

Time-Driven

Activity-Based Costing: A Powerful Cost Model



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Contemporary business, whether large or small, requires that management have a clear understanding of its costs and a scalable, easy-to-understand cost model that can quickly reflect changes in business as they occur. While original activity-based costing (OABC) provided a solid model for costing varied products and services, time-driven activity-based costing (TDABC) can capture more variation and complexity, providing the same high-quality information without many of the drawbacks associated with OABC models.

Today's customer focus finds business producing and stocking a greater variety of products, supporting more order-entry and order-tracking channels, producing and delivering in smaller order quantities, delivering to customer end-use locations, and providing various levels of technical support. Along with these increased levels of customer service is the need to manage customer and channel profitability. OABC called attention to cost differences between

high and low volume, simple and complex, standard and custom products. TDABC can provide quality information on customer and channel profitability by reflecting the cost differences between low-demand, simple-to-service customers and high-demand, complex customers.

Original ABC

OABC focused on the causes of cost in response to the diversity of product types, markets and customers, resulting in greater tracing of indirect costs to various cost objects. Diverse product features, varying quantities, shorter product life cycles and the need for fast production turnaround suggested that a costing model allocating indirect costs on a unit-level denominator activity would not be reflective of product costs. The normal model would likely over-cost large quantity, easy-to-make products and under-cost small quantity, more difficult-to-make products. The OABC model changed the face of tracing indirect costs to products. Valuing the

activities performed and assigning them to products and services based on their consumption of the activities resulted in a product cost more reflective of the economic reality of how resources were consumed.

Issues with OABC

Although OABC delivered improved costing, it had significant implementation issues. First, many models identified large numbers of activities necessary to capture the complexity of a process. The challenge was recognizing when enough activities had been identified to adequately describe a process.

Second, the assignment of departmental costs to individual activities was generally based on the results of employee interviews and surveys that asked them to estimate the time, in percentage terms, they spent on the various activities over the past year. Asking employees to accurately remember how they spent their time over the last year left the allocation results subject to challenge. Additionally, employees would likely account for 100 percent of their time being spent in assigned activities, suggesting no idle or unproductive time. Accordingly, the cost assignments were based on full capacity and the cost of idle time was included in the cost of the various activities. The result was a theoretically flawed model.

Finally, products and services offered, customers and activities changed over time. The time-consuming and expensive employee survey process needed to be repeated any time significant processes and activities changed if the model was to be reflective of current business reality.

Time-Driven Activity-Based Costing

TDABC is a simpler model – easily installed, validated, maintained and expanded – making it a perfect cost model for today's fast-paced business environment. It requires the determination of two parameters: the unit cost of supplying capacity and the time required to perform an activity.

Determining Departmental Costs. TDABC does not assign resource costs to cost pools on the basis of employee survey results. Rather, costs can be accumulated at the department level as a first step in determining the unit cost of capacity. Departmental costs should include the cost of all resources consumed by each department, including:

- employee salaries and fringe benefits;
- supervision salaries and benefits;
- indirect labor salaries, fringe benefits and the cost of any supervision;
- depreciation on equipment and technology used by employees and supervisors;
- employee and supervisor occupancy costs; and
- other costs from company support functions.

It is common for management to allocate support or shared services costs to operating units using a direct, stepped or reciprocal model based on such allocation bases as square feet, headcount or machine hours. Although these approaches seem simple and easy to apply, they are unlikely to reflect how the shared services

resources are actually consumed. Consideration should be given to extending the same TDABC analysis to shared services. Similarly, consideration should also be given to organization sustaining expenses. These costs evidence little relationship to volume or mix and are difficult to causally trace to operating units. As would be the case in an OABC model, these costs may be best handled as period costs and left out of the model. The goal is a simple accurate costing model for determining the resource cost of producing products and services. The use of an arbitrary allocation base for support costs would seem to detract from that goal.

The actual general ledger data should be used to validate the initial model verifying the arithmetic and accuracy of the time equations. Additionally, the use of general ledger data agreeing to financial statements will go a long way in achieving buy-in from management. The model time equations can be used to calculate various product, customer and department costs that can be reconciled to the general ledger validating the model.

The use of actual general ledger data does present some problems. The use of actual costs will reflect any unusual or non-recurring transactions. Seasonality, timing issues and cost variances are also reflected in the numbers, potentially causing distortions in monthly or interim model iterations. The use of budgeted or forecasted resource spending should be considered to alleviate these issues after the initial validation.

Determining Practical Capacity. The next step in determining the unit cost of capacity supplied is to determine the capacity of each department. TDABC uses time to drive cost since personnel and equipment have capacity easily expressed in terms of time. Capacity is measured by the quantity of time – in hours, minutes or seconds – that employees are available to perform work activities. Capacity might be better measured by available machine time in a department that is equipment paced. Each department's capacity would be estimated as its number of employees multiplied by the time each employee is available for work each day. Employee available time per-day should be adjusted for such things as meals, breaks, training time or maintenance times in arriving at a department's practical capacity. Depending upon whether the rate being determined is a quarterly or annual rate, the daily capacity would be multiplied by the appropriate number of available-for-work days. A capacity cost rate can then be calculated as:

$$\text{Capacity Cost Rate} = \frac{\text{Cost of Capacity Supplied (Departmental Costs)}}{\text{Practical Capacity}}$$

Identifying the Activities. Identifying the activities being done in each department is the next step. Observation and employee inquiry are used both to identify and confirm processes. The activity dictionary prepared as part of an OABC implementation or existing process maps will be useful in identifying the processes. An additional source of this information may be flow charts and narratives prepared for internal control and Sarbanes-Oxley compliance.

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TDABC replaces the employee survey process of OABC with estimates of the time or capacity required to perform an activity and expresses it in terms of an equation. The equation would contain any base time required to process a transaction plus a time required for each variation in the activity that could be encountered. Precision is not a requirement here; an accurate expression is more the goal.

Generally, equations are built by beginning with a transaction's principal factor and then adding the variables. A good approach is to begin with the most costly processes. Once the processes are defined, the significant variables or drivers that consume time can be identified. Initially, it might be easiest to use driver data already being collected rather than developing and expanding data collection facilities. Mix and volume changes have no effect on equations. A general form of the time equation is as follows:

$$\text{Time Required for Activity} = \text{Minutes (Base Activity)} + \text{Minutes X \# Variable 1} + \text{Minutes X \# Variable 2} + \text{Minutes X \# Variable } i$$

Transaction base times and times required to accomplish each variable can be determined several ways depending upon resource availability. Available industrial engineering data (results of time and motion studies) can provide the information. Employee inquiry and observing the processing of transactions and recording the time taken can establish time requirements and confirm any employee supplied data. A better approach might be to observe and time a number of similar transactions and calculate an average time.

The components of the model are now complete; what remains is to run it with data. Although TDABC may not be quite as data demanding as OABC, it does require transactional data on products, customers, orders and other intended cost objects for a company to enjoy its benefits. Companies with enterprise resource planning systems in place will already have access to the granular level of data necessary to feed a TDABC model. Others will find it necessary to invest in the required technology to capture and provide access to the required data.

The use of a pilot or small-scale implementation will provide companies with the ability to "test drive" the TDABC model before companywide implementation, thereby relieving some of the pressure on data. Driving initial formulas on data already in existence from legacy, homegrown or electronic spreadsheet packages may also provide some relief, though possibly resulting in a less accurate model output.

The beauty of the TDABC model can be seen in its ease of update. Changes in departmental costs or in available capacity are easily handled with adjustments to either the numerator or denominator and calculation of a new capacity cost rate. Time equations can easily be updated for improvements in times required to complete activities or for the addition of new variables to an activity reflecting increased levels of complexity. The addition of a completely new activity to a department requires only an estimate

of the times required for the tasks and the structuring of a new equation.

A TDABC Example

Customer Direct Inc. has its own call center selling and supporting its warehouse inventory and distribution direct to the products' end user. Although we have chosen to example a sales/distribution type of organization, the principles of TDABC are easily applied to manufacturers and other types of businesses. The costs associated with the purchasing, warehouse, shipping and customer service departments include direct wages and benefits, occupancy, technology and other support costs.

All employees work a five-day week and are paid for eight hours each day. Additionally, they are given 30 minutes for lunch, two breaks totaling 30 minutes, and spend 30 minutes in training each day, resulting in six-and-a-half hours (390 minutes per day) available for assigned activities. Capacity is expressed in terms of minutes, as we believe they are more easily understood than fractional amounts of an hour. Allowing for each employee receiving 10 days vacation and six paid holidays per year, each employee is available for work 244 days per year. Departmental costs, the number of employees, practical capacities in minutes and the capacity cost rates per minute are presented in Table 1.

Table 1

Department	Cost	# Employees	Minutes	\$ / Minute
Purchasing	\$525,000	5	475,800	\$1.10
Warehouse	520,000	10	951,600	.55
Shipping	300,000	6	570,960	.53
Customer Service	1,800,000	25	2,379,000	.76

Table 2

Purchase order processing time =	10 (prepare the basic PO) +15 (if contact vendor) +5 times the # of line items
Order entry time =	5 (enter customer header information) +2 (if a new customer) +2 times the # of line items +10 (if an international customer) +2 (if special handling required) +5 (contact production/warehouse)
Pick/pack order time =	3 (prepare/print pick-pack) +4 times the # of line items +1 times the # of line items w/special packing +3 times the # of cartons
Order shipping time =	8 (prepare basic docs) +5 times the # of cartons +10 (if international shipment) +5 (if "rush" order)

Direct observation and discussions with employees identified the key activities and variables in each department. Processing a purchase order, for example, requires 10 minutes to prepare the basic purchase order information (required for all purchase orders) plus 15 minutes if the purchasing agent is required to contact the vendor, plus five minutes for each line item ordered. The time equations for placing a purchase order and three other activities are presented in Table 2.

With the capacity cost rates and formulas established, the model is ready for use. Operating results for the purchasing department for the first month reveals that they processed 400 purchase orders representing 5,600 line items and initiated 85 vendor contacts. Applying the equation for placing a purchase order, the capacity consumed and the total cost of the months purchasing transactions are presented in Table 3. Note that the use of practical capacity enables quantification of any excess capacity for the month, in this case 5,725 minutes and \$6,297.50. Knowing which processes have excess or shortages of capacity enables management to choose whether to redeploy resource capacity to other processes or use excess capacity for other activities. Either way, the result is a more efficient use of resources.

Continuing our example, transactional data collected for the month for two customers, A and B, are presented in Table 4.

Again, making use of the equations and capacity cost rates, the estimated costs associated with servicing these very different customers are presented as Table 5.

The costs associated with handling customers A and B are \$789.18 and \$974.91, respectively. The data could be easily extended to reflect customer profitability by including the sales of customers A and B and their respective sales discount structure, product costs and resulting product margins. The mix of products purchased by A and B is the other key factor in determining account profitability. The challenge

Table 3

	# of Transactions	Minutes / Transaction	Total Minutes	Cost @ \$1.10 per Minute
Purchase orders	400	10	4,000	\$4,400.00
Line items	5,600	5	28,000	30,800.00
Vendor contacts	85	15	1,275	1,402.50
Capacity used			33,275	36,602.50
Capacity available	(475,800 / 244 X 20 days)		39,000	42,900.00
Excess capacity			5,725	\$6,297.50

Table 4

	Customer A	Customer B
# of orders placed	2	12
# of line items	200	200
# orders requiring special handling	0	4
# of warehouse contacts	0	10
# of cartons	6	12
# of items requiring special packing	0	20
# of orders requiring "rush" handling	0	3

for management is to utilize the knowledge gained from the TDABC model results to identify ways of managing each customer and improving each customer's profitability.

This example could have been modified to include a storage process, thereby reflecting the difference in resources consumed by products stocked in large versus small lots and products that move more slowly than others. Rather than attaching these costs to stocking or order picking, the costs of warehouse space

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Table 5

Variables	Customer A	Customer B
Order entry		
Customer header	2 x 5 min x \$.76 = \$7.60	12 x 5 min x \$.76 = \$45.60
Line items	200 x 2 min x \$.76 = 304.00	200 x 2 min x \$.76 = 304.00
Special handling	-	4 x 2 min x \$.76 = 6.08
Warehouse contact	-	10 x 5 min x \$.76 = 38.00
Pick/Pack		
Prepare/print	2 x 3 min x \$.55 = 3.30	12 x 3 min x \$.55 = 19.80
Line items	200 x 4 min x \$.55 = 440.00	200 x 4 min x \$.55 = 440.00
Special packing	-	20 x 1 min x \$.55 = 11.00
Cartons	6 x 3 min x \$.55 = 9.90	12 x 3 min x \$.55 = 19.80
Order shipping		
Basic docs	2 x 8 min x \$.53 = 8.48	12 x 8 min x \$.53 = 50.88
Cartons	6 x 5 min x \$.53 = 15.90	12 x 5 min x \$.53 = 31.80
Rush orders	-	3 x 5 min x \$.53 = 7.95
Total Cost	\$ 789.18	\$ 974.91

could attach to storage. The equation for storage might be driven by cubic yards or feet of available space, rather than time.

It should be noted here that you could encounter a resource capacity better measured by some unit other than

time. That causes no problem, as the basic model generalizes to other capacities easily. The cost of capacity, in this case a cost per cubic yard or foot per day, would be calculated with a numerator of annual building or space cost divided by 365, the number of days in a year and a denominator of the total available space in cubic yards or feet. This rate would enable occupancy costs to be assigned to products reflecting their use of space as a function of inventory quantity and turnover.

Implementation

As would be the case in any change of this type, obtaining management's buy-in to the model as early as possible is critical. Successful implementation of any change without the buy-in of stakeholders is doomed. The authors believe that validating the first iterations of the model with the actual general ledger numbers, as previously discussed, goes a long way in achieving the goal. Briefly, a plan for a TDABC implementation might look as follows.

Phase I – Preparation:

- Establish the implementation team.
- Establish the objectives for the model. (Why do we need it?)
- Establish the scope of the project. (Consider doing a pilot model to obtain clear vision of the benefits, costs and obstacles on a small scale.)



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Phase II – Data Definition:

- Analyze and gather the data to drive the initial model.
- Identify the relevant activities by department or other center.
- Estimate time equations and capacity cost rates.
- Determine the key processes and activity steps.

Phase III – The Pilot Model:

- Establish links from data to model.
- Drive general ledger data to departments.
- Load time equations for pilot processes.
- Load the transaction data.
- Calculate costs or profitability (as determined by objectives and scope).
- Validate the model.

The results from the first three phases will determine the extent of the final phase or rollout. Depending on the company, and given satisfactory results, the pilot model can serve as a template that can be propagated to other similar operating units perhaps with some minor modifications. For companies with more diverse product offerings and processes, unlike those of the pilot model, the experiences of the pilot team can be leveraged by functioning as the consulting group that advises other operating units as they develop their TDABC models during rollout.

CPAs Are Ideal for Development and Implementation

Accounting professionals play a key role in developing and implementing the TDABC model. Their broad-based understanding of business makes them excellent implementation team leaders and adds value to the processes of developing departmental cost rates and the activity time equations. CPAs can also play a key role in driving the TDABC model forward as a planning and forecasting tool. ■

References

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