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Time-Driven Activity-Based Costing

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Abstract

The traditional ABC model has been difficult for many organizations to implement because of the high costs incurred to interview and survey people for the initial ABC model, the use of subjective and costly-to-validate time allocations, and the difficulty of maintaining and updating the model as (i) processes and resource spending change, (ii) new activities are added, and (iii) increases occur in the diversity and complexity of individual orders, channels and customers.

Time-driven ABC requires estimates of only two parameters: (1) the unit cost of supplying capacity and (2) the time required to perform a transaction or an activity. A time-driven ABC model:

- can be estimated and installed quickly
- is easily updated to reflect changes in processes, order variety, and resource costs
- can be data fed from transactional ERP and CRM systems
- can be validated by direct observation of the model's estimates of unit times
- can scale easily to handle millions of transactions while still delivering fast processing times and real-time reporting
- explicitly incorporates resource capacity and highlights unused resource capacity for management action
- exploits time equations that incorporate variation in orders and customer behavior without expanding model complexity

The paper uses simple numerical examples to articulate the fundamentals of time-driven ABC and provides several examples of companies that have implemented the approach and enjoyed rapid and significant profit improvements.

Time-Driven Activity Based-Costing

Activity-based costing was introduced in the mid-1980s through several Harvard Business School cases and articles.[1] While the settings of these cases differed, they all had one characteristic in common. The resource expenses assigned to an activity were determined through interviews, time logs, and direct observation of the amount or percentage of time people spent on various activities. For example, the costs of warehousing goods would be driven to activities – such as Receiving, Inspection, Put-away, Picking, Packing, and Shipping – based on estimates by warehouse personnel of the percentage of their time they spent on each of the activities. The project team then calculated activity cost driver rates, used to assign activity costs to individual products or customers, by dividing these activity costs by the outputs of each activity – such as number of receipts, number of inspections, number of items picked, and number of shipments.

This procedure for estimating an ABC model, while feasible for initial pilot studies, has proved difficult and costly to extend to company-wide applications. Also, even after the initial model has been built, updating the model requires essentially re-estimating through a new round of interviews and surveys to reflect changes in a company's operations. Consequently, ABC models are often not maintained and their cost estimates soon become obsolete. In this paper, we review the problems associated with traditional estimation of ABC models. We describe a new approach that is both simpler – for estimating and maintaining an ABC model – and also more accurate. The new, time-driven approach allows for more heterogeneity in activities, orders, and customer behavior without placing burdensome demands for calculating activity, product and customer costs.

Estimating a Basic ABC Model

The standard procedure for estimating a simple ABC model starts with identifying a collection of resources that perform a variety of activities. For example, consider a customer service department that performs three activities:

- handle customer orders
- process customer complaints
- perform customer credit checks.

Assume that the cost of supplying resources – personnel, supervision, information technology, telecommunications, and occupancy – to perform these activities is $560,000 per quarter. In building an ABC model for the customer service department, the system designer asks employees to estimate the percentage of their time spent (or that they expect to spend) on the three principal activities they perform. Suppose they estimate these percentages as 70%, 10% and 20%, respectively. The ABC system designer also learns that the actual (or estimated) quantities of work for the quarter in these three activities are:

- 9,800 customer orders
- 280 customer complaints
- 500 credit checks

The system assigns the $560,000 resource cost to activities, based on the time percentage, and calculates activity cost driver rates as shown below:

Activity	%	Assigned Cost	Activity Cost Driver Quantity	Activity Cost Driver Rate
Handle orders	70%	$392,000	9,800	$ 40/order
Process complaints	10%	56,000	280	$200/complaint
Check credit	20%	112,000	500	$224/credit check
Total	100%	$ 560,000		

The project team then uses the calculated activity cost driver rates to assign the expenses of the three activities to individual customers based on the number of orders handled, complaints processed, and credit checks performed for each customer.

This approach works well in the limited setting in which it was initially applied, typically a single department, plant or location. Also, many of the initial studies were one-time events that provided a useful snapshot of the plant's current economics, such as to identify high cost, inefficient processes and the unprofitable products and customers. Even today, the revelation of high cost processes, products and customers stimulates near-term actions (activity-based management) that can lead to near-term and often dramatic profit improvements.

Problems with Estimating and Maintaining ABC Models

Several problems, however, arise when companies attempt to scale up this seemingly straightforward approach to enterprise-wide models, and to maintain the model so that it reflects changes in activities, processes, products, and customers. First, the process to interview and survey employees to get their time allocations to multiple activities is time consuming and costly. Consider the experience of a money center bank's brokerage operation. Its traditional ABC model required 70,000 employees at more than 100 facilities to submit monthly surveys of their time. The company had to provide 14 full-time people just to manage the ABC data collection, processing and reporting. A $20 billion distributor required several months and about a dozen employees to update its internal ABC model. The high time and cost to estimate an ABC model and to maintain it – through re-interviews and re-surveys – has been a major barrier to widespread ABC adoption. And, because of the high cost of continually updating the ABC model, many ABC systems are updated only infrequently, leading to out-of-date activity cost driver rates, and inaccurate estimates of process, product, and customer costs.

The accuracy of the cost driver rates when they are derived from individuals' subjective estimates of their past or future behavior has also been called into question.[2] Apart from the measurement error introduced by employees' best attempts to recall their time allocations, the people supplying the data – anticipating how it might be used – might bias or distort their responses. As a result, operations, sales and marketing managers often argue about the accuracy of the model's estimated costs and profitability rather than address how to improve the inefficient processes, unprofitable products and customers, and considerable excess capacity that the model has revealed.[3]

Another problem is that traditional ABC models are difficult to scale. Adding new activities to the model, such as to introduce heterogeneity within an activity, requires re-estimating the amount of cost that should be assigned to the new activity. For example, consider the complexity in the activity "*ship order to customer*." Rather than assuming 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 shipping order may be entered either manually or electronically, and it may require 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.[4]

As the activity dictionary expands – either to reflect more granularity and detail about activities performed or to expand the scope of the model to the entire enterprise – the demands on the computer model used to store and process the data escalate dramatically. For example, a company using 150 activities in its enterprise ABC model, and applying the costs in these 150 activities to 600,000 cost objects (products or SKUs, and customers), and running the model monthly for two years requires data estimates, calculations, and storage for more than 2 billion items.[5]

Such expansion has caused many home grown ABC systems to exceed the capacity of their generic spreadsheet tools, such as Microsoft Excel ®, or even their formal ABC software packages, such as ABC Technology's Oros® . The systems often take days to process one month of data, assuming the solution converges at all. 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.[6]

To reduce the computational and storage burden of operating an enterprise-wide ABC model, companies often build separate ABC models for each of their sites. But then the models do not easily handle products that move between facilities for processing. For example, at a steel fabricator and distributor, one particular grade of steel is processed through three different facilities before shipment to the customer. Trying to coordinate cost estimates for products traversing multiple ABC models, or for a product assembled from components built in separate factories, each with its own ABC model, becomes an essentially impossible task.

These implementation 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, invariably they 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, of course, operations at practical capacity are more the exception than the rule.

ABC cost driver rates should be calculated at practical capacity not at actual utilization.[7] Returning to the numerical example at the beginning of this paper, if the practical capacity of the resources are not fully used by the demands of handling 9,800 customer orders, 280 credit checks, and 500 credit approvals, the cost driver rates should be lower, perhaps significantly lower, than the rates calculated based on actual demands.

In summary, the process of calculating activity expenses through interviews, observation and surveys has proven to be time-consuming and costly to collect the data, expensive to store, process and report, difficult to update in light of changing circumstances, and theoretically incorrect, by suppressing the role for unused capacity when calculating cost driver rates.

Time-Driven ABC: A Simple, Accurate Approach

An alternative approach for estimating an ABC model, which we call "time-driven activity-based costing," addresses all the above limitations.[8] It is simpler, less costly, and faster to implement, and allows cost driver rates to be based on the practical capacity of the resources supplied. In retrospect, we wish that the evolution of ABC in the 1980s had taken a different path so that this method could have been implemented at the outset. But the underlying theory for ABC had not been developed when it was first introduced in the mid-1980s so the elegance and conceptual clarity of this new approach were not obvious at the time.

The basis for the new approach is highlighted in an early cost management article, where Robin Cooper articulated the difference between transactional and "effort" cost drivers.[9] Transactional cost drivers count the number of times an activity is performed. Examples include number of production runs, number of setups, number of shipments, number or purchase orders, and number of customer orders. When the resources required to perform each occurrence of an activity vary, such as when some setups are more difficult or complex to do than others, or when some customer orders require more time and effort to process than others, then simply counting the number of times an activity is performed gives an inaccurate estimate of the resources required to accomplish the work.

The heterogeneity in transactions can be handled in two ways by the ABC system. One is to expand the number of activities, into say handling a simple order, an average order, and a complex order. The resource costs then have to be assigned to the three types of order-handling activities, and a transactions driver – number of simple, average and complex orders – defined for each activity. Alternatively, the cost system can use *duration drivers*, which estimate the time required to perform the task. Examples of duration drivers are setup hours, material handling time, and, of course, direct labor hours and machine hours. While duration drivers are generally more accurate than transaction drivers, they are also more expensive to measure, so cost system designers have typically used transaction drivers whenever they reasonably approximate resource demands by each occurrence of an activity.[10]

Most ABC systems, like our numerical example of the customer service department, use a large number of transaction cost drivers. The cost driver rates are calculated by dividing the activity expense by the quantity of the transaction cost driver (such as number of setups, or number of customer orders). The calculation yields the cost per transaction. The implicit assumption behind this process is that each occurrence of the event (a setup, a customer order) consumes the same quantity of resources. This assumption is the key to the alternative approach for estimating cost driver rates.

The essence of activity-based costing and activity-based management is the measurement and management of the organization's capacity.[11] For this purpose, ABC systems require two estimates:

1. The unit cost of supplying capacity, and
2. The consumption of capacity (unit times) by the activities the organization performs for products, services, and customers.

Unit Cost Estimate

The new procedure starts, as with the traditional approach, by estimating the cost of supplying capacity. Identify the various groups of resources that perform activities. For example, for the set of activities performed by people involved in customer administration, the analyst identifies the front-line employees who receive and respond to customer-related requests, their supervisors, and the support resources they require to perform their functions – space, computers, telecommunications, furniture, and, potentially, resources in other support departments (information technology, human resources, utilities, etc.). In our numerical example, the sum of all these resources is $560,000 per quarter.[12] In addition, as in any well-designed traditional ABC model, the analyst also estimates the practical capacity of the resources supplied.

Measuring practical capacity of a group of resources is not a trivial issue, but neither is it an insurmountable issue. Often practical capacity is estimated as a percentage, say 80% or 85%, of theoretical capacity. That is, if an employee or machine normally can work 40 hours per week, practical capacity could be assumed to be 32 hours per week. This estimate allows for 20% of personnel time for breaks, arrival and departure, and communication and reading unrelated to actual work performance, and 20% of machine time for downtime due to maintenance, repair, and scheduling fluctuations.

A simple alternative for estimating practical capacity is to review the time series of past activity levels. For example, look at the number of customer orders handled over the past 12 or 24 months and identify the month with the maximum number of orders. Check whether for that period the work was handled without excessive delays, poor quality, overtime, or stressed employees. If not, as a starting point, use that maximum number as the estimate of the capacity of the resources performing that activity. As with all ABC design decisions, the analysis is not greatly sensitive to small errors in estimating parameters. The objective is to be approximately right, say within 5-10% of the actual number, not to measure the capacity to four significant digits. If the estimate is in error, the process of running the time-driven ABC system will reveal the error.

With estimates of (i) the cost of supplying capacity and (ii) practical capacity, the analyst calculates the unit cost as:

$$\text{Unit cost} = \frac{\text{Cost of capacity supplied}}{\text{Practical capacity of resources supplied}}$$

In our numerical example, assume that 28 customer service employees do the front-line work. 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. The unit cost (per minute) of supplying capacity is therefore:

$$\text{Cost per minute} = \frac{\$560{,}000}{700{,}000} = \$0.80 \text{ per minute}$$

Unit Time Estimate

The one new information element required for the time-driven ABC approach is an estimate of the **time required to perform a transactional activity**[13]. As discussed earlier, an ABC system uses a transaction driver whenever an activity – such as *setup machine*, *issue purchase order*, or *process customer request* – takes about the same amount of time. The time-driven ABC procedure uses an estimate of the time required each time the activity is performed. This unit time estimate replaces the process of interviewing people to learn what percentage of their time is spent on all the activities in an activity dictionary. The time estimates can be obtained either by direct observation or by interviews. Precision is not critical; rough accuracy is sufficient.

Returning to the numerical example, suppose that the analyst obtains estimates of the following average unit times for the three customer-related activities:

Handle customer orders	40 minutes
Process customer complaints	220 minutes
Perform credit check	250 minutes

We can now simply calculate the activity cost driver rate for the three activities:

Activity	Unit Time (minutes)	Activity Cost Driver Rate @ $0.80/minute
Handle customer order	40	$ 32
Process customer complaint	220	$176
Perform credit check	250	$200

These rates are lower than those estimated before. The reason for this discrepancy becomes obvious when we calculate the cost of performing these activities during the recent quarter.

Activity	Unit Time	Quantity	Total Minutes	Total Cost
Handle customer order	40	9,800	392,000	$313,600
Process customer complaint	220	280	61,600	49,280
Perform credit check	250	500	125,000	100,000
Total			578,600	$462,880

The analysis reveals that only 83% of the practical capacity (578,600/700,000) of the resources supplied during the period was used for productive work (and hence only 83% of the total expenses of $560,000 are assigned to customers during this period). The traditional ABC system over-estimates the costs of performing activities because its distribution of effort survey, while quite accurate – 70%, 10% and 20% of the productive work is the approximate distribution across the three activities – incorporates both the costs of resource capacity used and the costs of unused resources. By specifying the unit times to perform each instance of the activity[14] the organization gets both a more valid signal about the cost and the underlying efficiency of each activity as well as the quantity (121,400 hours) and cost ($97,120) of the unused capacity in the resources supplied to perform the activity.

With estimates of the cost of resource supply, the practical capacity of the resources supplied, and the unit times for each activity performed by the resources, the reporting system becomes quite simple for each period. Suppose the quantity of activities shifts, in the subsequent period, to 10,200 orders handled, 230 customer complaints, and 540 credit checks performed. During the period, the costs of each of the three activities are assigned based on the standard rates, calculated at practical capacity: $32 per order, $176 per complaint, and $200 per credit check. This calculation can be performed in real time to assign customer administration costs to individual customers, as transactions from customers occur.

The report at the end of the period is both simple and informative:

Activity	**Quantity**	**Unit Time**	**Total Time**	**Unit Cost**	**Total Cost Assigned**
Handle Customer Orders	10,200	40	408,000	$ 32	$ 326,400
Process Complaints	230	220	50,600	176	40,480
Perform Credit Checks	540	250	135,000	200	108,000

TotalUsed			593,600		$ 474,880
Total Supplied			700,000		$560,000
Unused Capacity			106,400		$ 85,120

The report reveals the estimated time spent on the three activities, as well as the resource costs required to handle the activity demands. It also highlights the difference between capacity supplied (both quantity and cost) and the capacity used. Managers can review the $85,120 cost of the 106,400 minutes (1,773 hours) of unused capacity and contemplate actions to reduce the supply of resources and the associated expense.

Rather than reduce currently unused capacity, managers may choose to reserve that capacity for future growth. As managers contemplate new product introductions, expansion into new markets, or just increases in product and customer demand, they can forecast how much of the increased business can be handled by existing capacity, and where capacity shortages are likely to arise that will require additional spending to handle the increased demands. For example, the vice president of operations at Lewis-Goetz, a hose and belt fabricator based in Pittsburgh, saw 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.

Time Equations

In general, not all orders are the same and require the same amount of time to process. Similarly for handling customer complaints, performing credit checks, or any other transactional process. We have found that companies can generally predict the drivers that cause some transactions to be simpler or more complex to process. For example, consider an activity to package a chemical for shipment. If the item is already a standard one in a compliant package, the operation may take only 0.5 minutes to get it ready for shipment. If the item requires a special package, then an additional 6.5 minutes is required. And if the item is to be shipped by air, an additional 0.2 minutes is required to place it in a plastic bag. Rather than define a separate activity for every possible combination of shipping characteristics, or use a duration driver for every possible shipping combination, the time-driven approach estimates the resource demand by a simple equation:

Packaging Time = 0.5 + 6.5 (if special handling required) + 0.2 (if shipping by air)

The data for special handling, method of shipment, and all other shipping characteristics are typically already in the company's ERP system where the order has been entered. Most modern ERP systems provide their users with tools to easily export these data to analytic software packages. Order-specific data enable the particular time demands for any given order to be quickly calculated with a simple algorithm that tests for the existence of each characteristic affecting packaging time. The time-driven approach usually operates with fewer equations than the number of activities used in any existing traditional ABC system, while permitting more variety and complexity in orders, products, and customers, and, therefore, delivering more accuracy.

Time-driven ABC models are usually similar for 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." Building an accurate time-based algorithm in one facility will typically serve as a template that can be easily applied and customized to other plants, or even other companies in an industry.

Another benefit of implementing a time-driven ABC model is the knowledge it generates about the efficiencies – unit cost and unit times – of critical business processes. Managers are often surprised by how much time it takes to process a special order or to set up a new customer, or the costs of performing a quality assurance check. Companies have enjoyed immediate benefits from their models by focusing their improvement efforts on high cost and inefficient processes.

And companies are using their time-driven process information in a predictive manner so that they can modify the behavior of their customers. Wilson-Mohr, an industrial controls company in Houston, Texas, worked as a subcontractor for Engineering Contractors (EC) 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 their ECs such as to replace parts or reconfigure the design. In the past, Wilson Mohr only charged the ECs for the predicted material cost changes from the change orders. Now it could also predict the cost of additional sales, design, engineering, and manufacturing labor time that were consumed when implementing the change orders. Wilson-Mohr now uses this information pro-actively in its discussions with its ECs about price recovery from engineering change orders.

Model Updating

Managers can easily update their time-driven ABC model to reflect changes in their operating conditions. For example, they might learn that the customer department performs more than the three activities specified in the original model. They don't have to return to re-interview the personnel in the department. They simply estimate the unit times required for each new activity identified. As already noted, if managers learn that all customer orders or all credit checks do not take the same amount of time, they can easily incorporate the effect of complex versus simple orders by estimating the incremental unit time required when a complex transaction must be handled. For example, at Maines Paper and Foodservice, the algorithm for Customer Service time adds three minutes for special orders, another three minutes if a credit memo is required, decreases the estimate if the order came via an EDI connection, and adds or subtracts times for known customer-specific characteristics. In this way, the model evolves seamlessly as managers learn more about additional variety and complexity in their processes, orders, suppliers, and customers.

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

The second factor leading to a change in the activity cost driver rate is a shift in the efficiency of the activity. Quality (six sigma) programs, other 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 modifies the unit time estimates (and therefore the demands on resources) to reflect the process improvement. For example, if a computerized data base is made available to the customer administration department, the people may be able to perform a standard credit check in 30 minutes rather than 250 minutes. The improvement is simple to accommodate; just change the unit time estimate to 30 minutes and the new activity cost driver rate automatically becomes $24 per credit check (down from $200). The new rate may be somewhat higher than $24 after the unit cost rate has been increased (above $0.80 per minute) to reflect the cost of the newly-acquired data base and computer system.

Following this procedure, an ABC model can be updated based on events rather than by the calendar (once a quarter, or annually). Anytime, analysts learn about a significant shift in the costs of resources supplied, or changes in the resources required for the activity, they update the cost rate estimates. And anytime they learn of a significant and permanent shift in the efficiency with which an activity is performed, they update the unit time estimate.

The key elements for time-driven ABC are, first, estimating the practical capacity of committed resources and their cost, and, second, estimating unit times for performing transactional activities. The practical capacity should be estimated anyway for doing a valid ABC analysis to avoid distortions and potential death spirals that arise when existing products and customers are burdened with the costs of unused capacity. And the unit time estimates are implicit in the very notion of a transaction driver. These unit times need not be estimated to four significant digits. Managers use the unit time estimates for strategic insights, not to monitor and control the performance of individual employees and equipment. For the strategic insight, a rough estimate, generally within 10 percent, should be adequate. Gross inaccuracies in unit time estimates will eventually be revealed either in unexpected surpluses or shortages of committed resources. At the time of such surprises, analysts can focus on the unit times required by the activities performed by these resources and obtain updated and more accurate estimates. A cost system used for operational control, in contrast, needs to monitor closely the resource requirements, quality, and cycle times of activities and processes to motivate and capture the small improvements from continuous improvement activities.

Practical Applications of Time-Driven ABC

Time-driven ABC is not a hypothetical improvement to traditional ABC analysis. It has been applied in dozens of companies, helping them to deliver significant profit improvements quickly.

Hunter Company

The Hunter Company (disguised name of actual company), a large, multinational distributor of scientific products with over 20 facilities, 300,000 customers, and 460,000 product SKUs, processes more than one million orders each month. Hunter already had an existing activity-based costing model that had been built with the assistance of an external consulting team. The insights revealed from the model were extremely informative but many in the company questioned if the view was worth the climb. Their main complaints can be summarized as follows:

- The model had been cumbersome to build and maintain. With more than 1,000 activities, the monthly survey of department staff of where they had spent their time was complex and costly. Also, tracking the driver quantities for each activity and customer was difficult.
- The model did not reconcile with actual financials since activity cost driver rates had not been updated recently.
- Despite the already large number of activities, the model was still not considered accurate or granular enough. It did not reflect several important differences between orders. To increase accuracy, more activities would have to be added, and employees would have to be re-interviewed. Also, an additional data extract to track the quantities of the new cost drivers would be required.

The existing ABC approach was not easily maintainable, and thus not sustainable. The company called in a software/consulting company to help it implement the time-driven ABC approach.[15] The time-driven approach led to the following changes:

> For a department, such as the inside sales department, the previous ABC model required employees to estimate, each month, the percentage of their time spent on their three activities: c*ustomer set-up, order entry,* and *order expediting*. In the time-driven approach, the ABC team estimated the time required to perform each activity. For example, the activity to *set-up a new customer* took 15 minutes. Since a field already existed within Hunter's ERP system that identified whether a customer was new, assigning a customer set-up cost to a new customer became a simple transaction. For *order entry*, the team learned that every order took about five minutes to enter the basic order information, plus three minutes for each line item on the order. Again this was a simple calculation to implement since the ERP

system already tracked the number of line items for each order. Finally, the team learned that *order expediting* was triggered by a request by the customer to rush the shipment, resulting in an additional 10 minutes of time to coordinate the expediting. The order included a field that identified it is a "rush order." The project team could write a simple equation to estimate the Inside Sales Department time required for each order received:

Inside Sales Process Time = 15*[**New Customer**] + 5 + 3*[**Number of Line Items**] + 10*[**Rush**]

The Inside Sales Department cost for the order was obtained by multiplying this time by the cost per minute of Inside Sales Department resources. This process was replicated in each department to arrive at the total cost of producing, handling, and fulfilling the order.

Note that once the team had created the Inside Sales Process algorithm, it did not need to continually re-interview personnel. Each period, the costs of the department would be assigned based on the volume and nature of the transactions it handled.

The Hunter Company identified the following benefits from shifting its ABC model to the time-driven approach.

- It reduced the number of activities to maintain. It transformed 1,200 activities (e.g., set-up new customer, enter orders, expedite orders) to 200 department specific processes (e.g., the equation used to estimate Inside Sales Department time). Also, it could easily update the resource cost of each cost center and departments so that its process costs were accurate and current.
- Its cost estimates were more accurate since they were based on actual observations of processing time and actual transaction data, not subjective estimates on where and how people spent their time
- It was easier to increase model accuracy and granularity, when wanted, for high cost and heterogeneous processes. Adding more elements to the time equation enabled managers to easily add more variety and complexity to the model when required. This enabled managers to identify specific SKUs, customers, and processes where improvements could be made.
- The model was easier to validate. The calculated total process time, based on all transactions in a period, could be reconciled to head count (resources supplied during the period). If the total process time exceeded the actual resources supplied, managers received a signal that some of their unit times were likely too high. If total calculated process time was well below the time supplied, but employees felt they were working at or beyond capacity, managers learned that some of their unit times were under-estimated or employees were working less efficiently than anticipated.
- The model provided explicit information on processes operating at or beyond capacity, and those operating well below capacity. Managers could take action to relieve bottlenecks expected to persist in future periods, or act to reduce capacity

in departments where any unused capacity was expected to persist for several periods into the future.

Today, it takes two people, two days per month to load, calculate, validate and report findings, compared to the 10-person team spending over 3 weeks to maintain the previous model. Employees now spend time generating increased profits from the information rather than just updating and maintaining the information.

Klein Steel

Klein Steel, a steel service center in upstate New York, distributes more than 3,500 products at an average mark-up of 30%. Because of high handling and distribution costs, however, its net margin was only 1%. It installed a time-driven ABC system that enabled it to see costs by distribution office, by product, by customer, and by size of order. By working from an industry template, Klein had such accurate cost and profitability information within 1-2 months. Among its findings were the following:

- twenty-five percent of its customers were unprofitable
- the company could not make a profit on any order selling for less than 20 percent gross margin – regardless of order size
- several entire distribution routes were unprofitable, and
- salespersons had been trying for years, unsuccessfully, to increase order volume with some unprofitable customers.

Klein acted quickly to establish new order acceptance guidelines, provide customer incentives to consolidate many small orders into a few large ones to reduce handling and shipping costs, enact a new sales commission plans based on net profitability of customers, and improve processes revealed to be high cost. Klein enjoyed an initial gross profit improvement of 4% and recaptured the cost of installing its new ABC system within six months. It was targeting a profit improvement of more than $700,000 annually.

Banta Foods

Banta Foods is a Midwest food distributor with revenues of approximately $100 million from 2,700 customers. Like Klein Steel, it operated with a razor thin net margin of about 1 percent. Historically, its profit drivers were increasing the number of orders per day, increasing aggregate revenues, and controlling aggregate expenses. Its time-driven ABC system, installed and running within a few weeks, revealed much more granularity in its expense structure by tracking costs to products, orders, customers, and territories. Sales managers learned that a $1,000 order, considered the smallest size to breakeven, could either be quite profitable or a loss depending on distance to customer, location of product in the warehouse, size of order, frequency of delivery, type of service, and credit worthiness of the customer – all of which were now incorporated in the algorithms in its new time-driven ABC system. Chuck Banta, President and CEO, noted:

> Your cost to serve is a lot less 50 miles away from your warehouse than it is 200 miles away. ABC allowed us to look at all our expenses through that kind of lens.

Based on the information in its ABC model, Banta instituted an non-negotiable minimum order size, reduced the inventory of unprofitable products, promoted sales of high profit products, negotiated with customers to either reduce or re-price the demand for high cost services, and offered incentives to its salespersons 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 their customers to become more profitable. He reported:

> Sales people can now increase their gross profit 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 increased revenues by 35% and net profits by 22 % significantly outperforming its industry and garnering the distinction of "Innovator of the Year" in its industry.[16] With all its initial actions, Banta's annual profits increased by 43%. Additional action plans being implemented are expected to yield an additional 25% increase in profits as shown below:

Opportunities Identified	**Profit Impact (total increase of 70%, equal to 1.4% of revenues)**
Sales incentives paid on net profits	+11%
Recover vendor rebate processing costs	+20%
What-if profit analysis on new business	+22%
Establish minimum order size	+22%
Perform vendor reviews	+ 5%

Summary

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 activity-based cost systems from being an effective, timely, and up-to-date management tool. The time-driven ABC approach has overcome these difficulties. It offers managers a methodology that has the following positive features:

1. Easy and fast to implement
2. Integrates well with data now available from recently installed ERP and CRM systems

3. Inexpensive and fast to maintain and update
4. Ability to scale to enterprise-wide models
5. Easy to incorporates specific features for particular orders, processes, suppliers, and customers
6. More visibility to process efficiencies and capacity utilization
7. Ability to forecast future resource demands based on predicted order quantities and complexity

These characteristics enable activity-based costing to move from a complex, expensive financial systems implementation to becoming a tool that provides meaningful and actionable data, quickly and inexpensively, to managers.

About the Authors

Robert S. Kaplan is the Marvin Bower Professor of Leadership Development at Harvard Business School. Kaplan joined the HBS faculty in 1984 after spending 16 years on the faculty of the Graduate School of Industrial Administration (GSIA), Carnegie-Mellon University. He served as Dean of GSIA from 1977 to 1983. Kaplan received a B.S. and M.S. in Electrical Engineering from M.I.T., and a Ph.D. in Operations Research from Cornell University. In 1994, he was awarded an honorary doctorate from the University of Stuttgart. Kaplan's research, teaching, and consulting focus on new cost and performance measurement systems, primarily activity-based costing and the The Balanced Scorecard. He has authored or co-authored more than 100 papers and ten books. Kaplan received the Outstanding Accounting Educator Award in 1988 from the American Accounting Association (AAA), and the 1994 CIMA Award from the Chartered Institute of Management Accountants (UK) for "Outstanding Contributions to the Accountancy Profession."

Steven Anderson is Chairman and Founder of Acorn Systems, Inc. a consulting and software company with offices in Houston, Austin and Philadelphia that specializes in profit management and other decision automation software tools that help boost the operating profits of their clients. In 1996, Mr. Anderson founded Acorn and pioneered this new time-based approach to ABC. He has written several white papers and articles on this and related subjects. Mr. Anderson is an alumnus of Harvard Business School (Baker Scholar) and McKinsey & Company. He also holds an engineering degree from Princeton University, and an accounting post-baccalaureate from University of Houston. He can be reached for advice at (610) 687-8400, x1002, or by e-mail at sanderson@acornsys.com. For additional information on this subject, visit Acorn Systems at www.acornsys.com.

Endnotes

[1] The cases include Schrader Bellows (186-050), John Deere Component Works (A) and (B) (187-101 and –187-108), Siemens EMW (A) (191-006), and Kanthal (A) (190-002). Papers include R. Cooper "The Rise of Activity-Based Costing- Part One: What is an Activity-Based Cost System?" *Journal of Cost* Management (Summer 1988): 45-58; R. Cooper "The Rise of Activity-Based Costing- Part Two: When Do I Need an Activity-Based Cost System?" *Journal of Cost* Management (Fall 1988): 41-48; R. Cooper "The Rise of Activity-Based Costing- Part Three: How Many Cost Drivers Do You Need, and How Do You Select Them?" *Journal of Cost* Management (Winter 1989): 34-46; R. Cooper and R. S. Kaplan, "Measure Costs Right: Make the Right Decisions," *Harvard Business Review* (September-October 1988).

[2] Steven Anderson "Should More Companies Practice their ABCs?" (September 1997)

[3] C. Argyris and R. S. Kaplan, "Implementing New Knowledge: The Case of Activity-Based Costing," *Accounting Horizons* (September 1994): 83-105.

[4] Steven Anderson and Richard Drobner, "Innovative Approach to ABC Delivers Profound Insight into Process Costs" (2002)

[5] According to Acorn Systems, Inc., a simple calculation for database size is # activities x total # cost objects (e.g. line items) x # months = 150 x 600,000 x 24 = 2.16 billion items

[6] Steven Anderson "Should More Companies Practice their ABCs?" (September 1997)

[7] Robin Cooper and R. S. Kaplan "Activity-Based Systems: Measuring the Costs of Resource Usage," *Accounting Horizons* (September 1992): 1-13; and "Measuring the Cost of Resource Capacity," Chapter 7 in R. S. Kaplan and R. Cooper, *Cost & Effect: Using Integrated Cost Systems to Drive Profitability and Performance* (Boston: HBS Press, 1998): 111-136.

[8] The modified approach was described in Chapter 14 of *Cost & Effect:* 296-299. It was also described by Acorn Systems in "Should More Companies Practice their ABCs?" (September 1997)

[9] R. Cooper, "The Two-Stage Procedure in Cost Accounting: Part Two," *Journal of Cost Management* (Fall 1997): 39-45.

[10] If different amounts of resources are used each time an activity is performed, then even time estimates (duration drivers) may not be adequate. In this case, an intensity driver that directly charges resource cost for each incident of the activity may be required. See Kaplan and Cooper, *Cost & Effect*: 95-99, for discussion on the nature and trade-offs of transaction, duration, and intensity cost drivers.

[11] Kaplan and Cooper, "Measuring the Cost of Resource Capacity," *Cost & Effect*.

[12] By assumption, the $560,000 of expenses are committed for the upcoming period; they are not expected to vary based on the actual number of customer orders processed, complaints handled, or credit checks performed

[13] Steven Anderson "Should More Companies Practice their ABCs?" (September 1997)

[14] Alternatively, at considerably higher expense, the company could have used a duration driver to measure the actual length of time required to perform each instance of the activity.

[15] The company is Acorn Systems (www.acornsys.com) .

[16] ID Magazine, April 7, 2003