to mask for painting, "So for us it was easy. We could stand the amount of manual painting in the low volumes, you know, just for the sake of having one tool. The tooling saving more than offset the increased piece cost with low volume, high series Corollas".

130. Finally, in this case, because of the improvement in quality, the one-piece design has now been adopted for certain models in Japan, which do not require painting. With much larger volumes of all models, it was possible to absorb the cost of two sets of tooling and still achieve cost savings.

Washer Bottles: Adapting the Process and Simplifying the Design

131. From a customer's perspective, a windscreen washer bottle should be durable and easy to refill, but it is unlikely that they would be concerned with the actual appearance of the bottle (a secondary or tertiary function). The Japanese design for the Corolla washer bottle called for injection molding, an accurate and high-speed process consistent with large-volume production in Japan. Injection molding results in uniform walls and a quality finish both inside and outside, but involves making the bottle in two-pieces. Because of the high tooling costs, the engineers at TMCA turned to the alternative process of vacuum molding, which involves one tool, but does compromise the uniformity and inner-wall finish.

132. In addition, the original design had a complicated washer-hose system (a series of tubes and elbows that were fitted together). It was replaced by a continuous tube, which the supplier attached to the bottle with clips. This resulted in a reduced assembly time. It is also worth noting that while the Japanese suppliers can produce the bottles cheaply using highly efficient injection molding, due to the bulk of the bottles (4 to 4.5 liters), shipping costs are prohibitive (as one is essentially shipping air). For this reason it was necessary to localize the manufacture of the part.

Corolla Instrument Panel: Utilizing One Design for Several Models

133. One feature that distinguishes high and low series models is the sophistication of the instrument panel. In high series Corollas, the Japanese design featured a speedometer and tachometer, side by side, surrounded by other gauges such as those for water and temperature, while the lower series models only had the speedometer in the center of the panel. Thus, there were two sets of tooling required for the panels, because of the different hole configurations. Again, with the low production volumes at TMCA, this led to very high tooling costs per unit. It was decided to use the "two-hole" panel for low series vehicles, but to install a backing piece with some warning lamps in place of the

high cost tachometer. This resulted in substantial savings with respect to tooling costs, without compromising functionality and the general appearance of the instrument panel.

Interior Roof Head Lining: Using Substitute Materials

134. In Japan, the head linings, which fit inside the roof of the vehicle and are covered with a fabric, are made from an oil-based plastic called urethane. But in Australia this material is expensive, and fiberglass was used as a substitute. The basis for the change was explained as follows:

> The material is a lot cheaper - that's the first benefit. The second benefit is that the Japanese use a urethane type base material which is much more soft, especially in the hotter environments. It can soften up quite a lot. And they had sagging problems near the rear window, so for theirs they have a rear window finisher panel which is a metal strip that they have to hold the whole thing in to stop it sagging. So they have to put a lot more work to hold it up to the roof and to stop sagging. But the fiberglass being a lot stiffer is more self supporting.

135. By eliminating the metal support strip, some savings were made with assembly. But at the same time, being made of a stiffer material, the liner was harder to fit, requiring greater care and accuracy by the assembler. In addition, it was necessary to use precision tooling for manufacture to ensure that it would fit properly first time, every time. After-sales servicing was another factor to be considered. On balance, these factors were outweighed by the material cost savings.

Installing the Catalytic Converter: Reducing Assembly Costs

136. This example of VE/VA revolves around the way in which the engine pipe from the manifold was attached to the catalytic converter for the Camry. The original design involved a flange arrangement to bolt the engine pipe to the converter, resulting in an expensive joint, especially for assembly. But recalling the "cardinal rule of design", the original reason for this design was that the Japanese sold into markets with quite different emission requirements and, given the cost of the precious metals in the converters, needed to be able handle the variety by installing the appropriate converter. In contrast, for TMCA, only one converter was required. Thus the pipes, which were made in Adelaide, were welded to the converters by a Melbourne firm, giving TMCA a one-piece assembly. But before this modification was made, it was necessary to ensure that the assembly operation could be performed efficiently, and that after-sales servicing would not cause problems. In the case of the latter, it was found that as the engine pipe was stainless steel, which research had shown would last at least as long as the converter, there was no need to replace the engine pipe independently of the converter. The change resulted in savings of several dollars per vehicle, and the end result exceeded the legal requirements in Australia.

Seat Pans: Utilizing a Common Part for Both Corolla and Camry

137. An expensive component of a car is the seat sets, and as with other parts, tooling costs are significant. For the latest Corolla, part of the tooling cost involved a press for the metal

seat pan, on which the foam seat cushion is located. Prior to this, similar tooling had been developed for seat pans for the Camry. An engineer described what transpired.

> One creative person said, “Well hang on, all our customers are pretty much the same size. Theoretically the seat pan should fit both vehicles”. So we got the seat pan from the Camry and found out it didn’t fit the Corolla, because the track mechanism that it sits on was a different width to the track mechanism on the Corolla. So all we did is put two indentations, two seams, into the Camry pan and then the Camry one could fit on the Corolla track. So we didn’t have to re-tool, we didn’t have to tool a Corolla one. So then we had a common pan, with two sets of indentations.

138. Again, from a customer perspective, the seat goes backwards and forwards and is comfortable, and the redundant indentations do not effect the functionality of the seat.

Overview of the Illustrative Examples

139. The illustrations start to provide some insight into the extent of innovative thinking and the diverse range of strategies adopted by TMCA engineers and suppliers when undertaking VE. And, in particular, what did become apparent during discussions with the engineers was the essentially heuristic nature of the process. There is no detailed manual on how to do VE. Rather, it appears that some general strategies (such as, examining whether a different process or material would be appropriate, or questioning the need for certain design features in the Australian context) can help the engineer in the quest for cost reductions. Indeed, on several occasions it was stated by TMCA managers that a strong background in the automotive industry was important, indicating that experience plays a crucial role in VE.

140. Another feature of the process, brought out in the illustrations, is the need to recognize the ramifications of a change or modification and the importance of understanding trade-offs and interactions. Thus, as was seen in the case of the roof head liner, it was necessary to investigate factors such as assembly difficulties and part quality when considering the use of a cheaper material substitute.

141. Finally, the illustrations underline the high degree of judgment that has to be exercised in the VE process. In particular, assessments have to be made about the likely impact of a design change on the customer. When discussing the trunk courtesy lamp example, it was noted that the decision involved a tool saving versus a styling issue, and as one of the engineers explained: “Does it affect the customer? We had to make that judgement and the judgement was made”.

VE/VA Post-SVP and for Model Changes during Production

142. Once the required parts for a new model are known, the VE/VA activity is intense leading up to and during production trials. But when SVP is reached, the process stabilizes. However, ongoing fine tuning of the design and improvement activities will continue after SVP. One of the factors requiring further work at TMCA may be the need to move to extra localization for the sourcing of parts. During production planning, certain economic parameters are set. An important one is the exchange rates between the Australian dollar and the US dollar and Japanese yen. Changes in exchange rates can

mean that parts are either under- or over-localized, and this may also affect where overseas sourcing should be sought (for example, from Japan versus USA).

143. The need for further VE/VA may also arise during the life of a model (which may be four to five years) as usually there is at least one “facelift”, involving major changes, and the production of at least two or three “limited editions”. This can involve substantial engineering work and, again, cost is a very important consideration. In fact, there could be major design changes. An engineering manager described this in detail:

> We could have a facelift or we could have a substantial revamp of things and, even a limited edition model. We could add, for example, ABS. It may be the road model that doesn’t have it - that’s a fair bit of engineering work. It involves a lot of parts and stuff. So it’s quite a considerable amount of work. We could rejig the option breakup of a model. There’s a fair bit of work in doing that, and some of it is designed to freshen up the model - to get a bit more of activity in the marketplace. But also we can take that opportunity to make a change, which allows us to revalue the retail pricing and also the life of the model. Sometimes we find that maybe Mitsubishi is doing a lot better volume than we are, and they’ve got features which now starting to become attractive to fleet market. Things like remote door entry, for example. That’s a sort of feature that we mightn’t have had initially - but it now seems to be the thing that the target market is valuing. It’s part of the buying decision of people that are in that group.

144. After the start of SVP manufacturing personnel engage in value engineering as they implement improvements in the manufacturing processes. This is described further in Chapter 7.

Concluding Comments

145. At TMCA value engineering is a critical part of product cost planning, as it is the process whereby cost reduction targets are translated into specific actions, on a part by part basis. This involves an enormous amount of detailed analysis, experimentation and innovation. As can been seen from the discussion in this chapter, VE, especially as it is practised at TMCA, involves many strategies and methods, and, to a large extent, its success depends on the initiative and creative thinking of the engineers involved. The following statement provides a good summary of what VE at TMCA embodies.

> What we force our engineers to do is to think very much outside the square - don’t just design parts. That’s what VE means, value - put yourself in the customer’s shoes. If you have a cost reduction idea and customer value is not impaired, and it meets all the Toyota standards, go ahead.

CHAPTER 7. COST TARGETS AND VALUE ANALYSIS IN MANUFACTURING

146. The Manufacturing Division has an important role to play in the product cost planning process, as well as in overall cost management at TMCA. During pre-SVP the Manufacturing Division agrees to targets that it needs to achieve during the product planning stage, and sets about the task of designing the assembly process to help achieve the targets. The assembly process is trialed over several months to refine the processing that will take place, and to train operators in the new activities. After SVP various

processes are put in place to achieve effective cost management. Detailed usage and man-hour targets are "pushed down" to individual activities within the various production shops, and frequent reporting helps managers and operators focus on specific problem areas.

Manufacturing Activities Pre-SVP

147. During the pre-SVP period for a new vehicle the Manufacturing Division needs to study how the car will be assembled, develop targets for usage and labor time and specify procedures for constructing the motor vehicle.

Assembling the Motor Vehicle

148. At the start of the product planning process the first activity that the Manufacturing Division undertakes is to strip back (de-assemble) a number of the new prototype motor vehicles to gain an understanding of how the car was made and how it was assembled. Element sheets provide the step-by-step details of how the car should be constructed, and the specific requirements for each stage of production. The element sheets specify the order in which the various parts are assembled, and the various standards required for usage of materials and labor. For example, the element sheet may specify that one liter of solvent is needed for each car, and that the grill is attached as one of the last steps.

149. As explained in Chapter 6, TMCA uses value engineering to modify many of the parts of the global cars, to help achieve cost targets as part of the product planning process, and to adapt the car to local Australian conditions. These changes do not usually influence the order of parts assembly of a motor vehicle. However, differences in the degree of automation of the Australian plant, compared to overseas Toyota plants, do have an impact on the order of construction of the motor vehicle. The Australian plant is far less automated than the Japanese and US plants of Toyota. A manufacturing manager explained the influence this has on operations and cost.

> In Japan and America, in the weld shop they are up around 80, no, nearly 90 percent automation. We are only at 50-54 percent automation. When you have a lower automation you have more sub-assembly done, but then there is also a cross over of investment to labor. If our production volume were as high as 150,000 total vehicles a year, we would have higher automation in the weld shop. If you go to assembly there is very little automation, because it's a labor-intensive process. The paint shop is probably about 60 percent automation and that's mainly because of spraying the vehicles. So what we do is start to break down the construction of the car by every shop - by weld, by paint, by assembly. Then we go back into the engine plant and then back into the press shop, and we break it down as the pyramid goes down. Then we do a time study and then allocate a cost.

150. The time it takes to assemble the car is determined step-by-step, taking account of the factors that may affect the ease of assembly. There are many factors that may impact on the assembly time, and hence cost. These include the extent of localization of parts, as explained:

> If we bring in a door, for example, we bring it in as one sub-assembly, and if we bring in the outer shell of the door, it is in the same size packaging as if we bring the full door in. So therefore it's better for us to bring the full door in. Also, it reduces the investment in dies, and therefore there are also savings in welding equipment to manufacture that door sub-assembly. So you are saving all along the process.

151. Manufacturing targets are set in a two-stage process in the pre-SVP stage. First, targets are set for the Manufacturing Division as part of the product cost planning process. The manufacturing managers then take those targets and make them more challenging. The overall targets are broken up into specific targets for each shop within the plant, which are further broken down into each part of the process line. A manufacturing manager described the process:

> So what we do now is we establish the targets for each shop. Finance may have given us a target for 2 percent down for budgetary and long term business plan purposes, but under target management you have to achieve maybe 3 percent in this area, 5 percent in this area, 4 percent in here and overall it might be 4 percent or 3 percent. So we start the targeting in on certain areas, in every shop. Every shop then has their own meeting with their shop floor people, and target is pushed down to every line. So if you go into each of the shops now - into assembly or weld - they have visual boards showing each line, what their overall cost target is, and what their cost target is on certain items, such as gloves or sealant or masking tape.

The Trials

152. During the pre-SVP stage manufacturing staff complete a number of "builds" of the new car. During the last six months of the pre-SVP period, the cars are built on-line in the "goshi" (trial) room. This is a simulated line layout. There are two trials. The purpose of the first trial is to look at the process and quality of the car, and to make improvements to allow the car to be built within the correct *takt* time[3]. Another outcome of the trial is to create an awareness of the assembly requirements for the operators. Dedicated teams are set up from each production shop to concentrate on the new model. They will examine all of the details on the element sheets, and consider issues such as where operators will stand to assemble various components. Engineering staff becomes involved, deciding what types of equipment the operators will use, and the tasks the robotics will undertake. Standard times are set for all aspects of assembly, and the line is stopped to examine problems when they occur. The usage of materials is also examined during this trial. Actual usage of materials, such as paint and solvents, will be compared to a standard. If the usage is above standard, engineering staff may need to study the reasons for this and the standard may need to be revised. Throughout the first trial, staff from quality control, product engineering, plant engineering and production engineering observe the assembly of the new motor vehicle. There may be up to thirty people observing the processes. Difficult assembly problems may be video-taped for intense study. A manufacturing manager described the processes within the first trial.

> Ten cars are built over a five-day period, and over different shifts to allow a range of operators to participate in the process. Differences in the efficiency of various shifts will lead to investigations. So if the performance is 50 percent above standard, the

[3] "Takt" is the Japanese term for the theoretical time required to complete an operation including set-up time.

> engineering group may come back and say, "No, they're doing something wrong. This is what's wrong. Okay, let's correct it." But we will then study the next car, out of that 10. Normally we will build two or three cars together, so then we test the whole process. Next day or next shift we do another three and we spread them out over a five day week, so it doesn't impact on efficiency but we are getting a true measure of both day shift and afternoon shift. Now if day shift are at 150 percent but afternoon shift is only 100 percent of target, we have a fair idea why it is, and that's where the training comes in, and then we will go back and train the operator or find out what is different. Normally, at that point of time, we will be above our targets, sometimes way above, and then we will start to eat our way down. The actual goal is to try and be effective from day one of SVP but in effect it is not realistic.

153. The purpose of the second trial is to focus on operator training. The operators are allowed to undertake assembly, without the groups of observers that were present in the first trial. If problems arise during the trial, they are noted and fixed afterwards.

154. As preparation for the manufacture of the new vehicle, a team of employees may visit an overseas Toyota plant to observe the assembly of a new vehicle. In 1998, a team visited the US to observe the manufacture of a car that is to be introduced in 2000 at TMCA. This team included three operators, a senior general foreman, staff engineer, TMCA coordinators and an assembly department manager. The team represented a cross-section of the plant, and it was particularly important to include operators. As one manager explained:

> A lot of people on the shop floor have a very rare ability that office people don't. They do something 400 times a day and they can tell you whether it is not working, or if there is another way of doing it, and they are the ones that can really help us. Sometimes you find that their value is probably a lot greater than maybe our staff engineering in the whole process. Our staff engineering value is only to analyze the problem, what the operators do in the whole process is probably more important.

155. A major focus of the trials is not only to consider how the car should be assembled, but also to gauge the impact of the assembly process on the operator. The trials may reveal that completing the processes is very difficult for the operator in terms of its ergonomics. "Human issues" in the manufacturing process are considered very important factors in the operations of the plant. A manager outlined why this was the case.

> If we make the process very hard or very tough for the operator, where he has to bend or twist, you may be exposed to a work safety issue. And there is fatigue. Once you have fatigue you may have absenteeism, and if you can't keep your operator at work then your efficiency decreases. There's a whole myriad of things that we have to try and balance to keep everything going.

156. By SVP, about twenty cars will have been built as part of the initial testing process: in the first trial ten cars are built, and a further ten cars in the second trial. This flows into SVP when between 60 and 100 cars will be built in the first few days.

Cost Management Post-SVP

157. Individual targets are set for the Manufacturing Division using the same two-stage process as used to set targets during the pre-SVP stages. That is, overall targets are set for the Manufacturing Division based on the annual budget and the long term business plan, and then specific targets are set for each shop, and then each process or activity within the plant.

158. At the start of SVP, targets are formulated for each individual activity within the production process. It may take up to sixty days before the rate of production of the new vehicle comes close to the standard times and usages for labor and material.

159. Cost control is driven by monthly reports, which are prepared based on usage (compared to standard) of material items and man hours for each process/activity, and major problem areas are targeted for improvement. High usage areas and high dollar areas are given priority, as this is where there is the greatest potential for cost savings. This very specific targeting system was only introduced at TMCA in 1997. A manufacturing manager contrasts the difference between the new and the old targeting systems.

> We used to track paint as a total. We were saying cost per unit of the car for paint is roughly x dollars - but that wasn't showing us anything. We were asking, "Why do you keep operating above target", we tended to get excuses. So then we would study the process for a month: what are we using, where are we using it, and where is the cost. We now set down usage targets and every month we track them, and inside the plant they're tracking it every week. For example, a report is prepared by paint color - some paints are easier to apply and so on. What we were doing also is if we were having a problem with the paint application, we would rub the paint back to bare metal, then putting on another primer and another sealer. This led to a focus on re-paints. We asked quality control to go into the paint shop and start monitoring the process. Instead of worrying about the end usage, we concentrated on the process - if you control the process the usage is an outflow of it.

160. Specific production areas may be targeted where there is the greatest potential for cost savings. For example, the paint shop has the highest energy consumption in terms of gas and electricity, so this provides a potential area for savings. Labor targets are also formulated for individual activities. Once a problem area is brought under control, another area is targeted, but only those areas where there is great potential for savings. The focus for targeting activities is usage, not cost, as usage is controllable and readily understandable at the shop floor level.

161. The Toyota Production System (TPS) used at TMCA is a lean manufacturing system that provides a strong discipline to the management of activities and cost. All processes are standardized, and usage of material and labor are prescribed. The TPS works on a just-in-time management system. Less than two hours supply of parts inventory are kept for most inventory items, and there is an hour and a half to two hours buffer between each area of the plant. For the TPS to work effectively, the processes must be stable, and the plant must operate at peak efficiency. Any stoppages in the production lines, or in delivery by suppliers, may create major disruptions to other part of the plant. In fact, if there is a stoppage due to, say a parts shortage, or breakdown, it takes only about eight minutes before the total line balance is affected. Rework and inefficiencies affect line balance, so strong control and elimination of these problems is essential. Once SVP is complete, the next year's manufacturing targets are set.

Resistance to the New System

162. The detailed target management system used in the Manufacturing Division at TMCA was only introduced in 1997. The changes in the cost management process were described by one manufacturing manager as part of a "cultural change". At first there was some resistance from manufacturing managers and shop-floor workers. However, it was found that the key to helping people accept the new system was to allow them to manage the system themselves:

> Management can't directly control usage of material. We can only give direction - the people on the line are the only ones that can control the usage. That's why a lot of the graphs are displayed in the plant, and maintained by the plant people. In earlier years it was all done in the office and then you were fed a result.

163. Measures are collected for the visual boards daily, and by shift. This has created a degree of competitiveness between shifts, with each shift "ramping each other up".

164. There are no specific monetary incentives or bonuses attached to meeting targets for manufacturing employees. However, operators and managers have taken on the responsibility for achieving their targets. One manager stated that high levels of competition between various lines and shops within the plants, peer pressure, and the feeling of pride that many of the employees now had in their work underlie the successful cost management efforts.

165. Teams of operators are also becoming used to presenting the results of their performance to senior management at TMCA. This has helped to create further a culture of pride and competitiveness:

> Every one in the shop knows what's going on. Everyone knows our Executive Vice-President of Manufacturing and our President because of their frequent visits to the shops. And people will say, "On Friday we have got to present to the President", or "We have to present to finance, we are doing this and that", so that people know. And there's just that pride that builds up in the place, which was lacking a couple of years ago.

Support by the Finance Function

166. A difficulty, which took some time for the finance staff to resolve, was deciding on the information that manufacturing managers needed. A senior finance manager explained how this was achieved.

> At the beginning of 1997 we established the cost controls and we got together all the plant managers with the very senior management and some finance people and we asked the question, "What sort of information do you need to run your business?" and we tried all sorts of things. I remember the trial and error method, when we put a report out they said, "Oh yeah, that sort of does it, but can you also do this?" It took about 6 months to actually evolve to the report that we currently use, and we got to know more and more about our business as we did that. They'd just ask us, "Can you do such and such?" and finance tried to collect it, fashion that information in the way that they would like it, but actually most of the measurement was really done by the plant, not by us. We just put dollar values to it.

167. Specific finance staff members have been assigned to areas of the plant to support this process. Finance staff are involved in manufacturing meetings within the plant to support the cost management efforts. This has helped to break down the barriers between finance and manufacturing and build up trust, as the following quotation explains, "Now the confidence of the management in the plants, and even the supervisors, to ask the finance to help us is much much higher now, because now they can see the value of finance tools".

Manufacturing Changes Post-SVP

168. Once the production of a new motor vehicle has commenced, additional changes may be made to the production processes over the life of the model. There may be several reasons for these changes. Improvements in processing are one source of change. These may be short-term, mid-term or long-term changes. Short-term change may involve changes to a process, which can be introduced within the normal production time. Continuous short-term improvements occur each month. Suggestions for these improvements may come from operators or from engineering staff. They may also be an outcome of monthly meetings in which plant managers consider reasons for performance being below target in specific areas.

169. Long-term changes, such as the replacement or modification of equipment, are very expensive to implement and may take six months to put in place. These changes are often introduced during Easter and Christmas, when the plant can be shut down. Until these changes are implemented, performance for some activities within the plant may be below target. However, it still may not be worth while to make a change until there is a major break in the production. Other steps may need to be undertaken to compensate for the problem. An interesting example of a major change related to the lifters:

> We have a problem with our lifters, which lift the cars from the end of each line up into the conveyor in the roof. We have a problem with the timing of some of the lifters, so there is a major exercise this year at Christmas to synchronize the lifters, but also to strengthen the lifters. They were installed about 4 or 5 years ago and now the equipment is susceptible to breakdowns. Until they receive that major service, special attention is given to the lifters by the maintenance people.

170. Improvements in processes or equipment may also feed through to production from developments in the pre-SVP stage of the next vehicle model. Other changes arise from problems in assembly that may still occur after SVP. For example, it may be difficult to assemble a particular part, or there may be a quality problem that arises from a part, which entails high warranty costs. This can lead to a change in the design of the part, which may take engineering up to two months to refine. However, the extensive trialing of parts and assembly processes pre-SVP, and the fact that many of the parts and assembly processes have been tested extensively overseas, generally ensures that there are few operator or part-related problems once production commences. Also, as discussed in Chapter 6, there may be model changes that occur a few years into production to "freshen up" the model. These will also require changes to take place in production processes.

Summary

171. There are several distinctive aspects of the cost management processes in the Manufacturing Division at TMCA. First, there is the interaction of cost targets and cost savings during the pre-SVP period, which may flow through to cost savings post-SVP. Second, the very specific targeting of activities or processes allows manufacturing to concentrate on problem areas, or on areas where there is potential for significant cost savings, and to move on to new areas as costs come more under control. Third, the activities undertaken within manufacturing (such as formal presentations to senior TMCA managers by manufacturing teams, and the encouragement of competitiveness between teams) also serves to encourage actions that lead to more effective cost management.

172. This system, however, could not function effectively without the provision of relevant and timely information, which is supplied and collated by the finance function. Clearly, the quality of the relationship between the finance function and manufacturing personnel is a key to making the system work.

173. The higher participation of the finance staff in the cost management activities of the Manufacturing Division has led to manufacturing managers becoming more cost aware: "…every manager is now a business manager; they know the cost of their operations." For the finance staff, the more specific targeting of information to the needs of manufacturing has led to the production of more relevant and reliable information.

CHAPTER 8. KEY ISSUES AND CONCLUSIONS

174. The aim of this study was to investigate and describe the target costing system used at Toyota Motor Corporation of Australia.

Central Role of the PCP Process

175. The study has highlighted the multi-disciplinary involvement in cost management process at TMCA. Several functions within the company have vital roles to play within the PCP process:

- **Finance** — The finance function plays a coordinating role within the PCP system, managing the assignment of cost targets, performance reporting and monitoring of performance achievements across all areas of the business. Also, they promote target achievement and highlight the need for countermeasures when deviations occur.

- **Sales planning and distribution** — The responsibilities of this function include the setting of the selling price of a new model. This critical activity drives the formulation of the target cost, which underlies the detailed cost targets for each of the functions of the business.

- **Purchasing** — The purchasing function provides opportunities for cost savings through the analysis of all parts and components used in the manufacture of a new vehicle. Cost savings may be achieved through increased localization of sourcing, improvements in suppliers' production practices, and the redesign of parts in conjunction with suppliers.

- **Engineering** — Through value engineering each part is analyzed to seek areas of cost savings. Improvements may be achieved through many different types of activities, including the substitution of materials, simplification of parts design, redesign of parts or components, and utilization of common parts. In all of these activities the functionality of the product must not be compromised.

- **Manufacturing** — At both the pre-SVP and post-SVP stages, manufacturing staff search for areas in which cost savings can be achieved. This may be through improvements in manufacturing processes, equipment and manual operations. Some of these changes occur through continuous improvement processes, while other changes require more long-term fundamental changes.

Key Issues Emerging from the TMCA Case

176. The key issues that emerged from the description of the target costing system (product costing planning system) at TMCA were as follows:

- The adaptation of target costing to a western context
- The operation of a target costing system within a global product strategy
- The critical nature of value engineering to the success of the target costing process
- The integrated nature of the cost management system
- The cross-functional nature of the target costing system
- The important coordinating role of the finance function

These issues are discussed below.

The Western Experience of Target Costing

177. Much of the literature relating to target costing has focused on the Japanese experience, especially at Toyota. Indeed, Toyota is regarded by some as the “inventor” of target costing (Tanaka 1993). In Western companies, however, there has been less documentation of the use of target costing. Moreover, it has been suggested by Lorino (1995) that, while some of tools of target costing are used in Western companies, there is not a well-developed management philosophy based on the target costing approach. This study of the Australian arm of Toyota provided an opportunity to view how target costing may be adapted to a Western culture, and the extent to which it can become an integrated management approach.

178. In general, it can be concluded that the target costing approach has been successfully adapted at TMCA. In part, this can be attributed to the strong influence of the Japanese parent. However, the target costing system at TMCA is not identical to that of its Japanese parent. For example, TMCA includes all of the life-cycle costs of a motor vehicle, including distribution and selling costs, within the product cost planning process.

Also, the role that the finance function plays within the PCP process is not the same as found in Toyota Japan.

179. Nevertheless, in discussions with the Australian personnel at TMCA, it became apparent that they are wholly committed to the process and, in fact, enjoy meeting the challenges posed by the cost reduction targets. Moreover, the focus on cost reduction pervades all areas of the company, from engineering and finance through to manufacturing and sales. There is a universal belief that there is always some component, activity or area where it is possible to achieve further cost reductions, while maintaining acceptable levels of quality and functionality. Thus, it is not obvious that there are intrinsic reasons why a target costing approach would not be successful in a Western firm. Success, however, does seem to be dependent on fostering a firm-wide appreciation and commitment to the idea that there will always be opportunities to reduce costs, and on the development of integrated systems to support cost reduction activities.

Target Costing within a Global Strategy

180. The fact that TMCA operates as an integral part of the Toyota group's global strategy presents some unique challenges. In particular, the lack of responsibility for the basic product design restricts the value engineering initiatives that can be pursued. But while design parameters have already been set, and detailed drawings already completed, as was illustrated in Chapter 6, there are still many opportunities for achieving cost reductions. Moreover, engineers at TMCA do have the advantage of seeing the designs and drawings supplied by the Japanese design team. This enables them to explore ways of improving or modifying these designs while maintaining the original design and quality parameters. And, as was seen in the example of the mudflap, results of value engineering efforts at TMCA can flow back to the Japanese parent company, to be used in future global models. Similarly, as described in Chapters 5 and 6, collaboration with local suppliers can result in producing components at costs lower than those of overseas suppliers, as well as attaining benefits from design suggestions of suppliers. Also, further cost savings may result from modifications necessary to adapt the global model to local circumstances. For example, global design parameters may need to be changed to allow the vehicle to comply with Australian legislative requirements for environmental emission standards, or Australian weather conditions. Additionally, specific preferences of Australian or export customers may lead to the changing of design features. These changes provide the engineers at TMCA further value engineering opportunities.

The Application of Value Engineering

181. A critical aspect of the product cost planning (target costing) process at TMCA is the application of value engineering (VE) techniques. In general terms, VE is the method by which cost reductions are achieved, especially during the product design and development stages. While there is a substantial literature on VE, the treatment tends to be focused on broad descriptions of the techniques themselves (for example, Cooper and Slagmulder (1997) outline zero-look VE and teardown approaches). In this study of TMCA, the people who were directly involved in performing VE were interviewed, thereby providing an in-depth examination of the processes of VE, and how VE operates in the context of component suppliers.

182. What becomes clear is that the practice of VE is perhaps more of an art than a science. Its success depends on high degrees of creativity and lateral thinking. While this is particularly the case for engineering personnel, all divisions of TMCA, and even suppliers, are actively involved. Experience appears to be an essential ingredient, but the detailed cost information is critical, as any design change must not only meet functionality and quality requirements, but must also be shown to result in cost savings.

An Integrated Cost Management System

183. The product cost planning processes at TMCA demonstrate how pre-production VE techniques that focus on the design of a new product can integrate with the ongoing cost management activities of currently produced products. While many published descriptions can create the impression that the pre-production cost management activities are distinct from post-production cost management systems, at TMCA the planned cost savings of new models of motor vehicles developed as part of VE may feed through to provide cost savings for vehicles that are currently under production. Also, the cost savings achieved during production of the current vehicles may be used in cost savings plans for the new models.

The Cross-functional Nature of Target Costing

184. This study provides a detailed example of the cross-functional nature of an effective target costing process. This is consistent with some prior studies that have indicated that many of the "new" cost management techniques require the involvement of employees from many parts of the business. In the case of TMCA, the success of the product cost planning process is dependent on a high degree of coordination and cooperation between employees from all areas of the business. In discussions with personnel at TMCA, it was clear that there was a great awareness among managers of the activities that were undertaken by all functions as part of the PCP process. Also, many of the cost reduction initiatives undertaken by engineering, purchasing and manufacturing personnel require close liaison between those functions. In many cases knowledge of the trade-offs that may be required to assess the viability of changes in design, material and assembly activities entails the sharing of knowledge across the business. These activities could not be undertaken effectively without high degrees of communication and cooperation.

The Role of the Finance Function

185. A critical aspect in the PCP system at TMCA is the role of the finance function. The finance function is essential in managing the PCP process, and in bringing a discipline to the processes. It also plays an important role in supplying information to manufacturing personnel and supporting cost management efforts within manufacturing. The quotations in Chapter 7 illustrate clearly the level of trust that has developed between the finance staff and manufacturing.

186. This issue is an interesting one with which to end this study. Several commentators in the accounting area have questioned the nature of the future role of management accountants, as many organizations adopt new cost management techniques such as target costing and activity-based management, which may no longer rely heavily on accountants or accounting information. Some commentators have suggested that, with the adoption of

contemporary cost management techniques, accountants should become more involved in the management process, and claim that accountants should

- become part of the organization's value-adding team,
- move away from being "scorekeepers of the past" and instead play an active role in systems design,
- participate in the formulation and implementation of strategy,
- translate strategic intent and capabilities into operational and managerial measures.[4]

187. However, other writers have argued that many new cost management techniques do not rely on a great deal of accounting information, and instead use organizational forces to achieve cost management. Therefore, the involvement of accountants may not be required.[5]

188. In the case of TMCA "organizational forces" clearly play a role in cost management processes. Also, the major cost saving initiatives arise from the engineering, purchasing and manufacturing functions, as staff in these area are in the best position to identify opportunities for cost savings, and initiate activities and changes that may reduce cost. The finance function coordinates the PCP process, supplies performance reports (using both cost and physical measures), and provides support in the interpretation of performance reports to staff in all functions. It has been instrumental in encouraging a cost consciousness throughout TMCA, and has played a vital role in providing the framework and discipline within which the PCP process can succeed. It has become an integral and respected contributor to cost management at TMCA — an "organizational force" of considerable value.

[4] See, for example, Kaplan, R.S. (1995) "New Roles for Management Accountants", *Journal of Cost Management*, (Fall): 6–13.

[5] See, for example, Cooper, R. (1996) "Look Out, Management Accountants (Part 1)", *Management Accounting* (US), (May): 20–26; Cooper, R. (1996) "Look Out, Management Accountants (Part 2)", *Management Accounting* (US), (June): 35–41.

APPENDIX 1

KEY REFERENCES FOR TARGET COSTING

While the following list of references does not constitute a comprehensive survey of the literature, it provides the interested reader with further information about target costing and the way in which it is practiced and implemented in different companies.

Books

Ansari, S.L., Bell, J.E. and the CAM-I Target Costing Core Group. 1997. *Target Costing*. Irwin: Chicago.

This book is a very comprehensive treatment of target costing. It provides the scope, framework, process and tools for implementing target costing. There is a focus on internal and external relationships needed to undertake effective target costing. Target costing is seen as consisting of top-down and bottom-up processes. Organisational relationships are seen as the key to enabling the target costing system to operate effectively, particular with customers and suppliers. Many examples of target costing in US companies are used throughout the text, including Eastman-Kodak, Boeing, Chrysler and Texas Instruments.

Cooper, R. 1995. *When Lean Enterprises Collide*. Harvard Business School Press: Boston.

This book examines the competitive environment in which companies are forced to compete on both product quality and innovation as well as on price. Based on his analysis of nineteen Japanese companies across a number of industries (including Isuzu Motors, Ltd and Nissan Motor Company, Ltd in the automobile industry), Cooper identifies and describes a series of "aggressive" cost management techniques that are used by these companies. Of particular interest here are Chapter 7 (Target Costing) and Chapter 8 (Value Engineering). The chapter on target costing outlines the process and the factors affecting the design of a target costing system (nature of the product, the type of customer serviced, and the degree of influence over parts suppliers). The chapter on value engineering explains how this technique enables a firm to preserve the functionality requirements of a product while achieving cost objectives. The approach to value engineering used at Isuzu is described in some detail.

Cooper, R., and R. Slagmulder. 1997. *Target Costing and Value Engineering*. Institute of Management Accountants: Montvale, New Jersey.

This book is part of planned trilogy, which expands on the cost management technologies discussed in *When Lean Enterprises Collide*. The techniques and methods of target costing and value engineering are discussed in greater detail. Chapter 11 raises six questions that should be addressed by companies considering adopting a target costing approach to achieving and sustaining a competitive advantage and includes a checklist to help decide suitability. There are also seven case studies of Japanese companies reported in the study, including Nissan, Toyota and Isuzu.

Key Articles

Bhimani, A., and H. Okano. 1995. Targeting Excellence: Target Cost Management at Toyota in the UK. *Management Accounting*, 73(6): 42–44.

Burstein, M. C. 1988. Life cycle costing. In *Cost Accounting in the 90s*, 260. Montvale, New Jersey: Institute of Management Accountants.

Kato, Y. 1993. Target Costing Support Systems: Lessons from Leading Japanese Companies. *Management Accounting Research* 4: 33–47.

Kato, Y., G. Boer, and C. Chow. 1995. Target Costing: An Integrative Management Process. *Journal of Cost Management* (Spring): 39-51.

Lorino, P. 1995. Target Costing- Part 1: Target Costing — Practice and Implementation. *Articles of Merit 1995 Competition: FMAC Article Award for Distinguished Contribution to Management Accounting*, 101–121. New York: International Federation of Accountants.

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Moden, Y., and K. Hamada. 1991. Target Costing and Kaizen Costing in Japanese Automobile Companies. *Journal of Management Accounting Research* 3: 16–34.

Tanaka, T. 1993. Target Costing at Toyota. *Journal of Cost Management*, 7(1): 4–11.

Tani, T., H. Okano, N. Shimizu, Y. Iwabuchi, J. Fududa, and S. Cooray. 1994. Target Cost Management in Japanese Companies: Current State of the Art. *Management Accounting Research* 5: 67–81.

Yoshikawa, T., J. Innes, and F. Mitchell. 1989. Cost Management Through Functional Analysis. *Journal of Cost Management* 3 (Spring): 14–19.

APPENDIX 2

KEY TERMS AND DEFINITIONS

Confrontation strategy A strategy where it is assumed that it is unlikely that a firm will be able to achieve a sustainable competitive advantage. Rather, it is necessary to match competitors head-on in terms of product functionality, cost and quality.

Continuous improvement A commitment by all members of the workforce to find new ways to decrease waste and costs and increase efficiency in all organizational processes.

Cost leadership A generic competitive strategy whereby a firm strives to be the lowest cost producer in the industry in order to satisfy customers who do not have such high demands for quality and functionality.

Countermeasures Used within Toyota to describe corrective actions undertaken to help achieve a certain target, when planned actions cannot be carried out.

Differentiation A generic competitive strategy whereby a firm strives to provide products to customers who demand high quality and functionality and are prepared to pay premium prices for this.

Functionality This refers to the ability to which a product or service is able to meet the performance requirements of customers.

Kaizen costing An approach to costing which is concerned with reducing the costs of existing processes, products and components over time to pre-specified targets. Also called continuous improvement.

LTBP The long term business plan used at Toyota.

MPL Master parts list used within Toyota.

PCP The product cost planning system used at Toyota Australia to manage costs through target costing techniques.

RDDP "Request for design and development parts". This is used in value engineering at Toyota to indicate the situation when a part is based on drawings from Toyota Japan which are not too prescriptive.

SVP Start of volume production, which is a term used in Toyota to indicate the commencement of manufacture of a new model of motor vehicle.

Survival triplet A term defined by Cooper as the cost (price), quality and functionality of a product, which must be managed to ensure that products remain within the "survival zone".

Survival zone A term defined by Cooper as the difference between minimum and maximum levels or cost (price), quality and functionality in which product must fall to be successful.

TMCA The Toyota Motor Corporation of Australia.

TPS The Toyota Production System, which is the lean manufacturing system used by Toyota globally.

Target costing An approach to product cost planning in which the cost of a product with a given level of quality and functionality is determined in order to give a certain level of profit given the expected selling price.

Value analysis (VA) A process which entails studying the activities that are involved in producing the product to detect non-value-adding activities that may be eliminated or minimized to save costs, but without reducing functionality of quality of the product.

Value engineering (VE) A process which involves searching for opportunities to modify the design of each component to reduce cost, but without reducing functionality or quality of the product.