

# Linking Value Chain Costs To Products And Customers: Survey And Evaluation Of Large U.S. Manufacturing Firms' Current Practices

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## ABSTRACT

*Success in a competitive environment requires effectively selecting an optimal mix of value chain activities. Despite the fact that corporate executives need to understand the costs and benefits of supporting particular products and customers, little empirical evidence is available on how, and how well, companies are linking their value chain costs to these two cost objects. The results of this study, based on responses to a survey of 120 large U.S. manufacturing companies, indicate that firms tend to link their value chain costs to products/product lines more than to customers/customer classes. For both cost objects, most of the cost allocation bases used is volume-based. These findings suggest that while there is attention to the value chain costs, there is room for increasing the proportion of costs traced to products and customers and for expanding the use of non-volume allocation bases.*

## INTRODUCTION

This study contributes to the business literature by examining how large U.S. manufacturing firms apply value chain framework and trace costs to products and customers. Boer's comments made on his 1996 article motivate our study. As Boer states, management accountants are responsible in shaping up corporate accounting information system in order to support a firm's strategy. Specifically (Boer, 1996, p. 46),

*Management accountants will be business partners in the year 2000 and beyond as they become increasingly involved in shaping the direction and scope of their companies. Accounting systems will become dynamic and flexible to help managers create financial analyses of critical drivers of business success. A central accounting function will define and maintain the core sets of data used to make sure that companies satisfy all the internal needs as well as all external reporting requirements for external stakeholders.*

To ensure an organization can survive and succeed in a competitive marketplace, management accountants need to understand the firm's current management accounting practices so that they can design and implement an information system to support managerial decisions. Within the core set of data provided by the management accountants to corporate executives, allocation of indirect costs, such as manufacturing overheads, is crucial to the product pricing and marketing decisions. While traditional cost system (e.g., volume-based allocation) may be easier to adopt and more convenient to use than a sophisticated system (e.g., activity-based costing), the extant literature has documented that a traditional cost management system has a number of weaknesses, including the problem of over-costing or under-costing of products or services. To mitigate this potential problem, during the past two decades, practitioners and academicians have invested considerable effort in refining the existing management accounting practices.

Among many methods proposed, Porter (1985, p. 33) has suggested the “value chain” approach. Value chain analysis can be an effective tool for optimizing the usage of the firm’s resources, because it “disaggregates a firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation.” Since then, many authors have expanded on Porter’s framework and explained how value chain analysis can be an important tool to manage costs strategically (Shank and Govindarajan, 1993; SMAC, 1996; Booth, 1997; Bromwich and Hong, 1999; Anderson et al., 2000; Mouritsen et al., 2001; Dekker 2004).

To contribute to the body of accounting literature, our study explores the current practices among large U.S. manufacturing firms on how they link value chain costs to products and customers. Insights gained from the results of this study will enhance our understanding on how organizations link their corporate strategies to operations across the value chain (Chenhall, 2005). In our view, such understandings will offer venues for companies that are seeking for opportunities to continue improving their practices.

According to Porter (1985), a value chain is the sequence of major business activities which add utility (usefulness) to the products or services provided by an organization to its customers. While one can define or group such activities in many different ways, the following categorization is a reasonable approach to structuring such activities<sup>1</sup>:

- **Overall Administration** -- Strategy formation, establishment of policies, coordinating, directing, and undertaking the legal, financial, human resource, and accounting functions.
- **Research and Development** -- The generation of, and experimentation with, ideas related to new products, services, or processes.
- **Design** of products, services, or processes -- The detailed planning and engineering of products, services, or processes.
- **Production** -- The coordination, acquisition and use of resources to produce products or deliver services.
- **Marketing** -- The process by which external customers (a) learn about and value the attributes of products or services, and (b) purchase those products or services.
- **Distribution** -- The mechanism or process by which products or services are delivered to external customers.
- **Customer Service** -- The support activities provided to external customers after the sale.

How an organization undertakes these activities can affect an organization’s profitability in two ways. First, the efficiency with which the firm undertakes each activity directly affects total operating costs. Second, the mix of activities can affect both total costs and how much customers are willing to pay for the firm’s output (Artto, 1994; Shields and Young, 1991; Susman, 1989). Focusing on internal operations, increasing emphasis on the design stage, an upstream activity, could increase the cost of this activity. At the same time, it may reduce the costs of marketing, a downstream activity, while increasing the customer appeal of the final product. By selectively outsourcing activities (e.g., maintenance, data processing) and managing relationships with both suppliers and customers, a firm can enhance the value of its products while reducing costs.

Given the importance of value chain management, it is useful to consider how management accountants and the firm’s information systems can best help an organization to manage its value chain activities. Based on our preceding discussion, the primary concern of corporate executives is how to maximize the value that customers place on the product while producing the product at the lowest possible cost. To achieve this objective, the firm needs data on the mix of value chain costs involved in supporting each product and to serve different customers (Boer, 1996; Foster, 1996; Foster and Gupta, 1994; Foster et al., 1996; Innes and Mitchell, 1995). Since the ultimate concern for corporate executives is profitability, optimal tradeoffs made among value chain activities require a combination of cost data with revenue data for products and customers. Our study focuses on the costing side of the equation. Specifically, this study aims to increase our understanding on how firms’ annual operating costs are distributed among the major classes of

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<sup>1</sup> Six of these value chain activities are based on Horngren, Foster and Datar (1997, p. 3) and SMAC (1996, p. 4). We added the first activity, namely “overall administration,” based on Porter’s (1985) discussion.

value chain activities, the extent to which firms attribute each value chain cost to product/product lines and customer/customer classes based on a cause and effect analysis, and the cost allocation bases used.

The remainder of this paper is structured as follows. Section II reviews the extant literature in value chain analysis. Section III discusses the data collection method. Section IV presents findings on current practices. Section V contains a summary and discussion.

## **LITERATURE REVIEW**

An extensive body of accounting literature has addressed the importance of using value chain analysis to manage an organization's practices. For instance, Shank and Govindarajan (1992) stress that the starting point for cost analysis is defining an industry's value chain activities and then assigning costs, revenues, and assets to the various value-adding activities. Shank and Govindarajan believe that value chain activities are the building blocks of an organization to create products valuable to buyers. Implementing value chain analysis would assist firms in reaching decisions that achieve better product differentiation and create price leadership. Along a similar line of arguments, Boer (1996) underscores the significance of developing models in order to maximize firm value by incorporating all the costs of product development, production, and marketing that add value to the firm's products or services. In addition, Booth (1997) points out that value chain analysis provides a useful perspective into a company's competitive position. As Booth indicates, two benefits of the value chain analysis are reaching better decisions on how to achieve product differentiation and creating cost leadership. Donelan and Kaplan (1998) emphasize that whether a firm can sustain and strengthen its competitiveness depends on the ability of its managers to differentiate the firm's products/services from those of its competitors. Overall, many believe it is desirable for corporate managers to fully implement value chain analysis so their companies can differentiate their products and achieve a high level of customer satisfaction.

To provide useful information for decision-making, a firm needs to build an accounting information system that fits into its organization. To achieve this objective, Shank and Govindarajan (1993) support the use of cost analysis to develop superior strategies in the search for sustainable competitive advantage. Foster and Gupta (1994) point out that many market executives have perceived significant gaps between the usefulness of information available from existing accounting systems and the potential value of accounting information in making decisions. In spite of these calls to modernize cost accounting systems, it appears corporations are rather slow in adopting new management tools. For instance, Innes and Mitchell (1995) find that, based on the results of a survey of the UK's largest 1,000 companies, the impact of Activity-Based Costing (ABC) is often restricted in scope, and it has been rejected by a sizable number of organizations. Despite the fact that companies claim to be customer-driven, most management accounting systems do not focus on the customer but on products, departments or geographic regions (Foster et al., 1996). Since profitability depends not only on the unit cost of a product, but also on the back-end services required, such as marketing, distribution, and customer service, it is beneficial for a firm to analyse customer profitability and to track the profitability of customers over extended periods of time.

Despite corporate executives' need to understand the costs and benefits of supporting particular products and customers, little empirical evidence is available on how, and how well, companies are linking their value chain costs to these two cost objects. To address the void in the extant literature, several researchers have made attempts to explore how firms' annual operating costs are distributed among the major classes of value chain activities, the extent to which firms attribute each value chain cost to product/product lines and customer/customer classes based on a cause and effect analysis, and the cost allocation bases used. For instance, Hwang (1999) provides evidence as to the current practices in value chain cost tracing and cost system obsolescence based on the data collected from 73 small- to medium-sized companies headquartered in one of the U.S. metropolitan areas. The research findings of the study indicate that companies do a better job of linking value chain costs to products/product lines than to customers/customer classes. However, the proportion of each value chain cost attributed to either cost object tends to be low. Such results are consistent with the finding of Innes and Mitchell (1995) that firms' management may be rather slow in adopting new management tools and most companies are still using volume-based cost allocations. Similar results have also been reported in Chang and Hwang (2002) when they compare the value chain analysis implementation among firms in the United States and Hong Kong. Overall, the results of these studies provide useful insights to value chain analysis.

However, to our knowledge, there is no empirical evidence on how large U.S. manufacturing companies, a major sector of the national economy, link their value chain costs to their products and customers.

## **DATA COLLECTION METHOD**

In this study, we first focus on identifying value chain categories and the specific costs within them. According to Garrison and Noreen (1997), cost objects can be products, product lines, customers, jobs, or organizational sub-units such as departments or divisions of a company. For the purpose of this study, two commonly used cost objects are selected: (1) products or product lines, and (2) customers or customer classes. Since limited research has been done to examine cost tracing along the value chain activities, this study contributes to the accounting literature by exploring, through a survey to managers, regarding how these cost objects are used to trace costs to each of the value chain categories.

Upon completing the design of the survey, we sent the questionnaire to 2,887 companies listed in the Manufacturing USA Directory that had a minimum of US\$100 million in annual sales. The instrument was personally addressed to the CEO of each target firm, with a request to direct it to the person most knowledgeable about the firm's costing practices. A total of 141 questionnaires were returned for a 4.88 percent initial response rate.<sup>2</sup> Eliminating 21 that were grossly incomplete, this left a final sample of 120 usable responses. Since the survey aimed to collect data from the top level executives of very large companies, the number of usable responses can be viewed as a favourable outcome in spite of a low response rate.<sup>3</sup>

As demographical information of the sample firms indicates, the responded firms are an important subset of the U.S. national economy, with average annual sales of US\$2,139 million with a range of \$100 million to \$90 billion. The responding managers are also highly ranked in the responded firms, with 52 (43.3%) being chief financial officers, 44 (36.7%) being controllers, and the remaining 24 (20%) holding a range of other high level positions. On average, the managers who completed the survey had worked for their respective firms for 13.24 years, with a range of one to 40 years. The average tenure of the respondents in their current positions is 5.36 years, with a range of one to 36 years. These demographics lend credibility to the results of the study, since the respondents should have sufficient knowledge about their firms' current cost management systems to be able to provide informed answers.

## **RESEARCH FINDINGS ON CURRENT PRACTICES**

### **Distribution Of Costs Among Value Chain Activities**

Table 1 presents the cost distribution among the seven value chain activities. It shows that, on average, production accounts for the highest percentage of the annual operation cost (59.92%). This is not a surprising result given that the sample firms were from the manufacturing sector. The average proportions of costs in the other value chain activities were as follow: marketing (10.79%), overall administration (8.60%), distribution (6.87%), research and development (5%), customer service (4.58%), and design (4.25%).

Two points about these findings are worth mentioning. First, there is a wide range within each value chain activity, suggesting that the sample firms either face a range of different circumstances and/or they have elected to emphasize different parts of the value chain. Second, many non-production activities make up a high proportion of the costs, suggesting the desirability of close management and scrutiny.

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<sup>2</sup> Whenever responses are obtained from only part of the sample, there is the potential for the respondents to be non-representative of the sample as a whole. Survey studies often assess the severity of this problem by comparing the answers in early versus late responses. We did not conduct such a comparison because (1) all of the responses were received within a three-week window, and (2) geographic dispersion of the responses' origins.

<sup>3</sup> Typical mail survey response rate ranges from 10 to 20 percent (Kanuk and Berenson, 1975; Biner and Kidd, 1994). Since the targeted participants of this study are highly-ranked corporate executives, the response rate of this study is in line with our expectation.

**Table 1**  
**Distribution Of Sample Firms’ Annual Operating Costs Across Value Chain Activities**

	Value Chain Activity	Mean	Std. Dev.	Minimum	Maximum
1	Overall Administration	8.60%	9.42%	0.00%	95.00%
2	Research and Development	5.00	5.70	0.00	27.00
3	Design	4.25	6.13	0.00	30.00
4	Production	59.92	23.52	0.00	98.00
5	Marketing	10.79	12.09	0.00	50.00
6	Distribution	6.87	7.70	0.00	50.00
7	Customer Service	4.58	6.27	0.00	40.00

**Linking Value Chain Costs To Products/Product Lines**

Table 2 shows the percentage of each value chain cost being traced or allocated to products/product lines, based on explicit consideration of cause and effect relationships. If we consider the 61-80% and 80-100% categories to represent “a high degree” of cost allocation or tracing, then only production and design costs are well traced by more than half of the sample firms (85.9% and 55.8%, respectively).

**Table 2**  
**The Extent Of Sample Firms’ Assignment Of Value Chain Costs To Products Or Product Lines: Number Of Firms (Percent Of Sample) In Each Category**

Value Chain Cost	Sample Average	Percent Of Each Cost Assigned						
		None	1-20%	21-40%	41-60%	61-80%	81-100%	Missing Values
Overall Administration	25.7%	60 (50%)	17 (14.2%)	5 (4.2%)	8 (6.7%)	7 (5.8%)	20 (16.7%)	3 (2.5%)
Research and Development	43.3%	47 (39.2%)	6 (5%)	2 (1.7%)	5 (4.2%)	15 (12.5%)	40 (33.3%)	4 (3.3%)
Design	52.8%	37 (30.8%)	3 (2.5%)	2 (1.7%)	3 (2.5%)	18 (15%)	49 (40.8%)	8 (6.7%)
Production	80.3%	6 (5%)	1 (0.8%)	2 (1.7%)	4 (3.3%)	11 (9.2%)	92 (76.7%)	4 (3.3%)
Marketing	46%	37 (30.8%)	7 (5.8%)	9 (7.5%)	11 (9.2%)	14 (11.7%)	39 (32.5%)	3 (2.5%)
Distribution	49.5%	34 (28.3%)	5 (4.2%)	9 (7.5%)	7 (5.8%)	11 (9.2%)	45 (37.5%)	9 (7.5%)
Customer Service	46.5%	38 (31.7%)	5 (4.2%)	10 (8.3%)	10 (8.3%)	7 (5.8%)	44 (36.7%)	6 (5%)

Table 2 also reports the average percentage of each value chain cost being traced to products/product lines.<sup>4</sup> These are 25.7% for overall administration, 43.3% for research and development, 52.8% for design, 80.3% for production, 46% for marketing, 49.5% for distribution, and 46.5% for customer service. In addition to the considerable variation across value chain costs in their average percentages traced to products or product lines, there also is a high degree of divergence in the percentages of firms tracing each value chain cost to products/product lines. While only 6 (5%) firms report that they do not trace their production costs to this cost object, 60, or 50% of the firms, report that they trace none of their overall administrative costs to products or product lines.

<sup>4</sup> These percentages were computed by assigning each firm a percentage of cost traced equal to the midpoint of the category it has checked. Thus, if a firm checked the category “1-20%”, it was assumed to trace 10% of the cost. Because of this procedure, the most that a firm can be considered to trace of its value chain costs is 90%, or the midpoint of the highest category (“81-100%”). Dividing each of the sample averages in Table 2 by .9 will better approximate the percentage of costs actually traced. The same procedure applies to Table 4, discussed later.

A question that the preceding statistics cannot answer is whether firms are deliberative in which costs to trace to products/product lines. Specifically, if a particular value chain cost is small, a firm may find it cost-effective not to engage in an elaborate cost tracing exercise. To explore whether the degree of cost attribution is a function of its relative size, we computed Pearson correlations between each value chain cost’s proportion in a firm’s total operating cost to the degree that the firm traces it to products/product lines. The coefficients for research and development, design, marketing and customer service were all significant (respectively,  $r = .34, .40, .29, .16, p = .000, .000, .002, .099$ ). The higher these value chain costs, the more our sample firms traced them to products/product classes.

An examination of Table 2 also helps us understand why the correlations were not significant for some of the other costs. In the case of production, for example, almost all firms (103 out of 120) trace either 61-80% or 81-100% of this cost to products/product lines. This uniformity of practice leaves little variation for the correlation to be significant. But a similar explanation does not seem to apply in the case of distribution cost, where 34 of 120 firms trace none of this cost to product/product lines, while at the other extreme, 56 firms trace over 60% of this cost.

To explore further the underlying reasons for this finding, we separated the sample firms into six categories based on how much of their distribution cost is attributed to products/product lines (i.e., “none”, “1-20%”, “21-40%”, “41-60%”, “61-80%”, “81-100%”). For each category, we calculated the mean proportion of total operating costs that were for distribution. We then examined the pattern of these means for evidence of a “threshold” effect, i.e., that value chain costs which are above a certain proportion are treated similarly. We were unable to discern such a pattern. Below, we list the six categories of extent of cost tracing to products/product lines, then, in parentheses after each category, we report the mean proportions of distribution costs for companies in that category: none (6.26%); 1-20% (11%); 21-40% (14.28%); 41-60% (9%); 61-80% (7.27%); and 81-100% (6.18%). A similar exercise for overall administrative costs also failed to reveal a systematic pattern. These results may mean that companies have not paid enough attention to the tracing of distribution and administration costs. But they also may indicate that tracing these value chain costs based on a cause and effect relationship is costly. Since our survey did not encompass the costs of linking value chain costs to cost objects, future research is needed to resolve this uncertainty.

Table 3 provides further details about the sample firms’ costing practices. For each value chain cost, it reports the factors most often reported as the primary bases for allocating that cost to products/product lines. Because not all respondents provided answers, the available sample size differs across activities and is less than the full sample of 120 in all cases.

Table 3 shows that direct tracing based on actual usage is the most common approach, with the following mean percentages (in descending order) of usage across the value chain activities: marketing (43.84%), design (40%), research and development (39.66%), distribution (36.36%), production (31.91%), customer service (26.15%), and overall administration (14.3%). Other frequently used allocation bases are sales revenues, direct labour cost, direct labour hours, and engineering hours. There is some variation across value chain costs in the number of allocation bases and the relative use of these bases. But except for an “other” category, nine specific items plus direct tracing cover all the bases that the sample firms reportedly use to allocate their value chain costs to products/product lines. It also is notable that, by and large, all of these bases are proportional to output volume. Given the attention paid to activity-based costing in the past decade and the identification of a hierarchy of non-volume-related cost drivers (e.g., batch level, product level and facility level), these findings suggest that there still is much potential for practice to increase the accuracy of its cost tracing to products and product lines.

**Table 3**  
**Cost Allocation Bases Used To Trace Or Allocate Value Chain Costs To Products Or Product Lines**

A. Overall Administration		
Allocation Bases	No. of firms	(%)

Sales revenue	23	54.76
Direct tracing based on actual usage	6	14.30
Direct labour	5	11.90
Number of employees	3	7.14
Others	5	11.90
Total	42	100.00

**B. Research and Development**

Allocation Bases	No. of firms	(%)
Sales Revenue	2	3.45
Direct tracing based on actual usage	23	39.66
Engineering hour	11	18.97
Direct labour in dollars	5	8.62
Total hours spent	6	10.34
# of projects	6	10.34
Others	5	8.62
Total	58	100.00

**C. Design**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	26	40.00
Engineering hours	18	27.69
Direct labour in dollars	6	9.23
Total hours spent	5	7.69
# of projects	4	6.15
Sales revenue	3	4.62
Others	3	4.62
Total	65	100.00

**D. Production**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	30	31.91
Direct labour in dollars	17	18.09
Total machine hours	12	12.77
Total labour hours	8	8.51
Total hours	6	6.38
Total materials in dollars	5	5.32
Others	16	17.02
Total	94	100.00

**E. Marketing**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	32	43.84
Sales revenue	26	35.62
Others	15	20.54
Total	73	100.00

**F. Distribution**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	24	36.36
Sales revenue	22	33.33
Others	20	30.31
Total	66	100.00

**G. Customer Service**

Allocation Bases	No. of firms	(%)
Sales revenue	23	35.39
Direct tracing based on actual usage	17	26.15
Direct labour costs in dollars	6	9.23
Direct labour hours	4	6.15
Others	15	23.08
Total	65	100.00

**Linking Value Chain Costs To Customers/Customer Classes**

Table 4 reports the percentage of the annual cost of each value chain activity being traced or allocated to customers or customer classes, based on an explicit consideration of cause and effect relationships. The results show

that most firms do not engage in such tracing, as indicated by the number of firms in the “none” category of the table. Even for the relatively dominant production activity cost, we still find that 46.7% of the firms do not trace it to customers or customer classes.

**Table 4**  
**The Extent Of Sample Firms’ Assignment Of Value Chain Costs To Customers**  
**Or Customer Classes: Number Of Firms (Percent Of Sample) In Each Category**

Value Chain Cost	Percent of Each Cost Assigned							
	Sample Average	None	1-20%	21-40%	41-60%	61-80%	81-100%	Missing Values
Overall Administration	8.9%	97 (80.8%)	6 (5%)	2 (1.7%)	2 (1.7%)	2 (1.7%)	6 (5%)	5 (4.2%)
Research and Development	12.7%	87 (72.5%)	6 (5%)	6 (5%)	4 (3.3%)	7 (5.8%)	6 (5%)	4 (3.3%)
Design	17.8%	81 (67.5%)	5 (4.2%)	2 (1.7%)	4 (3.3%)	6 (5%)	14 (11.7%)	8 (6.7%)
Production	38%	56 (46.7%)	4 (3.3%)	5 (4.2%)	5 (4.2%)	9 (7.5%)	37 (30.8%)	4 (3.3%)
Marketing	20.7%	65 (54.2%)	12 (10%)	10 (8.3%)	8 (6.7%)	12 (10%)	8 (6.7%)	5 (4.2%)
Distribution	26.2%	62 (51.7%)	7 (5.8%)	7 (5.8%)	7 (5.8%)	9 (7.5%)	18 (15%)	10 (8.3%)
Customer Service	24.8%	66 (55%)	7 (5.8%)	5 (4.2%)	9 (7.5%)	7 (5.8%)	18 (15%)	8 (6.7%)

If we consider the 61-80% and 80-100% categories to represent “a high degree” of cost tracing, then the following percentages of sample firms are adequately tracing each of the value chain costs: production (38.3%), distribution (22.5%), customer service (20.8%), design (16.7%), marketing (16.7%), research and development (10.8%), and overall administration (6.7%). More generally, comparing the sample averages and distribution of firms across cost-tracing categories between Tables 4 and 2 suggests that the sample firms are doing a worse job of tracing or allocating value chain costs to customers or customer classes than to products or product lines.

We also computed Pearson correlations between each value chain cost proportion and the percentage that it is traced to customers/customer classes. Only the correlation for the design activity was significant ( $r = .27, p = .004$ ). An examination for a “threshold effect” for the other value chain costs shows that only two activities: production and marketing, have this pattern. Thus, as with the tracing of costs to products/product lines, there is a need for future research into the costs of tracing value chain costs to customers/customer classes or perhaps even more broadly, the key factors behind firms’ approaches to cost tracing.

Table 5 summarizes the cost allocation bases most often used to trace value chain costs to customers or customer classes. As with the tracing of costs to products/product lines, only a subset of the sample provided information on this aspect of their costing approach. The table shows that sales revenue is by far the most frequently used allocation base, with the following usage percentages (in descending order) across the value chain activities: overall administration (71.44%), marketing (50%), customer service (40.48%), distribution (36.84%), research and development (29.63%), production (18.87%) and design (13.33%). Other frequently used bases are direct tracing based on actual usage, direct labour cost, and engineering hours. As with allocating costs to products or product classes, most of the allocation bases are volume-based. When considered in conjunction with the finding of less cost tracing to customers/customer classes, this finding strongly suggests that there is room for improving how firms are accounting for the costs of serving particular customers and customer classes.

**Table 5**  
**Cost Allocation Bases Used To Trace Or Allocate Value Chain Costs To Customers Or Customer Classes**

A. Overall Administration		
Allocation Bases	No. of firms	(%)



Sales revenue	15	71.44
Direct tracing based on actual usage	3	14.28
Others	3	14.28
Total	21	100.00

**B. Research and Development**

Allocation Bases	No. of firms	(%)
Sales revenue	8	29.63
Direct tracing based on actual usage	5	18.52
Engineering hours	3	11.11
Direct labour in dollars	3	11.11
Others	8	29.63
Total	27	100.00

**C. Design**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	7	23.33
Engineering hours	6	20.00
Direct labour in dollars	5	16.67
Sales revenue	4	13.33
Others	8	26.67
Total	30	100.00

**D. Production**

Allocation Bases	No. of firms	(%)
Direct tracing based on actual usage	19	35.85
Direct labour in dollars	10	18.87
Sales revenue	10	18.87
Machine hours	3	5.66
Standard cost	3	5.66
Direct materials in dollars	3	5.66
Others	5	9.43
Total	53	100.00

**E. Marketing**

Allocation Bases	No. of firms	(%)
Sales revenue	22	50.00
Direct tracing based on actual usage	12	27.27
Others	10	22.73
Total	44	100.00

**F. Distribution**

Allocation Bases	No. of firms	(%)
Sales revenue	14	36.84
Direct tracing based on actual usage	12	31.58
Direct tracing to customer	5	13.16
Others	7	18.42
Total	38	100.00

**G. Customer Service**

Allocation Bases	No. of firms	(%)
Sales revenue	17	40.48
Direct tracing based on actual usage	9	21.43
Direct labour costs in dollars	5	11.90
Others	11	26.19
Total	42	100.00

**SUMMARY AND DISCUSSION**

As documented by the current literature in management and accounting (Anderson, et al., 2000; Dekker, 2004; Mouritsen, et al., 2001; Roslender, 1995; Shank and Govindarajan, 1992, 1993), competitive advantage depends on

how a firm manages its own value chain relative to those of its competitors. For an organization to stay competitive, accounting information on the value chain costs of supporting particular products/product lines and customers/customer classes is essential to the corporate executives to manage their value chain activities effectively.

Our survey findings from 120 large U.S. manufacturing firms show that, on average, production activity accounts for the highest percentage of the annual operation cost (59.92%), though the other value chain costs also make up a significant proportion of annual operating costs. Overall, more firms tend to trace or allocate a higher proportion of their value chain costs to products or product lines than to customers or customer classes. For the former purpose, direct tracing based on actual usage is most often used, with other commonly used allocation bases being mostly volume-based. Sales revenues are most often used for allocating value chain costs to customers/customer classes, and the other commonly used allocation bases also tend to be proportional to volume. By and large, the findings of this study are consistent with the studies reported in the literature (e.g., Innes and Mitchell, 1995, Hwang, 1999, Chang and Hwang, 2002).

Our findings offer three major avenues that firms can take to improve their management accounting practices. First is to attend to the entire set of value chain costs, especially the increasing amount of costs spent on activities that are upstream (e.g., design) and downstream (e.g., customer service) to production. Second is to increase tracing of value chain costs to customers/customer classes. Third, in conjunction with the preceding two initiatives, activity-based costing and activity-based management techniques should be used to obtain better cost drivers (allocation bases) for each value chain activity. A benefit of these initiatives is the increased feasibility of using innovative cost management techniques like target costing, product line and customer profitability analysis, and life cycle costing to improve value chain activities.

Given the potential importance of these implications, it is worthwhile for future research to expand and refine the inquiry. In addition to seeking a larger sample, there is room for much insight from future studies which either focus on seeking a representative sample or concentrate on particular industries (perhaps by obtaining the sponsorship of industry organizations). There also is need for applying methods of data collection (e.g., case studies) which are better suited for in-depth pursuit of phenomena. This is especially useful for understanding the costs or process of value chain cost tracing. Finally, since the presumed objective of value chain management is to increase firm profitability, data collection and analysis need to also encompass the revenue impacts of alternate value chain configurations, and relate these impacts to their costs.

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**NOTES**