CHAPTER 89

Activity-Based Management in Manufacturing

KEITH V. SMITH
Purdue University

1. INTRODUCTION

During the last 15 years of the 20th century, the industrial sector of the United States made remarkable progress in restoring its competitiveness. The need to do so resulted from the trend toward a global economy, the increasing pace of technological innovation and development, and rapid advances in informational technology that made it possible. Progress occurred when industrial engineers and corporate managers began to *understand* the reasons why the U.S. industrial sector had slipped competitively. They began to *focus* on specific areas within the organization where things could be done more efficiently and effectively. And they began to develop a series of technological and management *improvements* in how work is planned, organized, and controlled in the modern-day organization. Improvements included material requirements planning (MRP), total quality management (TQM), computer-integrated manufacturing (CIM), just-in-time inventory (JIT), and activity-based costing (ABC).

This chapter deals with improvements in cost management systems, specifically with activity-based costing systems that are designed to provide more accurate costing of products and processes. The application of ABC systems to improve decision making within the organization is referred to as activity-based management (ABM). Included are decisions about product and process pricing, profitability of responsibility centers, capital equipment justification, and organizational performance. After reviewing the need for and development of ABC systems within the evolving manufacturing environment, we illustrate activity-based management with a case study from the automotive sector.

2. CONVENTIONAL COSTING SYSTEMS

The purpose of a cost management system is to provide management with information needed for external reporting and internal planning and control. A cost management system for a manufacturing firm includes cost accounting information for proper valuation of inventory and cost of goods sold; proper pricing of manufactured products, cash flow, and other information for proper justification of

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capital expenditures; and performance measurements for proper assessment of how the business unit, plus its managers and employees, are doing relative to their expressed goals and objectives.

Johnson and Kaplan (1987) provide a useful historical review of the development of cost management systems in the United States. Conventional cost management systems were first developed with the advent of the industrial revolution in the 19th century. Early systems were designed for firms that manufactured one or two products using a fairly simple production process. These early systems and the information they provided were appropriately expanded with changes in manufacturing. By 1920, virtually all management accounting practices used today had been developed: cost accounts for material, labor, and overhead; budgets for cash, income, and capital; and flexible budgets, sales forecasts, standard costs, variance analyses, transfer prices, and divisional performance measures.

But as the scope and diversity of manufacturing continued to increase in the 1930s and 1940s, the state of the art of management accounting did not keep pace. The lack of new ideas for cost management was in part due to the enormous growth of audited financial reporting, plus the emergence of the public accounting profession. By their nature, public accountants were interested more in generating financial statements for external public consumption and less in generating financial information for internal use by management. Until recently, external financial statements also focused on financial activity in the aggregate, with little attention to the financial progress of profit centers and/or business units within the total organization. Unfortunately, there was not enough pressure by management to develop a second accounting system for internal use.

When companies did attempt to account for individual profit centers, the procedure was straightforward. Costs of material and direct labor were relatively easy to track. The difficulty was in how to assign corporate overhead costs to each profit center. Because direct labor tended to be the largest expense category for most businesses, the easiest practice was just to allocate overhead expenses based on direct labor hours. In other words, the profit center with the largest amount of direct labor would thus have the largest overhead assignment. In essence, allocation of overhead to profit centers was a single-stage process based on direct labor. And because direct labor did not necessarily correlate with the way in which corporate overhead expenses were actually incurred, the single-stage allocation system was also an *arbitrary* costing system.

3. THE EVOLVING MANUFACTURING ENVIRONMENT

During the 1980s, U.S. manufacturers faced increasing competition, largely from abroad. They allowed themselves to fall behind by failing to recognize shifts in consumer demand. They compounded the difficulty by continuing to utilize manufacturing processes and costing systems that were developed in a different time under a different competitive environment. Better news was that many U.S. manufacturers began to understand these developments and began to take steps to improve their competitive posture during the decade of the 1990s. By emphasizing product quality, building flexibility into production processes, reducing inventory, shifting factors of production from direct labor to machinery and equipment, and reorganizing product lines toward less centralized service departments, U.S. manufacturers fought back. A pivotal ingredient was the use of newer and improved information technologies. Of interest in this chapter is the role that cost accounting played in enabling improved information for improved decision making by management.

In addition to the pioneering work of Johnson and Kaplan (1987), important contributions to the literature on cost management systems were provided by Berliner and Brimson (1988), Kaplan (1990), Brimson (1991), and Hicks (1992). An earlier source on the emerging literature on manufacturing management is Hayes et al. (1988). These sources collectively acknowledged the need for improved cost management systems and provided tangible examples of how improved systems could be used to help in improved management decision making.

At the beginning of the 1990s, a comprehensive survey of cost management systems in the United States was conducted by Sullivan and Smith (1993a, b). They investigated the extent and processes by which corporate managers adapted their costing systems to the evolving manufacturing environment. They analyzed responses from 289 manufacturing firms (with a wide range of firm size) to discover linkages between changes in cost management systems and changes in production processes, competitive market conditions, and key elements of manufacturing strategies. They found that while cost management systems were changing, it was more likely to be the fine-tuning of existing systems and less likely to be bold innovation in changing costing systems that would allow management to better understand the economics of their internal managed transactions.

Sullivan and Smith concluded that the evolution in costing systems was really just beginning because plant managers were not yet satisfied that they had the proper information for effective decision making within the organization. An example of bold innovation in cost management systems at that time was activity-based costing, but only 15% of the responding firms reported that they had developed an ABC system. We turn now to a closer look at how ABC developed during the 1990s, and especially how ABC was useful in improving activity-based management.

4. ACTIVITY-BASED COSTING SYSTEMS

Broadly defined, an *activity-based accounting system* is one that attempts to identify the primary activities that allow each cost category to be allocated to all business unit products as reasonably and accurately as possible. Unfortunately, activity-based information is rarely obtainable from the financial accounts that comprise a conventional cost accounting system. Why is it important to have accurate costs? Because managers in a competitive manufacturing environment need to know the true costs in order to decide what to produce and distribute. Decisions involving product design, new product introductions, and the amount of effort expended on trying to market a new product will be influenced by anticipated costs as well as anticipated revenues. Product costs also play an important role in setting prices for products, especially those customized products where there are no comparable market prices.

As mentioned before, direct labor is the basis for overhead allocations in conventional costing systems. But in a manufacturing environment that features technological development and automation, direct labor has become less and less important. Profitability no longer results from just reducing direct labor costs. For example, quality and flexibility play important roles in determining the profitability of the manufacturing firm.

How does a manufacturing firm design and develop an activity-based costing system that provides more accurate information on product costs? As explained by Hilton (1997), management must continue to collect accurate data on direct labor and material costs. But management must also analyze the demands that various products make on the overhead resources of the firm. In so doing, it is useful to give greater attention to more expensive overhead activities, as well as those overhead activities whose consumption varies dramatically across products or product groups.

Another difference between conventional and ABC costing systems is that conventional costing is a single-stage allocation system, while ABC is a two-stage system of allocation. In conventional costing, overhead costs are allocated to profit centers or business units based on direct labor. In ABC, overhead costs are first allocated to *cost pools* of activity. Examples of cost pools in a manufacturing firm are machinery, engineering, purchasing, receiving, inspection, materials handling, quality assurance, packaging, and shipping. For each cost pool, the key activity or *cost driver* is identified. Examples of cost drivers are purchase orders, units produced, inspections, and shipments. In the second stage of allocation, costs in each overhead pool are allocated to profit centers based on the cost driver that is unique to that cost pool.

As a result of a two-stage process of cost allocation, activity-based costing is apt to reflect different costs than in a conventional costing system. For example, costs associated with ordering parts, keeping track of parts, inspecting parts, and setting up to produce parts as input to larger assemblies make up a large fraction of what normally might be classified as purchasing, as just one segment of total manufacturing overhead. However, there are two cost categories that should *not* be included in an activity-based costing system. Research and development costs for new products are more appropriately treated as a capital expenditure. And cost of excess capacity should be separated from product costs so as not to penalize products unfairly during periods of slack demand.

While there is a need for improved cost information, establishing an activity-based cost management system is not easy. And it becomes more difficult as the business firm becomes larger and more complicated. Many corporate managers have been reluctant to abandon a single conventional costing system. But the increased availability of computational power over time has enabled firms to develop and install an improved, second accounting system that provides useful information for internal decision making. Armed with more accurate product cost information, managers can contemplate improved strategic decisions on product lines, product prices, capital expenditures, and organizational performance. That is why the application of ABC is referred to as activity-based management

Activity-based costing represents a distinct improvement over conventional costing. But according to Kaplan and Cooper (1998), most U.S. firms are only at the third of four possible stages of development. Their first stage includes many firms that a decade or more ago had a conventional accounting system that simply did not provide accurate information. The second stage includes firms having an adequate accounting system for external reporting, but nothing that would help with internal management decisions. Kaplan and Cooper believe that many firms are now in the third stage because they have realized the need for improved information for managerial decision making and have developed a second and alternative accounting system for measuring and monitoring costs internally that leads toward improved decision making. The authors suggest a fourth stage in which firms develop a comprehensive accounting system that provides for both external financial reporting and internal decision making. It also should have the capacity to integrate financial reporting of the past and management decision making in the future.

5. CASE STUDY OF AN AUTOMOTIVE MANUFACTURER

To illustrate activity-based costing systems and how they can be used to make improved management decisions, we examine the case of the Titantic Auto Production Company (TAP). An earlier version

TABLE 1 Titatic Auto Production Company Balance Sheet as of December 31, 1999 (in millions)

Cash et al.	$3.1	Current liabilities	$18.1
Receivables	9.4	Long-term debt	13.3
Inventory	12.7	Common stock	7.2
Net fixed assets	30.8	Retained earnings	17.4
Total	$56.0	Total	$56.0

of the case study was presented in Smith and Leksan (1991). Henry Hankinson, president and chief executive officer of TAP has decided that his firm must do something rather drastic to improve their cost management system. Two years ago, Mr. Hankinson attended a seminar in Boston entitled "Manufacturing Strategies for the Future." The seminar was attended by about 70 CEOs of medium-sized manufacturing firms. In addition to making interesting new contacts, Hankinson found the presentations excellent and the ensuing discussions both intense and useful.

Among the topics covered at the seminar, Hankinson was particularly interested in one session on cost management. The featured speaker at that session, a well-regarded professor from an eastern university, discussed management's critical need for better financial information. The thesis of his presentation was that for many manufacturing firms, today's financial information is based on antiquated cost-accounting systems that do not reflect the reality of the increasingly competitive environment for manufacturing.

That single presentation, together with the lively discussion that followed, convinced Hankinson that he and the TAP board of directors were just not getting the information needed to make important decisions at this critical time in the history of their firm. Among those questions were the pricing of one particular auto model, the relative profitability of TAP's three product lines, the possibility of further automation, and the overall ability of TAP management to control the business. As a result, Henry Hankinson has decided to look beyond the monthly reports that he now receives.

Last month at the TAP annual meeting, CEO Henry Hankinson presented the financial statements for 1999. As seen in Tables 1 and 2, TAP had total sales revenue of $66.5 million on assets of $56 million at year end. After-tax income of $4.9 million (up from $4.6 million in 1998) amounted to 7.4% of sales, 8.8% of assets, and a return on equity of 19.9%. These profitability numbers were well received at the annual meeting, but Hankinson is not sure how TAP compares with other firms in the automotive industry. He also is not sure what changes, if any, should be made in the TAP product line and marketing strategy so as to remain competitive in the years ahead. In order to answer these questions, as well as to learn more about TAP's cost management system, Mr. Hankinson requests a meeting with corporate comptroller Bradley Bartlett.

Bradley Bartlett is well prepared for his meeting with Henry Hankinson. Breakdowns of sales and profitability for each of the three automobiles produced by TAP—compact, midsize, and luxury—are shown in Tables 3 and 4, respectively. In Table 3, we see that total sales volume reached 10,000 autos in 1999, an increase of almost 650 vehicles from the prior year. Although sales volume increased for all three models, compacts accounted for most of that. Management has been pleased with the results of the vigorous advertising program for compacts that led to that increase. For purposes of this illustration, we assume that TAP is operating nearly at maximum capacity.

TABLE 2 Titantic Auto Production Company Income Statement for the Year Ended December 31, 1999 (in millions)

Gross revenues	66.5
Operating expenses	−58.3
Gross margin	8.2
Corporate overhead	− 1.2
Before-tax income	7.0
Federal taxes (30%)	− 2.1
After-tax income	$4.9

TABLE 3 Schedule of Sales Revenues by Model for the Year Ended December 1999

Model	Volume	Price	Revenue
Compact	7,000	$ 5,000	$35.0 million
Midsize	2,900	10,000	29.0 million
Luxury	100	25,000	2.5 million
Totals	10,000		$66.5 million

Profitability by model is analyzed in Table 4, and we see a quite different picture, with compacts actually losing almost $2.3 million. In Table 4, manufacturing overhead totaling $25.0 million is allocated by the conventional method on the basis of direct labor hours at the rate of $25 per hour. By far the largest contributor to TAP's gross margin in 1999 was the midsize product line. Bartlett explains that TAP's corporate overhead of $1.2 million must be subtracted from the gross margin of $8.2 million (Table 4) in order to obtain the firm's before-tax income of $7.0 million (Table 2). Profitability of an individual vehicle is presented in Table 5. Under a conventional cost management system, we see that TAP loses $325 on each compact sold. In contrast, TAP makes $3,150 on each midsize and $13,400 on each luxury automobile.

Despite the favorable aggregate results of TAP for 1999, Hankinson and Bartlett agree that they need to reconsider the emphasis on particular models within the total product line. In particular, should TAP continue its aggressive advertising for compact automobiles when that particular product apparently is losing money? Mr. Hankinson shares his notes and experiences from the seminar that he attended, and he asks Mr. Bartlett to see if he can apply some of the newer thinking to their firm—especially the concept of ''activity-based'' cost accounting.

Two weeks later, Messrs. Hankinson and Bartlett have a second meeting to continue their discussion of the relative profitability of the TAP automotive products. Because Mr. Hankinson is scheduled to attend a local meeting of financial analysts to discuss the latest earnings prognosis for TAP, he has time for only a summary of Bradley's work during the last few days. Mr. Bartlett thus decides to present only the comparison in Table 6.

The comparison between conventional and activity-based cost accounting systems is striking. We see that the results have reversed. Namely, compacts made money, while luxuries lost money. Meanwhile, midsized automobiles continued to generate the largest part of gross margin. Both Hankinson and Bartlett are surprised at these results. Henry Hankinson asks for further explanation at their next

TABLE 4 Schedule of Profitability by Model—Conventional Cost Management System—for the Year Ended December 31, 1999 (in millions)

Model	Sales Revenue	Material	Direct Labor	Overhead	Total Cost	Gross Margin
Compact	$35.0	$14.0	$6.65	$16.62	$37.27	($2.27)
Midsize	29.0	8.7	3.19	7.98	19.87	9.13
Luxury	2.5	0.6	0.16	0.40	1.16	1.34
Totals	$66.5	$23.3	$10.00	$25.00	$58.30	$8.20

TABLE 5 Schedule of Profitability by Vehicle—Conventional Cost Management System—for the Year Ended December 31, 1999 (in millions)

Model	Sales Revenue	Material	Direct Labor*	Overhead	Total Cost	Gross Margin
Compact	$5,000	$2,000	$950	$2,375	$5,325	($325)
Midsize	10,000	3,000	1,100	2,750	6,850	3,150
Luxury	25,000	6,000	1,600	4,000	11,600	13,400

*Direct labor is charged at $10/hr.

TABLE 6 Comparison of Accounting Systems on Gross Margin for the Year Ended December 31, 1999 (in millions)

Model	Sales Revenue	Gross Margin	
		Conventional-Cost	Activity-Based
Compact	$35.0	($2.27)	$2.00
Midsize	29.0	9.13	8.79
Luxury	2.5	1.34	(2.59)
Totals	$66.5	$8.20	$8.20

meeting as to why activity-based cost accounting leads to such different results. Bradley Bartlett agrees to try to provide the requested information.

6. IMPROVED PRODUCT PRICING AND PROFITABILITY

Ten days later, Bradley Bartlett provides the necessary backup information to justify the comparison in Table 6. He explains that TAP has four distinct overhead functions, and thus it is necessary to examine each function individually. The four overhead departments are purchasing, production planning and control, quality control and inspection, and inventory control. The respective analyses are presented as Tables 7–10.

For each overhead department, it is necessary to define the particular activities that drive the functions within that department. For example, in 1999 the purchasing department (see panel A of Table 7) incurred total costs of $5 million. Cost drivers were the purchasing of raw materials, the purchasing of components, and vendor relations. Appropriate allocation measures for these activities are the number of orders for purchasing, and the number of vendors for vendor relations. Levels of those activities for each auto model are indicated in panel B. In turn, these levels lead to the total allocated costs for each auto model in panel C.

TABLE 7 Activities and Costs for Purchasing for the Year Ended December 31, 1999

Panel A: Analysis

Activity	Number of Employees	Total Cost	Allocation Measure	Unit Cost
Purchasing materials	20	$2.0 million	Number of orders	$2,000
Purchasing components	5	1.0 million	Number of orders	250
Vendor relations	10	2.0 million	Number of vendors	20,000
Totals		$5.0 million		

Panel B: Activities

Model	Number of Purchase Orders		Number of Vendors
	Materials	Components	
Compact	500	2000	25
Midsize	300	1500	30
Luxury	200	500	45
Totals	1000	4000	100

Panel C: Costs (in millions)

Model	Purchasing Materials	Purchasing Components	Vendor Relations	Total Cost
Compact	$1.00	$0.50	$0.50	$2.00
Midsize	0.60	0.38	0.60	1.58
Luxury	0.40	0.13	0.90	1.43
Totals	$2.00	$1.00	$2.00	$5.00

TABLE 8 Activities and Costs for Production Planning and Control for the Year Ended December 31, 1999

Panel A: Analysis

Activity	Number of Employees	Total Cost	Allocation Measure	Unit Cost
Developing manufacturing plan	10	$1.0 million	Number of units produced	$100
Controlling manufacturing plan	10	1.0 million	Number of units produced	100
Expediting manufacturing plan	10	1.0 million	Number of units expedited	500
Totals		$3.0 million		

Panel B: Activities

Model	Number of Units Produced	Expedited
Compact	7,000	1,500
Midsize	2,900	450
Luxury	100	50
Totals	10,000	2,000

Panel C: Costs (in millions)

Model	Developing Manufacturing Plan	Controlling Manufacturing Plan	Expediting Manufacturing Plan	Total Cost
Compact	$0.70	$0.70	$0.750	$2.150
Midsize	0.29	0.29	0.225	0.805
Luxury	0.01	0.01	0.025	0.045
Totals	$1.00	$1.00	$1.000	$3.000

The other overhead departments for TAP are production planning and control ($3 million), inventory control ($10 million), and quality control and inspection ($7 million). Similar activity and cost analyses for the other overhead departments (see Tables 8–10) provide improved overhead allocations that can be used to better understand the relative profitability of each of the TAP auto models. The results are included in a revised profitability schedule in Table 11. It shows how a conventional costing system can lead to incorrect decisions by management.

For example, Simon Starling, senior manager of the TAP compact product line, recently suggested that the price of compacts should be increased by 10% in the next model year from $5000 to $5500. According to Starling, if sales remained at the current level of 7000 vehicles, revenues and costs would increase, but gross margin would improve from a loss of $2.27 million to a profit of $1.2 million. Such an improvement certainly would be welcomed. But, more realistically, a price increase of 10% may well affect sales volume for compacts, especially since the compact model competes in a price-sensitive segment of the market. Mr. Starling forecasts an *expected* sales volume of only 5500 vehicles as a result of the 10% price increase. At the same time, Starling's colleagues believe that sales of midsize and luxury automobiles are likely to remain the same during the next model year.

A comparison of direct labor utilization is shown in Table 12. Total overhead costs of $25 million remain the same, at least in the short run, and per hour costs thus increase from $25 per hour (before the price increase) to $25 million/857,500 hr = $29.15/hr (after the price increase). Recomputation of overhead allocations on model profitability via a conventional cost system is presented in Table 13.

Comptroller Bradley Bartlett notes that sales revenue for compacts would be expected to decrease from $35 million to $30.2 million as a result of the lower volume. The gross margin for compacts improves from a loss of $2.27 million (before price increase) to a loss of $1.28 million (after price increase). Gross margins of both midsize and luxury models decrease because they are penalized by having to absorb more of the total corporate overhead. Under the conventional cost management system, management might also look at the decreased gross margins for the midsize and luxury models and thus propose price increases for those products as well. In other words, conventional cost management systems give incorrect signals that are not in the best interest of the firm and its owners.

TABLE 9 Activities and Costs for Inventory Control for the Year Ended December 31, 1999

Panel A: Analysis

Activity	Number of Employees	Total Cost	Allocation Measure	Unit Cost
Receiving parts	25.0	$5.0 million	Number of shipments	$1,250
Receiving materials	12.5	2.5 million	Number of shipments	2,500
Disbursing materials	12.5	2.5 million	Number of production runs	50,000
Totals		$10.0 million		

Panel B: Activities

Model	Number of Shipments		Number of Production Runs
	Parts	Materials	
Compact	2000	500	10
Midsize	1500	300	15
Luxury	500	200	25
Totals	4000	1000	50

Panel C: Costs (in millions)

Model	Receiving Parts	Receiving Materials	Disbursing Materials	Total Costs
Compact	$2.500	$1.250	$0.500	$4.250
Midsize	1.875	0.750	0.750	3.375
Luxury	0.625	0.500	1.255	2.375
Totals	$5.000	$2.500	$2.500	$10.000

If TAP instead were to utilize an activity-based costing system, Simon Starling probably would not have proposed a price increase, since compacts already were making a positive contribution (see Table 11) to the overall profitability of TAP. Under the activity-based costing system, the difficulty caused by lower volume would be avoided by treating the cost of idle capacity as a *period cost,* rather than attributing it to individual products. This is illustrated in Tables 14 and 15. The Starling proposal would cause the gross margin of compacts to increase from $2 million (in Table 11) to $4.01 million (in Table 15). However, that improvement would be more than offset by the $2.39 million cost of idle capacity, so the project should be rejected. However, note that the activity-based costing system suggests that TAP's problem is not with the compacts, but with the luxury line of automobiles. Specifically, either the price of the luxury line should be increased substantially, and/or costs for luxury vehicles should be decreased if possible. Alternatively, TAP should consider abandoning that segment of the market.

7. IMPROVED CAPITAL INVESTMENT JUSTIFICATION

Two months ago, the TAP board of directors heard a presentation from the president of a foreign firm that manufactures high-technology industrial equipment. The firm has a new machine that performs a variety of inspection activities with great precision and considerable flexibility. The president of the foreign firm argues that their new machine is ideally suited for relatively low volume, high-quality manufacturing, such as TAP's midsize automobiles. The new machine costs $2.2 million, has an expected useful lifetime of six years and an estimated salvage value of $400,000, and is expected to reduce by two-thirds the manual inspection of midsize automobiles.

The TAP board was impressed by the presentation, and some members believe that the proposed new machine will add to the profitability of the midsize line. As a result, Henry Hankinson asks Bradley Bartlett to run the numbers, factor in other relevant considerations, and make a recommendation. Bartlett wonders if his new data, using activity-based cost analysis, will have any impact on his eventual recommendation.

Bradley Bartlett has worked hard on trying to understand the full implications of the proposed new machine for automated inspection of midsize automobiles. He wonders what incentive there

TABLE 10 Activities and Costs for Quality Control and Inspection for the Year Ended December 31, 1999

Panel A: Analysis

Activity	Number of Employees	Total Cost	Allocation Measure	Unit Cost
Inspecting materials	15	$3 million	Number of shipments	$600
Inspecting autos	20	4 million	Number of inspection points × number of autos	12.50
Totals		$7 million		

Panel B: Activities

Model	Number of Shipments	Number of Inspection Points/Auto	Total Number of Points
Compact	2500	28	196,000
Midsize	1800	41	118,900
Luxury	700	51	5,100
Totals	5000		320,000

Panel C: Costs (in millions)

Model	Inspecting Materials	Inspecting Autos	Total Cost
Compact	$1.500	$2.450	$3.950
Midsize	1.080	1.486	2.566
Luxury	0.420	0.064	0.484
Totals	$3.000	$4.000	$7.000

TABLE 11 Revised Schedule of Profitability by Model—Activity-Based Cost Management System—for the Year Ended December 31, 1999 (in millions)

Model	Sales Revenue	Material	Direct Labor	Overhead	Total Cost	Gross Margin
Compact	$35.0	$14.0	$6.65	$12.35	$33.00	$2.00
Midsize	29.0	8.7	3.19	8.32	20.21	8.79
Luxury	2.5	0.6	0.16	4.33	5.09	(2.59)
Totals	$66.5	$23.3	$10.00	$25.00	$58.30	$8.20

TABLE 12 Revised Schedule of Direct Labor Utilization—Conventional Cost Management System—for the Next Model Year

	Before Price Change		After Price Change	
Model	Volume	Labor Hours	Volume	Labor Hours
Compact	7,000	665,000 (66.5%)	5,500	522,500 (61%)
Midsize	2,900	319,000 (31.9%)	2,900	319,000 (37%)
Luxury	100	16,000 (1.6%)	100	16,000 (2%)
Totals	10,000	1,000,000	8,500	857,500

TABLE 13 Revised Schedule of Profitability by Model—Conventional Cost Management System—for the Next Model Year (in millions)

Model	Sales Revenue	Material	Direct Labor	Overhead	Total Cost	Gross Margin
Compact	$30.2	$11.0	$5.23	$15.25	$31.48	($1.28)
Midsize	29.0	8.7	3.19	9.25	21.14	7.86
Luxury	2.5	0.6	0.16	0.50	1.21	1.29
Totals	$61.7	$20.3	$8.58	$25.00	$53.88	$7.82

TABLE 14 Comparison of Direct Labor Utilization for the Next Model Year

Model	Conventional Cost	Activity-Based Cost
Compact	522,500	522,500
Midsize	319,000	319,000
Luxury	16,000	16,000
Idle capacity	0	142,500
Totals	857,500	1,000,000

TABLE 15 Revised Schedule of Profitability by Model—Activity-Based Cost Management System—for the Next Model Year (in millions)

Model	Sales Revenue	Material	Direct Labor	Overhead	Total Cost	Gross Margin
Compact	$30.2	$11.0	$5.23	$9.96	$26.19	$4.01
Midsize	29.0	8.7	3.19	8.32	20.21	8.79
Luxury	2.5	0.6	0.16	4.33	5.09	(2.59)
Subtotals	61.7	20.3	8.58	22.61	51.49	10.21
Cost of idle capacity				2.39	2.39	(2.39)
Totals	$61.7	$20.3	$8.58	$25.00	$53.88	$7.82

TABLE 16 Allocation of Overhead on All Product Lines—Proposed Inspection Equipment for Mid-Sized Automobiles—Conventional Cost Management System

Model	Before	After	Savings
Compact	$4,655,000	$3,990,000	665,000
Midsize	2,233,000	1,914,000	319,000
Luxury	112,000	96,000	16,000
Totals	$7,000,000	$6,000,000	$1,000,000

might be for management of the midsize line to adopt such a cost-savings device, since under the conventional cost management system the savings would reduce that portion of total overhead attributable to quality control and inspection, which in turn is then allocated to all three TAP product lines. The midsize product line thus would not receive the full benefit of the new inspection equipment. To understand the implication of this, he decides to prepare an analysis of the potential savings from the proposed foreign equipment under both cost management systems.

The conventional cost management system cannot even tell TAP management how many hours currently go into inspection. In a sense, this isn't important to the conventional system, since total

overhead expenses are allocated on the basis of direct labor hours. Bartlett proceeds as follows for his analysis of the midsize product line:

20 employees × 32 effective hr per week × 50 weeks = 32,000 hr/yr.

320,000 inspection points/32,000 hr/yr = 10 inspection points/hr.

Each midsize auto has 41 inspection points, hence 4.1 hr of inspection time per auto.

2,900 autos × 4.1 hr = 12,000 hr of inspection.

Reduced by two-thirds from 12,000 to 4,000 hours, hence savings = 8,000 hr, or 5 employees.

5 employees × ($10 wages/hr + $2 benefits/hr) × 40 hours/wk × 52 weeks = $125,000/yr.

Since this is a permanent reduction in number of employees, the fixed overhead attributed to each employee is also eliminated, for a savings of $1 million.

Assuming overhead percentage among the three product lines remains the same, under conventional costing, the midsize line would have an overhead reduction of $1 million × 31.9% (see Table 12) = $319,000.

Total quality control and inspection overhead of $7 million is reduced by $125,000 in labor saved and $875,000 of fixed overhead to become $6 million. The savings by product line is shown in Table 16.

Bradley Bartlett is puzzled by this result. Under the conventional cost management system, the primary beneficiary of the proposed inspection equipment for midsized automobiles is the compact line, even though that part of the business has nothing to do with the proposed new equipment. Management of the midsize product line would have little incentive to even propose the project, since they would be charged the entire $2.2 million cost of the new machine and yet receive credit for only part of the potential savings. In fact, under conventional costing, the project would actually reduce the return on investment of the midsize line, even though the project would help the corporation overall.

Bartlett next proceeds to analyze of how the proposed new equipment for midsized inspection would look under an ABC system. His calculations are shown in Table 17. The results are striking. Under an activity-based system, the $1 million savings per year is fully attributed to the midsized product line. If TAP has a tax rate of 30% and an annual after-tax cost of capital (i.e., required rate of return) of 15%, then the net present value of the six year investment would be as follows:

Present value:		
Savings	(3.784)(1,000,000)	$3,784,000
Tax shield	(3.784)(2,200,000 − 400,000)/6 yr	340,560
Salvage	(0.432)(400,000)	172,800
		$4,297,360
Cost of the inspection equipment		−2,200,000
Net present value		$2,097,360

This, of course, looks very good for TAP, and it is directly a result of a proposal appropriately attributable to the midsize product line.

8. IMPROVED PERFORMANCE MEASUREMENT

Bradley Bartlett had just completed his analysis of the inspection equipment when he received another proposal from the compact division. Their top management proposes a $2 million automation project that is expected to reduce direct labor from 95 hr to 90 hr per automobile. Again, he wonders how this proposal will look under different cost management systems. He also feels that he should be careful to include all relevant considerations in his analysis.

Mr. Bartlett proceeds to analyze the new proposal from the compact division. The automation project will result in the reduction of direct labor from 95 hours to 90 hours per auto. That would represent an annual savings of:

$$5 \text{ hr} \times 7{,}000 \text{ autos} \times \$12/\text{hr} = \$420{,}000$$

The new automated process costs $2 million and has an expected lifetime of five years and an estimated salvage value of $300,000. The annual tax shield would be:

TABLE 17 Activities and Costs for Quality Control and Inspection for the Year Ended December 31, 1999

Panel A: Analysis

Activity	Number of Employees	Total Cost	Allocation Measure	Unit Cost
Inspecting materials	15	$3 million	Number of shipments	$600
Inspecting	15	3 million	Number of inspection points × number of autos	12.50
Totals		$6 million		

Panel B: Activities

Model	Number of Shipments	Number of Inspection Points/Auto	Total Number of Points
Compact	2500	28	196,000
Midsize	1800	⅓ × 41 = 14	40,600
Luxury	700	51	5,100
Totals	5000		241,700

Panel C: Costs (in millions)

Model	Inspecting Materials	Inspecting Autos	Total Cost
Compact	$1.500	$2.450	$3.950
Midsize	1.080	0.500	1.580
Luxury	0.420	0.064	0.484
Totals	$3.000	$3.000	$6.000

$$30\% \times (\$2 \text{ million} - \$300{,}000)/5 \text{ years} = \$102{,}000$$

The present value calculation, again using a 15% cost of capital, would be as follows:

Present value:

Savings	(3.353)(350,000)	$1,408,260
Tax shield	(3.353)(102,000)	342,000
Salvage	(0.497)(300,000)	149,100
		$1,899,360
Cost of investment		−2,000,000
Net present value		($100,640)

Because net present value is negative, the proposal would not be accepted using the conventional costing system.

Suppose, however, that the new equipment will also improve the flexibility of TAP to offer additional options of the component whose production is being automated. The machine can perform certain manufacturing steps in very short times that were economically infeasible to perform under the current production process.

This ability to offer additional variations of the component is expected to be valued by consumers, and TAP will be able to charge more for compacts that have these option variations. It is anticipated that 2000 compacts per year would be sold with the more expensive option at a price of $5,070 (i.e., $70 higher). Added material cost for the option is $10, and hence TAP would benefit each year by the after-tax amount of:

$$2{,}000 \text{ autos} \times (\$70 - \$10) \times (1 - 30\%) = \$84{,}000$$

The present value of this is:

$$\$84{,}000 \times 3.353 = \$281{,}650$$

The net present value of the proposal becomes $181,010, and the project should now be accepted. Once again, activity-based costing leads to an improved management decision.

Henry Hankinson and Bradley Bartlett are preparing for the next monthly meeting of the TAP board of directors. As part of his CEO report, Hankinson has decided to make a presentation to the board on the firm's improved cost management system. He asks Mr. Bartlett to prepare illustrations for some recent management proposals where the older cost management system would have led to incorrect or myopic decisions. More work needs to be done to improve their cost management system further, but Henry Hankinson is pleased with the progress as TAP strives to be more competitive in the automobile industry. Mr. Hankinson also decides that he must confront the issue of whether the Titantic Auto Production Company should consider moving into the next stage of development, namely an integrated accounting system that would provide accurate information both externally and internally.

9. SUMMARY

As suggested by the TAP case study, it is likely that much of the information generated by conventional costing systems is inadequate in the evolving manufacturing environment. Focusing on the key costs of a bygone competitive era, conventional costing systems cannot adequately explain the rise of key costs today, namely, overhead. Making matters worse, conventional costing systems allocate overhead on the basis of direct labor, which in many operations is a relatively minor expense. This is where product cost distortions occur. Finally, the standard approaches toward pricing and investment decision making may well not reflect all of the relevant factors that have an impact on the firm.

Managers need to know what their products cost in order to make appropriate decisions concerning the products that they manufacture. This has become critical in the evolving manufacturing environment in which U.S. firms find themselves. However, product-costing decisions cannot be made in a vacuum. In and of itself, this does not increase the competitive advantage of a company. Company management must analyze its entire manufacturing strategy and make necessary changes that will lead to a competitive advantage in its operating activities.

The cost management system of a successful firm needs to be developed to handle two functions. First, it must generate nonfinancial indicators of operating results on a timely basis so that management can control the manufacturing process. Second, it must cost products on the basis of the underlying activities and their costs, rather than on just the purely financial numbers that are utilized for product costing in their conventional systems. In sum, the focus of their cost management system much be changed from its current role of inventory costing for financial statement purposes to a role that involves the effective control of operating activities, the accurate pricing of a company's products, and correct decisions about proposed capital investments and how the organization is appraised overall. Only when the cost management system reaches the third stage can it be used as a competitive weapon in the evolving manufacturing environment of the 20th century. The fourth stage of development for cost management systems is even more promising for firms in the 20th century as they explore the possibility of developing an integration of their external and internal accounting systems.

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