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TOOL KIT

Time-Driven Activity-Based Costing

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by Robert S. Kaplan and Steven R. Anderson

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In the classroom, activity-based costing looks like a great way to manage a company's limited resources. But many managers who have tried to implement ABC in their organizations on any significant scale have abandoned the attempt in the face of rising costs and employee irritation. They should try again, because the new approach we lay out in the following pages sidesteps the difficulties traditionally associated with large-scale ABC implementation by relying on informed managerial estimates rather than on employee surveys. It also provides managers with a far more flexible cost model to capture the complexity of their operations.

ABC Made Difficult

The roots of the problem with ABC lie in the way people traditionally construct ABC models. Assume you are analyzing a customer service department that performs three activities: processing orders, handling inquiries, and performing credit checks. The department's total expenses (the cost of the personnel, management, IT, telecommunications, and other fixed resources) amount to $560,000. The actual (or estimated) quarterly quantities of work in the three activities are 49,000 orders, 1,400 inquiries, and 2,500 credit checks.

To build a traditional ABC model for this department, you would survey employees to estimate the percentage of time they spend (or expect to spend) on the three activities and then assign the department's resource expenses according to the average percentages you get from the survey. Let's say employees report that they spend (or expect to spend) about 70% of their time on customer orders, 10% on inquiries or complaints, and 20% on credit checks. This implies, under ABC, that each order consumes $8 of resource expense, each inquiry $40, and each credit check $44.80, as shown in the exhibit "Doing ABC the Traditional Way." Armed with these figures, known as the cost-driver rates, managers can assign the costs of the department's resources to the customers and products that use its services.

This approach works well in the limited set-

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ting in which it was initially applied, typically a single department, plant, or location. Difficulties arise, however, when you try to roll this approach out on a large scale for use on an ongoing basis. In one large bank's brokerage operation, the ABC data-gathering process required 70,000 employees at more than 100 facilities to submit monthly reports of their time allocation. The company employed 14 people full-time just to manage the data collection, processing, and reporting.

The time and cost demands of creating and maintaining an ABC model on this scale is a major barrier to widespread adoption at most companies. Since the systems that are put in place are updated infrequently (because of the costs of reinterviewing and resurveying), the model's estimates of process, product, and customer costs soon become inaccurate. What's more, people waste their time arguing about the accuracy of cost-driver rates that are derived from individuals' subjective beliefs rather than addressing the deficiencies the model reveals: inefficient processes, unprofitable products and customers, and excess capacity.

Traditional ABC models also often fail to capture the complexity of actual operations. Consider the activity "ship order to customer." Rather than assume a constant cost per order shipped, a company may wish to recognize the cost differences when an order is shipped in a full truck, in a less-than-truckload (LTL) shipment, using overnight express, or by a commercial carrier. In addition, the order may be entered into the system either manually or electronically, and it may be either a standard or an expedited transaction. To allow for the significant variation in resources required by the different shipping arrangements, new activities must be added to the model, thereby expanding its complexity.

As the activity dictionary expands—either to reflect more detail about activities or to expand the scope of the model to the entire enterprise—the demands on the computer programs used to store and process the data escalate. Suppose a company has 150 activities in its enterprise ABC model, applies the costs in these activities to some 600,000 cost objects (products and customers), and runs the model monthly for two years. That would require data estimates, calculations, and storage for more than 2 billion items.

Such expansion has caused ABC systems to exceed the capacity of generic spreadsheet tools, such as Microsoft Excel, and even many ABC software packages. The systems could take days to process one month's worth of data. For example, the automated ABC model for Hendee Enterprises, a $12 million fabricator of awnings, took three days to calculate costs for its 40 departments, 150 activities, 10,000 orders, and 45,000 line items.

These problems have become obvious to most ABC implementers. But a subtle and more serious problem arises from the interview and survey process itself. When people estimate how much time they spend on a list of activities handed to them, they invariably report percentages that add up to 100. Few individuals report that a significant percentage of their time is idle or unused. Therefore, cost-driver rates are calculated assuming that resources are working at full capacity. But as we all know, operations often run at considerably less than their capacity. That means that the estimated cost-driver rates are usually much too high. (Technically, they will be overstated by the reciprocal of the capacity utilization percentage: At 80% utilization, the rates are 25% too high; at 67% utilization, the rates are 50% too high.)

The New ABC

The solution to the problems with ABC is not to abandon the concept. ABC after all has helped many companies identify important cost- and profit-enhancement opportunities through the repricing of unprofitable customer relationships, process improvements on the shop floor, lower-cost product designs, and rationalized product variety. Its potential on a larger scale represents a huge opportunity for companies. Fortunately, simplification is now possible through an approach that we call time-driven ABC, which we have successfully helped more than 100 client companies implement, including those described in this article. In the revised approach, managers directly estimate the resource demands imposed by each transaction, product, or customer rather than assign resource costs first to activities and then to products or customers. For each group of resources, estimates of only two parameters are required: the cost per time unit of supplying resource capacity and the unit times of consumption of resource capacity by products, services, and customers. At the same time, the new approach

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provides more accurate cost-driver rates by allowing unit times to be estimated even for complex, specialized transactions.

Estimating the cost per time unit of capacity. Instead of surveying employees on how they spend their time, managers first directly estimate the practical capacity of the resources supplied as a percentage of the theoretical capacity. There are various ways to do this. As a rule of thumb, you could simply assume that practical full capacity is 80% to 85% of theoretical full capacity. So if an employee or machine is available to work 40 hours per week, its practical full capacity is 32 to 35 hours per week. Typically, managers would allot a lower rate—say 80%—to people, allowing 20% of their time for breaks, arrival and departure, communication, and training. For machines, managers might allot a 15% differential between theoretical and practical capacity to allow for downtime due to maintenance, repair, and scheduling fluctuations. A more systematic approach, perhaps, is to review past activity levels and identify the month with the largest number of orders handled without excessive delays, poor quality, overtime, or stressed employees. Whichever approach you prefer, it's important not to be overly sensitive to small errors. The objective is to be approximately right, say within 5% to 10% of the actual number, rather than precise. If the estimate of practical capacity is grossly in error, the process of running the time-driven ABC system will reveal the error over time.

Returning to our example, let's assume that the customer service department employs 28 reps to do the frontline work and that each puts in eight hours per day. In theory, therefore, each worker supplies about 10,560 minutes per month or 31,680 minutes per quarter. The practical capacity at about 80% of theoretical is therefore about 25,000 minutes per quarter per employee, or 700,000 minutes in total. Since we already know the cost of supplying capacity—the $560,000 in overhead costs—we can now calculate the cost per minute of supplying capacity ($0.80).

The capacity of most resources is measured in terms of time availability, but the new ABC approach can also recognize resources whose capacity is measured in other units. For example, the capacity of a warehouse or vehicle would be measured by space provided, while memory storage would be measured by megabytes supplied. In these situations, the manager would calculate the resource cost per unit based on the appropriate capacity measure, such as cost per cubic meter or cost per megabyte.

Estimating the unit times of activities. Having calculated the cost per time unit of supplying resources to the business's activities, managers next determine the time it takes to carry out one unit of each kind of activity. These numbers can be obtained through interviews with employees or by direct observation. There is no need to conduct surveys, although in large organizations, surveying employees may help. It is important to stress, though, that the question is not about the percentage of time an employee spends doing an activity (say, processing orders) but how long it takes to complete one unit of that activity (the time required to process one order). Once again, precision is not critical; rough accuracy is sufficient. In the case of our example, let's suppose that managers determine that it takes 8 minutes to process an order, 44 minutes to handle an inquiry, and 50 minutes to perform a credit check.

Deriving cost-driver rates. The cost-driver rates can now be calculated by multiplying the

Doing ABC the Traditional Way

This table provides a traditional ABC analysis for a customer service department for its first fiscal quarter. The percentage of time spent on activities is determined from employee surveys. Once activity quantities are known or forecast, cost-driver rates are used to allocate the department's costs based on customers' utilization of the department's activities.

Activity	% of Time Spent	Assigned Cost	Activity Quantity	Cost-Driver Rate
Process customer orders	70%	$392,000	49,000	$8 per order
Handle customer inquiries	10%	$56,000	1,400	$40 per inquiry
Perform credit checks	20%	$112,000	2,500	$44.80 per credit check
Total	**100%**	**$560,000**		

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two input variables we have just estimated. For our customer service department, we obtain cost-driver rates of $6.40 (8 multiplied by $0.80) for processing customer orders, $35.20 (44 by $0.80) for handling inquiries, and $40 (50 by $0.80) for performing credit checks. Once you have calculated these standard rates, you can apply them in real time to assign costs to individual customers as transactions occur. The standard cost rates can also be used in discussions with customers about the pricing of new business.

Note that these rates are lower than those estimated using traditional ABC methods (see again the exhibit "Doing ABC the Traditional Way"). The reason for this difference becomes obvious when we recalculate the quarterly cost of performing the customer service activities. In the exhibit "The Impact of Practical Capacity," time-driven ABC analysis reveals that only 83% of the practical capacity (578,600 of the 700,000 minutes) of the resources supplied during the quarter has been used for productive work, and hence, only about 83% of the total expenses of $560,000 were assigned to customers or products during this period. This takes care of the technical drawback of traditional ABC systems we mentioned earlier—the fact that surveyed employees respond as if their practical capacity were always fully utilized.

In the case of our customer service department, the traditional ABC survey produced a work distribution of 70%, 10%, and 20% of the employees' time performing the department's three activities. But while that distribution did reflect how workers spent their productive time, the fact that their total productive time was significantly less than their practical capacity of 32 hours per worker per week was completely ignored. The calculation of resource costs per time unit forces the company to incorporate estimates of the practical capacities of its resources, allowing the ABC cost drivers to provide more accurate signals about the cost and the underlying efficiency of its processes.

Analyzing and reporting costs. Time-driven ABC enables managers to report their costs on an ongoing basis in a way that reveals both the costs of a business's activities as well as the time spent on them. In our customer service department example, a time-driven ABC report would look like the exhibit "ABC, the Time-Driven Way."

Note that the report highlights the difference between capacity supplied (both quantity and cost) and the capacity used. Managers can review the cost of the unused capacity and contemplate actions to determine whether and how to reduce the costs of supplying unused resources in subsequent periods; they can then monitor those actions over time. In some cases, the information can save companies that are considering expansion from making unnecessary new investments in capacity. For example, the vice president of operations at Lewis-Goetz, a hose and belt fabricator based in Pittsburgh, saw from his time-driven ABC model that one of his plants was operating at only 27% of capacity. Rather than attempt to downsize the plant, he decided to maintain the capacity for a large contract he expected to win later that year, for which he otherwise would have created new capacity.

Updating the model. Managers can easily update their time-driven ABC models to reflect changes in operating conditions. To add more activities for a department, they don't have to reinterview personnel; they can simply estimate the unit time required for each new activity.

Managers can also easily update the cost-

The Impact of Practical Capacity

This table shows the effect on cost assignment when we use rates based on practical capacity (700,000 minutes), assumed here at 80% of theoretical full capacity. We can see that only about 83% of the customer service department's practical capacity was actually put to productive use during the first fiscal quarter.

Activity	Unit Time (minutes)	Quantity	Total Minutes	Total Cost
Process customer orders	8	49,000	392,000	$313,600
Handle customer inquiries	44	1,400	61,600	$49,280
Perform credit checks	50	2,500	125,000	$100,000
Total			**578,600**	**$462,880**

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driver rates. Two factors can cause these rates to change. First, changes in the prices of resources supplied affect the cost per time unit of supplying capacity. For example, if employees receive an 8% compensation increase, the resource cost rate in our example increases from $0.80 per supplied minute to $0.864 per minute. If new machines are substituted or added to a process, the resource cost rate is modified to reflect the change in operating expense associated with introducing the new equipment.

The second factor that can cause a change in the activity cost-driver rate is a shift in the efficiency of the activity. Quality programs, continuous improvement efforts, reengineering, or the introduction of new technology can enable the same activity to be done in less time or with fewer resources. When permanent, sustainable improvements in a process have been made, the ABC analyst recalculates the unit time estimates (and therefore the demands on resources) to reflect the process improvements. For example, if the customer service department gets a new database system, the reps may be able to perform a standard credit check in 20 minutes rather than 50 minutes. To accommodate the improvement, just change the unit time estimate to 20 minutes, and the new cost-driver rate automatically becomes $16 per credit check (down from $40). Of course, you then have to add back in the cost impact of purchasing the new database system by updating the cost per time unit estimate, so the final figure may be somewhat higher than $16.

By updating the ABC model on the basis of events rather than on the calendar (once a quarter or annually), you get a much more accurate reflection of current conditions. Any time analysts learn about a significant shift in the costs of resources supplied or the practical capacity of those resources, or about a change in the resources required to perform the activity, they update the resource cost per time unit, or resource cost rate, estimates. And any time they learn of a significant and permanent shift in the efficiency with which an activity is performed, they update the unit time estimate.

Time Equations to Capture Complexity

So far, we have relied on an important simplifying assumption that all orders or transactions of a particular type are the same and require the same amount of time to process. But time-driven ABC does not demand this simplification. It can accommodate the complexity of real-world operations by incorporating time equations, a new feature that enables the model to reflect how order and activity characteristics cause processing times to vary. Time equations greatly simplify the estimating process and produce a far more accurate cost model than would be possible using traditional ABC techniques.

The key insight is that although transactions can easily become complicated, managers can usually identify what makes them complicated. The variables that affect most such activities can often be precisely specified

ABC, the Time-Driven Way

This reporting template for time-driven ABC shows the customer service department's costs in the second quarter of operations. Here we assume that the department processes 51,000 customer orders, handles 1,150 inquiries, and performs 2,700 credit checks. The data reveal that the company supplied $85,120 worth of unused resource capacity during this period, representing opportunities for savings or growth depending on the company's circumstances.

Activity	Quantity	Unit Time	Total Time Used (in minutes)	Cost-Driver Rate	Total Cost Assigned
Process customer orders	51,000	8	408,000	$6.40	$326,400
Handle customer inquiries	1,150	44	50,600	$35.20	$40,480
Perform credit checks	2,700	50	135,000	$40.00	$108,000
Total Used			**593,600**		**$474,880**
Total Supplied			**700,000**		**$560,000**
Unused Capacity			**106,400**		**$85,120**

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and are typically already recorded in a company's information systems. To take an example, let's assume a manager is looking at the process of packaging a chemical for shipment. In this situation, complexity arises from the potential need for special packaging and the additional demands of air as opposed to ground transportation.

Let's say that if the chemical is already packaged in a way that meets standard requirements, it should take 0.5 minutes to prepare it for shipment. If the item requires a new package, however, the manager estimates, either from experience or from making several observations, that an additional 6.5 minutes will be required to supply the new packaging. And if the item is to be shipped by air, he or she knows (or can quickly determine) that it will take about 2 minutes to put the package in an air-worthy container.

This information allows the manager to estimate the time required for the packaging process:

Packaging Time = 0.5 + 6.5 [if special packaging required] + 2.0 [if shipping by air]

Many companies' ERP systems already store data on order, packaging, distribution method, and other characteristics. These order- and transaction-specific data enable the particular time demands for any given order to be quickly determined using a calculation like the one above.

Thanks to this extension, the time-driven approach to ABC can capture the complexities of business far more simply than the traditional ABC system could, which might well have had to account for varying transaction times by treating each variant of the process as a distinct activity. Consider the case of Hunter Corporation (not its real name), a large, multinational distributor of scientific products, whose 27 facilities process more than one million orders each month to distribute up to 300,000 different product SKUs to 25,000 customers. Its old ABC model required that employees in its inside sales department (the salespeople handling phone and Internet orders rather than dealing with customers face-to-face) estimate each month the percentage of their time that they spend on three activities: customer setup, order entry, and order expediting.

With the time-driven approach, Hunter's ABC team of analysts was able to group the three activities into a single departmental process, called inside sales order entry. The team learned that it took about 5 minutes to enter the basic order information, plus 3 minutes for each line item, and an additional 10 minutes if the order had to be expedited. If the customer were new, 15 more minutes would be required to set up the customer in the company's computer system.

Following the approach described earlier, the previous three-activity model was replaced by a single time equation:

Inside Sales Order Entry Process Time = 5 + (3 × number of line items) + 15 [if new customer] + 10 [if expedited order]

This was straightforward to implement since Hunter's ERP system already tracked the number of line items for each order and included fields that identified whether it was a rush order and whether the customer was new. The model multiplied the estimated sales process time by the departmental cost per minute to arrive at the cost of processing each order. Hunter could now obtain a more accurate and nuanced estimate of its costs in the unit while simultaneously reducing the complexity of the process for gathering and analyzing the data. Hunter has since rolled out time-driven ABC over all its operations. The results have been dramatic:

• Hunter has reduced the number of items tracked from 1,200 activities to 200 department processes.

• Managers can add complexity to the model by simply adding new elements to the time equations, which places less strain on Hunter's accounting system than incorporating new activities would.

• Cost estimates are now based on actual order characteristics and direct observations of processing times, not on subjective estimates of where and how people spend their time.

• The new model is easier to validate. Hunter can reconcile the total process time—that is, the total absolute time spent on all the activities tracked in a given period—to other measures of resources supplied, such as head count. If the total process time is lower than the time implied by the head count, for example, managers know that some of their unit time estimates are too low or that people are not working to capacity. This validation is difficult with traditional ABC, which is based on estimated proportions of time spent and rarely incorpo-

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rates idle or unused capacity time.

• Hunter's time-driven ABC model requires only two people working two days per month to load, calculate, validate, and report findings, compared with the ten-person team and three weeks that were necessary to maintain the previous model. Employees now spend time generating profits from the information rather than just updating and maintaining it.

The kind of rollout Hunter conducted is not difficult to achieve. Time-driven ABC models can be easily applied and customized for other plants and companies within an industry because the processes they use are similar. Dave Deinzer, CEO of Denman & Davis and president of the North American Steel Alliance, commented, "For the most part, we are all pretty much the same…cutting, sawing, and finishing metal with the same equipment and the same procedures. You could probably apply the same time-driven ABC model to all of us." The chief information officer of another steel distributor, TW Metals, noted, "We were able to roll out our time-driven ABC template model to all 36 of our facilities within three months."

The ability of time-driven ABC to identify and report complex processes in a simple way also provides a powerful negotiation tool when it comes to dealing with customers. Wilson-Mohr, an industrial controls company in Houston worked as a subcontractor to engineering contractors (ECs) on the construction of custom process-control systems for refineries and chemical plants. Its time-driven model revealed, for the first time, the high cost of engineering change orders issued by the ECs to replace parts or reconfigure the design. In the

Strategic Change at Kemps LLC

Kemps, headquartered in Minneapolis, is a full-line dairy, that produces milk, yogurt, sour cream, cottage cheese, and ice cream products. Its customers are retailers and distributors as large as SuperValu and Target and as small as convenience stores. Kemps markets its products under its own branded portfolio along with products sold through private label and copacking contracts. Like most dairies, Kemps was experiencing consolidation in its customer base. It decided to shift from its former customer relationship strategy—willing to do whatever the customer asked—to a lower-total-cost strategy. The new approach clearly required an accurate understanding of cost by product and customer that Jim Green, Kemp's CEO, would use to instill a "low total cost" culture throughout the organization.

As a critical component of the cost-to-serve model, Kemps implemented a time-driven ABC system so it could track the costs of changeovers in producing and packaging all its products and the costs of picking, loading, and delivering products to its diverse customer base. The model captured differences in how the company entered orders from customers (customer phone call, salesperson call, fax, truck-driver entry, EDI, or Internet), how it packaged orders (full stacks of six cases, individual cases, or partial break-pack cases for small orders), how it delivered orders (commercial carriers or its own fleet, including route miles), and time spent by the driver at each customer location. The extra time for changeovers to clean out allergens (such as nuts, eggs, soy, or wheat) used in certain ice cream products could now be accurately assigned to those products. The model also captured the extra packaging costs for special promotions and customer-specific labels and promotions.

The company soon learned it was losing money with one of its customers, a chain of specialty high-end shops, because of the low volume and high variety of products ordered and the small just-in-time deliveries the chain requested. Kemp's vice president of sales called on the customer, explained the situation, and offered three options: accept a price increase and a minimum order size; eliminate its private-label ice cream, replacing it with Kemp's standard branded product that was already being produced in efficient, high volumes; or find another ice cream supplier. When the customer inquired why Kemps was making the change, the VP responded that after 25 years, Kemps only now understood its true manufacturing costs and the impact of specialty production on its margins. The customer accepted a price increase of 13%, agreed to the elimination of two low-volume products, and agreed to accept full rather than partial truckload orders, thereby eliminating internal storage charges for Kemps. The changes produced immediate benefits of $150,000 per year, transforming this unprofitable customer into a profitable one.

Kemps also used its time-driven ABC model proactively to become the leading dairy supplier to a national customer. Kemps demonstrated that it could identify the specific manufacturing, distribution, and order handling costs associated with serving this customer on the basis of actual order characteristics: DSD (direct store delivery) or shipments to distribution centers, gallon versus pint deliveries, and volume and mix of products. The time-driven ABC model facilitated an open, trusting relationship between supplier and customer that differentiated Kemps from its competitors.

Kemps also became aware that some of its smaller convenience store customers had been overordering and returning product when the date code expired. To avoid the high cost of these rebates and returns, Kemps offered these retailers a 2% discount if they would manage their own inventories without the return option. In this way, Kemps eliminated 95% of out-of-code returns, generating a net saving of $120,000 per year.

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Profitable Decisions at Banta Foods

This table details the opportunities for profit revealed by the introduction of time-driven ABC and the estimated impact on total profits at a $155 million food distributor.

Opportunities Identified	Total Profit Impact
Establish minimum order size	22%
Recover vendor rebate processing costs	21%
Conduct what-if profit analysis on new business	20%
Perform vendor reviews	5%
Total	**68% (1.4% of revenues)**

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past, Wilson-Mohr charged an EC only for the predicted materials cost changes resulting from the change orders. Now it can also clearly itemize the cost of additional sales, design, engineering, and manufacturing labor time consumed when implementing change orders, which makes it easy to recuperate these costs through price recovery. (For a detailed example of how time-driven ABC helps companies manage customers, see the sidebar "Strategic Change at Kemps LLC.")

The Bottom Line

Over the past seven years, we and our colleagues at Acorn Systems have successfully helped more than 100 clients introduce time-driven ABC into their processes. Most have reported substantial improvements in profitability that they attribute to the information generated by the new approach. Take the case of Banta Foods, a Midwest food distributor with revenues of $155 million from 17,000 SKUs and 5,000 customers. It operated on a razor-thin net margin of about 1%. Historically, its profit drivers were increasing the number of orders taken per day, increasing aggregate revenues, and controlling aggregate expenses.

Banta's time-driven ABC system, which was fully implemented within 16 weeks, revealed much more granularity in its expense structure by tying costs to products, orders, customers, and territories. Managers learned that a $1,000 order, previously considered the smallest size to break even, could either be quite profitable or a loss depending on the distance to the customer, the location of the product in the warehouse, the size of the order, the frequency of delivery, the type of service, and the credit rating of the customer—all of which were incorporated in the algorithms in its new time-driven ABC system.

Based on the data in its ABC model, Banta instituted a nonnegotiable minimum order size, reduced the inventory of unprofitable products, promoted sales of high-profit products, negotiated with customers either to reduce the demand for high-cost services or to reprice them, and offered incentives to its salespeople to increase the net profits of their customers. It also renegotiated with vendors to recoup the cost of processing customer rebates. The general manager of sales used the information to transform his sales representatives from order takers to consultants, helping them to create customers and territories that were more profitable for Banta. He reports, "Salespeople can now increase their gross profits not by simply adding points to their margin but by knowing which items to sell."

By accurately projecting the cost and profits of proposed business, Banta has been able to take on new business that has increased revenues by 35% and generated immediate profit improvements of 43%, with a further 25% yet to come through from future opportunities. (See the exhibit "Profitable Decisions at Banta Foods.") Its performance has led to the distinction of being named "Innovator of the Year" by the industry journal, *Institutional Distributor*.

Over the past 15 years, activity-based costing has enabled managers to see that not all revenue is good revenue and not all customers are profitable customers. Unfortunately, the difficulties of implementing and maintaining traditional ABC systems have prevented them from being adopted on any significant scale. Time-driven ABC has overcome these difficulties, offering a transparent, scalable methodology that is easy to implement and update. It draws on existing databases to incorporate specific features for particular orders, processes, suppliers, and customers. Activity-based costing is no longer a complex, expensive financial-systems implementation; the time-driven ABC innovation provides managers with meaningful cost and profitability information, quickly and inexpensively.

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