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ROBERT S. KAPLAN

Time-Driven Activity-Based Costing

Consider the situation faced in the 1990s by Carolina Distributors, a Fortune 500 distributor of medical and surgical supplies. Sales had more than tripled in five years (325%) to nearly $3 billion. Yet its selling, general, and administrative (SG&A) expenses, thought by many to be a "fixed" or "semi-fixed" cost, had increased even faster than sales (337%). Despite the tripling in sales, gross margins had declined by one percentage point and the company experienced its first loss in decades. Rather than SG&A costs being fixed or even variable, these costs had become "super-variable." They had increased faster than sales revenue.

The experience of this large distributor is hardly unique. Companies, attempting to retain and grow their business with existing customers and also attract new customers from competitors, often agree to provide customers with new value-added services such as the following:

- Producing and stocking a greater variety of products
- Customizing products and services to individual customer preferences
- Supporting more order-entry and order-tracking channels
- Producing and delivering in smaller order sizes
- Delivering directly to customers' end-use locations, often in expedited and narrow time windows
- Providing specialized technical application support

All these new services create value and loyalty among customers, but none of them comes for free. Like many companies, Carolina had added extensive infrastructure to make the transition from its historic *low-cost* strategy to its new strategy of providing differentiated and complete solutions to its customers. But it had not modified its pricing formula. It continued to use the traditional cost-plus pricing in which the customer paid the base manufacturer price plus a standard markup for the distributor. No provision was made in the price for any special services performed for customers. The consequences of this pricing policy were highly predictable.

First, customers, learning that Carolina's average markup on expensive, low-bulk items, such as cardiovascular sutures, greatly exceeded their cost of handling and distributing them, began to order such items directly from the manufacturer. Carolina was left handling low-price, low-margin, bulky items like boxes of diapers where the flat percentage markup was well below the true cost of storage,

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Professor Robert S. Kaplan prepared this note as the basis for class discussion. The company mentioned in this note has been disguised.

handling, and distribution. Second, customers increased their demands for special services such as breakpacks, small order sizes, overnight delivery, and delivery directly to the point of use. After all, customers calculated, if suppliers were willing to deliver small quantities directly to the point of consumption, why incur the extra costs associated with receiving carton and pallet quantities at a receiving dock, moving them into a local storage area, and subsequently distributing them, with internal resources, to its own end-use customers. The demand from customers for specialized services, willingly provided at no additional cost by companies such as Carolina, can be enormous.

In general, as a customer's demands for unpriced services increases, the supplier incurs large losses when serving that customer. This was the situation in which Carolina Distributors found itself; it had accommodated customers' increased demands by adding resources whose cost outstripped revenue increases, leading to operating losses. Second, to avoid the losses, the supplier decides not to supply some services requested by the customer. For example, Carolina was beginning to refuse a customer's requests for delivery of small quantities directly to multiple locations at the customer's site. In this case, the market between supplier and customer has broken down. Customers are making excessive demands and the vendor is restricting supply. The lethal combination leads to frustration and confrontation.

This conundrum occurs in many companies. A semiconductor manufacturer with nearly $2 billion in annual sales found its profitability eroding. It had increased the scope of its product line to accommodate customers' specialized requests, and had expanded the services it offered, such as express (overnight) delivery of small shipments, consignment warehousing, special packaging and labeling, and electronic data interchange (EDI). While EDI is normally thought to be a cost-reducing alternative, the manufacturer found that customer error rates were more than 50% when submitting EDI orders, requiring extensive error correction and data validation processes. The company had no understanding of how the costs of the special products and services varied among its individual customers; consequently it had no basis for recovering these costs.

A Solution and a Problem: Activity-Based Costing to Measure "Cost-to-Serve"

Companies can remedy the supplier-customer conflict through improved information systems and better aligned incentives. The solution starts when the supplying company builds a new system that reports accurately on its cost to produce products, process orders, distribute to customers, and provide special services to them. Activity-based costing (ABC) provides the conceptual framework for linking financial, production, scheduling, order-entry, marketing, and sales data—from general ledger, ERP, and CRM systems—into a comprehensive costing and profitability model that reports profitability by individual product, customer, and even, by order.[1] An ABC system gives a clear and accurate picture of a company's gross margins by individual product or SKU, and the company's costs of serving its diverse customer base. This picture provides the basis for companies to take actions on process improvement, pricing, and managing customer relationships that transform unprofitable products, orders, and customers into profitable ones.

[1] Activity-based costing was introduced in R. Cooper and R. S. Kaplan, "Measure Costs Right; Make the Right Decisions," *Harvard Business Review* (September–October 1988), pp. 96–103; and was extended in "Profit Priorities from Activity-Based Costing," *Harvard Business Review* (May–June 1991), pp. 130–135; and *Cost and Effect: Using Integrated Cost Systems to Drive Profitability and Performance* (Boston: HBS Press, 1998).

The problem comes when managers attempt to apply activity-based costing to complex enterprises. First, the process of interviewing and surveying employees to get their time allocations to multiple activities can prove time-consuming and costly. At one large money center bank's brokerage operation, the 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. Managers also questioned the accuracy of the system since cost assignments were based on individuals' subjective estimates of how they spend their time. Because of the high cost of continually updating the ABC model, many systems were updated only infrequently, leading to out-of-date activity cost-driver rates, and inaccurate estimates of process, product, and customer costs.

A subtler and more serious concern arose from the interview and survey process itself. When people estimated how much time they spend on various activities, they invariably reported percentages that added up to 100%. Few individuals reported that a significant percentage of their time was idle or unused. Therefore, cost-driver rates were calculated assuming that resources were working at full capacity. But, of course, operations at practical capacity are more the exception than the rule.

In summary, the process of calculating activity expenses through interviews, observation, and surveys requires a time-consuming and costly process to collect the data, an expensive information system to run the model, and a difficult process to update the model in light of changing circumstances. It is also theoretically incorrect, by including the cost of unused capacity when calculating cost-driver rates.

Time-Driven Activity-Based Costing: A Simpler, More Powerful Path to Profitability

A new approach, which we call time-driven ABC, is far simpler and also much more powerful than the conventional ABC models.[2] The TDABC model requires, for each group of resources, only two parameter estimates:

1. The cost rate of supplying resource capacity; and
2. The consumption of resource capacity (typically unit times) by the activities performed by the resources for products, services, and customers.

The model allows all types of complexity to be incorporated within the capacity consumption estimates.

Capacity Cost Rate Estimate

Time-driven ABC starts by identifying the various groups of resources performing activities. For example, customer administration resources include 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.).

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[2] The foundational references are R. S. Kaplan and S. R. Anderson, "Time-Driven Activity-Based Costing," *Harvard Business Review* (November 2004): 131–138; and Kaplan and Anderson, *Time-Driven Activity-Based Costing: A Simpler and More Powerful Path to Higher Profits* (Boston: HBS Press, 2007).

Consider a customer service department, costing $560,000 per quarter. The department has 28 customer service employees performing the front-line work. For simplicity, assume that all costs are committed for the period. They will not vary based on the actual work performed. During the most recent period, the department performed three types of activities:

- Processed 49,000 customer orders
- Handled 1,400 customer inquiries
- Performed 2,500 customer credit checks

We already know that the cost of the department totals $560,000, which includes compensation for employees and their supervisors, occupancy and technology costs, and any direct assignment of expenses from support departments such as human resources, information technology, and finance. To calculate the practical capacity of the department, assume that each of the 28 front-line employees works an average of 22 days per month, 7 1/2 hours per day, for a total of about 9,900 minutes per month. Suppose that about one hour per day is unavailable for actual work, due to breaks and training activities. So each employee is available for work about 8,580 minutes per month, approximately, 25,000 minutes per quarter. With 28 employees, the department has a quarterly practical capacity of about 700,000 minutes.

The formula and calculations for the capacity cost rate are shown below:

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

$$\text{Capacity cost rate} = \frac{\$560{,}000}{700{,}000} = \$0.80 \text{ per minute}$$

While most resources measure capacity using time availability, the time-driven approach also recognizes resources whose capacity is measured in other units. For example the capacity of a warehouse, truck, or freight car could be measured by space available, while memory storage would be measured by megabytes supplied. In these cases, the designer calculates the cost rate based on the appropriate capacity measure, such as $/cubic meter or $/megabyte.

Unit Time Estimate

Next, the time-driven ABC approach requires an estimate of the **time required to perform a transactional activity**. 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:

Process customer order	8 minutes
Handle customer inquiry	44 minutes
Perform credit check	50 minutes

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

Activity	Unit Time (minutes)	Cost-Driver Rate @ $0.80/minute
Process customer order	8	$6.40
Handle customer Inquiry	44	35.20
Perform credit check	50	40.00

Then apply these cost-driver rates to the three different activities performed in the department:

Activity	Unit Time	Quantity	Total Minutes	Total Cost
Process customer order	8	49,000	392,000	$313,600
Handle customer inquiry	44	1,400	61,600	49,280
Perform credit check	50	2,500	125,000	100,000
Used Capacity			578,600	$462,880
Unused Capacity (17.3%)			121,400	97,120
Total			700,000	$560,000

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; hence only 83% of the total expenses of $560,000 are assigned to customers during this period. By specifying the unit times to perform each instance of the activity, the organization gets a 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.

The reporting system for time-driven ABC is quite simple. Suppose, in the next period, the quantity of activities is 51,000 customer orders, 1,150 customer inquiries, and 2,700 credit checks. During this period, the costs of each of the three activities are assigned based on the standard rates, calculated at practical capacity: $6.40 per order, $35.20 per complaint, and $40 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 standard cost rates can also be used in discussions with customers about acceptance and pricing of new business.

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

Activity	Quantity	Unit Time	Total Time	Cost-Driver Rate	Total Cost Assigned
Process customer order	51,000	8	408,000	$ 6.40	$326,400
Handle customer inquiry	1,150	44	50,600	35.20	40,480
Perform credit check	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

The report reveals the time required to perform the three activities, as well as their resource costs. It also highlights the difference between capacity supplied (both quantity and cost) and capacity used. Managers can review the $85,120 cost of the unused capacity and contemplate actions to determine whether and how to reduce the costs of supplying unused resources in subsequent periods.

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 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.

Time Equations

Time-driven ABC does not require the simplifying assumption made so far that all orders or transactions are the same, requiring the same amount of time to process. A simple extension allows the unit time estimates in a time-driven ABC model to vary based on order and activity characteristics. 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 estimate transaction times 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)

Many companies may already have the information needed for time equations if they are doing process mapping, a standard tool for business process design or re-engineering. Consider the process map shown in Exhibit 1 for the inside sales process of a distribution company. A standard order from a customer already in the system for a product with an existing price can be handled simply: 2 minutes to receive the order from the customer, 2 minutes for each line item in the order, and 1 minute to confirm the entire order. But the order will take longer to enter if it is from a new account or is for a product where the sales entry clerk must contact the manufacturer for a quote. These branches are shown in Exhibit 1. From this process map, the analyst can easily construct a time equation for the sales order entry process, as shown below:

Order Quote Time (minutes) = Time to [{receive order} + {enter order} + {confirm order}]

+ {if new account} setup account

+ {if quote needed} (identify need + contact vendor + quote price)

= 2 + 2* number of line items + 1 + 5 {if new account}

+ {if quote needed} [1 + 6 * number of line items + 5 {if not in stock}]

While seemingly complicated and demanding of data, in fact time equations are generally quite simple to implement since many companies' ERP systems already store data on order, packaging, distribution, and other characteristics. These order- and transaction-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 (e.g., new customer, product requires vendor quote, rush order, overseas shipment) that affects resource consumption. The time-driven approach typically requires fewer equations than the number of activities used in any existing traditional ABC system, while permitting much more variety and complexity in orders, products, and customers. As a result, the time-driven ABC model is more compact and far more accurate than traditional ABC models.

Model Updating

Managers can easily update a time-driven ABC model to reflect changes in their operating conditions. To add more activities for a department, they do not have to return to re-interview personnel. They simply estimate the unit times required for each new activity identified. Managers 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 one food service company, the algorithm for Customer Service time was modified to reflect the added time to process special orders and credit memos with orders, as well as the time subtracted if the order came via an EDI connection. 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 cost-driver rates. Two factors cause a cost-driver rate to change. First, changes in the prices of resources supplied affect the capacity cost rate. For example, if employees receive an 8% compensation increase, the cost rate 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 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 database is made available to the customer administration department, the people may be able to perform a standard credit check in 10 minutes rather than 50 minutes. The improvement is simple to accommodate: just change the unit time estimate to 10 minutes, and the new activity cost-driver rate automatically becomes $8 per credit check (down from $40). The new rate may end up somewhat higher than $8 after the capacity cost rate has been increased (above $0.80 per minute) to reflect the cost of the newly acquired database 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 capacity cost rate. 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.

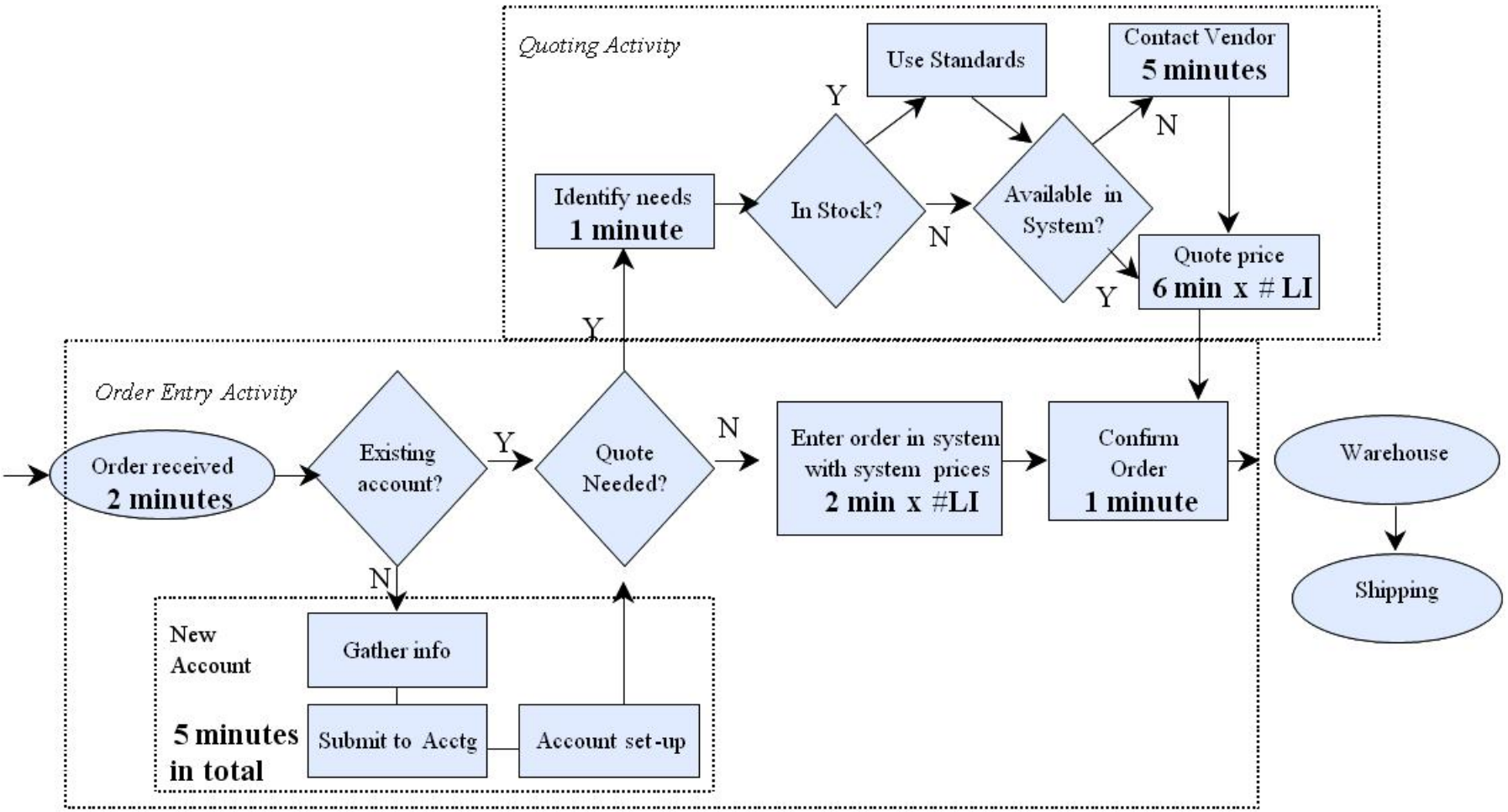
Summary

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 incorporate 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.

Exhibit 1 Sales Order Entry Process Map



Source: Casewriter.