Appendix 7A: Time-Driven Activity-Based Costing: A Microsoft Excel-Based Approach

The purpose of this appendix is to introduce you to *time-driven activity-based costing* (TDABC). The approach demonstrated in this appendix overcomes two important limitations that accompany the activity-based costing (ABC) model described in the main body of the chapter. First, TDABC does not require extensive interviews with employees (as depicted in Exhibit 7–5) to perform stage one allocations. For a company that employs thousands of people, these interviews can be very time-consuming—which limits a company's ability to frequently update its cost model. Second, the ABC model depicted in Exhibits 7–5 and 7–6 assumes that employees will self-report their own idle time within the "Other" cost pool. In reality, most employees are very averse to reporting their own idle time because it may signal to management that the size of the labor force can be reduced.

This appendix will demonstrate how TDABC can be used to assign indirect costs to cost objects such as products and customers. We'll also explain how TDABC can be used for capacity analysis purposes. For simplicity, we limit the scope of this appendix to focus solely on labor costs. While TDABC systems can include other types of indirect costs such as equipment costs and utility costs, we purposely omit these kinds of costs to simplify our capacity analysis discussion.

Ridley Company: An Example

Ridley Company would like to improve its understanding of customer profitability and capacity utilization. As an initial pilot project, the company has decided to use TDABC to analyze its Customer Service Department labor costs. The goals of the project are to obtain a better understanding of how customer service labor costs are used by individual customers and to obtain a more informed basis for making employee staffing decisions within the department. In the past, the company has relied on "educated guesses" to make staffing decisions, which often resulted in an imbalance between the number of employees on the payroll and the number of employees needed to serve customers. Ridley hopes that TDABC will enable it to estimate the financial implications of better aligning its labor capacity with its customer demand.

The Data Inputs

Exhibit 7A–1 summarizes three types of data inputs for Ridley's TDABC model—resource data, activity data, and cost object data. The resource data includes the number of employees in the Customer Service Department (30), the average salary per employee ($29,952), the number of weeks in a year (52), the minutes available per week (2,400), and the practical capacity percentage (80%). The practical capacity percentage acknowledges that employees are not serving customers 100% of their available minutes. They spend some of their available time on vacation, on breaks, in training, attending to personal needs, etc. Thus, Ridley estimates that 80% of an employee's available minutes are spent actually serving customers.

The activity data contained in Exhibit 7A–1 specifies three activities within the Customer Service Department, namely order processing (cell B13), query resolution (cell C13), and credit reviews (cell D13). It also states the average number of minutes required to perform each activity one time. For example, on average it takes 10 minutes to process one order, 30 minutes to resolve one query from a customer, and 40 minutes to review one customer's credit worthiness.[4] The cost object data that is shown in Exhibit 7A–1 provides activity data for customers A, B, and C as well as all customers served by the Customer Service Department during the year. For example, customers A, B, and C placed 30, 18, and 7 orders, respectively. A total of 200,000 orders were placed by all of Ridley's customers during the year.

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[4] For simplicity, we assume that all orders, queries, and credit reviews consume the same amount of minutes per unit of the activity.

	A	B	C	D	E
1	Ridley Company				
2	Customer Service Department				
3	Data Inputs				
4					
5	Resource Data:				
6	Number of employees	30			
7	Average salary per employee	$ 29,952			
8					
9	Weeks per year	52			
10	Minutes available per week (40 hours × 60 minutes)	2,400			
11	Practical capacity percentage	80%			
12					
13	Activity Data:	Order processing	Query resolution	Credit reviews	
14	Minutes per unit of the activity	10	30	40	
15					
16	Cost Object Data:	Customer A	Customer B	Customer C	All Customers
17	Number of orders processed	30	18	7	200,000
18	Number of customer queries	17	10	8	4,500
19	Number of credit reviews	1	1	1	8,900
20					

Exhibit 7A-1 / Exhibit 7A-2 / Exhibit 7/I

EXHIBIT 7A-1
Ridley Company: The Data Inputs

Customer Cost Analysis

Exhibit 7A–2 summarizes the three-step TDABC process that Ridley Company uses to assign Customer Service Department labor costs to customers A, B, and C. The first step is to divide the total cost of the resources supplied in cell B10 ($898,560) by the practical capacity of the resources supplied in cell B14 (2,995,200 minutes) to obtain the cost per minute of the resource supplied in cell B16 ($0.30). Notice that cell B12 shows a practical capacity per employee of 99,840 minutes. This amount is obtained by multiplying together three cells from the data inputs tab shown in Exhibit 7A–1—cell B9 (52 weeks), cell B10 (2,400 minutes per week), and cell B11 (80%).

The second step in Exhibit 7A–2 is to calculate the time-driven activity rate for each of the three activities. For example, the time-driven activity rate for the order processing activity of $3.00 per order (cell B21) is derived by multiplying 10 minutes per unit of the activity (cell B19) by the cost per minute of the resource supplied of $0.30 (cell B20). Similarly, the time-driven activity rate for the query resolution activity of $9.00 per query (cell C21) is derived by multiplying 30 minutes per unit of the activity (cell C19) by the cost per minute of the resource supplied of $0.30 (cell C20).

The third step in Exhibit 7A–2 is to assign customer service labor costs to customers A, B, and C. For example, the total customer service costs assigned to Customer A of $255 (cell B36) is the sum of the order processing costs of $90 (cell B26), the query resolution costs of $153 (cell B30), and the credit review costs of $12 (cell B34). Notice that the number of orders processed in cell B24 (30), the number of customer queries in cell B28 (17), and the number of credit reviews in cell B32 (1) are linked to cells B17 through B19 in the data inputs tab shown in Exhibit 7A–1.

The type of cost assignments summarized in Exhibit 7A–2 could be useful to Ridley Company in larger initiatives, such as measuring customer profitability and managing its customer mix based on those insights. Furthermore, the cost assignments shown in Exhibit 7A–2 were performed without having to interview the 30 employees within the Customer Services Department. Instead, Ridley Company only needed to make a reasonable estimate regarding its practical capacity percentage (80%) and to estimate the amount of time required to perform each activity one time in order to compute its time-driven activity rates.

However, the data in Exhibit 7A–2 does not help Ridley quantify and manage its used and unused capacity costs, nor does it enable the company to estimate the number of customer service department employees that it would need to meet future customer

LO7–6
Use time-driven activity-based costing to assign costs to cost objects.

EXHIBIT 7A–2
Ridley Company: Customer Cost Analysis

	A	B	C	D
1	Ridley Company			
2	Customer Service Department			
3	Customer Cost Analysis			
4				
5	Step 1: Calculate the cost per minute of the resource supplied			
6				
7	*Customer Service Department:*			
8	Number of employees (a)	30		
9	Average salary per employee (b)	$ 29,952		
10	Total cost of resources supplied (a) × (b)	$ 898,560		
11				
12	Practical capacity per employee (in minutes) (a)	99,840		
13	Number of employees (b)	30		
14	Practical capacity of resources supplied (in minutes) (a) × (b)	2,995,200		
15				
16	Cost per minute of the resource supplied	$ 0.30		
17				
18	Step 2: Calculate the time-driven activity rate	Order processing	Query resolution	Credit reviews
19	Minutes per unit of the activity (a)	10	30	40
20	Cost per minute of the resource supplied (b)	$ 0.30	$ 0.30	$ 0.30
21	Time-driven activity rate (a) × (b)	$ 3.00	$ 9.00	$ 12.00
22				
23	Step 3: Assign costs to cost objects	Customer A	Customer B	Customer C
24	Number of orders processed (a)	30	18	7
25	Time-driven activity rate (b)	$ 3.00	$ 3.00	$ 3.00
26	Order processing costs assigned (a) × (b)	$ 90.00	$ 54.00	$ 21.00
27				
28	Number of customer queries (a)	17	10	8
29	Time-driven activity rate (b)	$ 9.00	$ 9.00	$ 9.00
30	Query resolution costs assigned (a) × (b)	$ 153.00	$ 90.00	$ 72.00
31				
32	Number of credit checks (a)	1	1	1
33	Time-driven activity rate (b)	$ 12.00	$ 12.00	$ 12.00
34	Credit review costs assigned (a) × (b)	$ 12.00	$ 12.00	$ 12.00
35				
36	Total customer service costs assigned	$ 255.00	$ 156.00	$ 105.00
37				

Exhibit 7A-1   Exhibit 7A-2   Exhibit

demand. To glean these types of insights from Ridley's TDABC system, we turn our attention to the topic of capacity analysis.

Capacity Analysis

LO7–7
Use time-driven activity-based costing to analyze capacity.

Exhibit 7A–3 shows the four-step process that Ridley Company uses for capacity management purposes. It focuses on *all* of Ridley's customers rather than just customers A, B, and C. The first step is to calculate the total used capacity in minutes of 2,491,000 (= 2,000,000 + 135,000 + 356,000). The second step is to take the total minutes available of 2,995,200 from cell B11 (and as previously computed in cell B14 in Exhibit 7A–2) minus the minutes used of 2,491,000 (from cell B12) to derive the 504,200 minutes of unused capacity shown in cell B13.

The third step translates the unused capacity in minutes to unused capacity in terms of employees. We perform this calculation because customer service employees are a step-fixed cost rather than a variable cost. In other words, Ridley does not purchase customer service capacity by the minute. Instead, it hires individual employees who each provide 99,840 minutes of practical capacity per year. Because the unused capacity in minutes is 504,200 and the practical capacity of one employee is 99,840 minutes, the total unused capacity equates with 5.05 employees (= 504,200 ÷ 99,840).

	A	B	C	D	E
1	Ridley Company				
2	Customer Service Department				
3	Capacity Analysis				
4					
5	Step 1: Calculate the used capacity in minutes	Order processing	Query resolution	Credit reviews	Total
6	Customer demand for each activity (a)	200,000	4,500	8,900	
7	Customer service minutes required per unit of each activity (b)	10	30	40	
8	Customer service minutes used to meet demand (a) × (b)	2,000,000	135,000	356,000	2,491,000
9					
10	Step 2: Calculate the unused capacity in minutes				
11	Total customer service minutes available to meet demand (a)	2,995,200			
12	Total customer service minutes used to meet demand (b)	2,491,000			
13	Unused capacity in minutes (a) − (b)	504,200			
14					
15	Step 3: Calculate the unused capacity in number of employees				
16	Unused capacity in minutes (a)	504,200			
17	Practical capacity per employee (in minutes) (b)	99,840			
18	Unused capacity in number of employees (a) ÷ (b)	5.05			
19					
20	Step 4: Calculate the financial impact of matching capacity with demand				
21	Potential adjustment in number of employees (rounded) (a)	(5.00)			
22	Average salary per employee (b)	$ 29,952			
23	Impact on expenses of matching capacity with demand (a) × (b)	$(149,760)			
24					
25	Note: Cell B21 uses the formula =If(B18>0,rounddown(-B18,0),roundup(-B18,0))				
26					

Exhibit 7A-2 | Exhibit 7A-3 | Exhibit 7A-4 | Exhi

The fourth step calculates the financial impact of matching capacity with demand. The key to this step is the formula in cell B21 of Exhibit 7A–3, which rounds the value reported in cell B18 to a whole number. We perform this rounding function because Ridley alters its step-fixed employee headcount in terms of whole employees, not portions of an employee. So, for example, cell B18 shows an unused capacity of 5.05 employees; however, Ridley cannot eliminate .05 employees. It could possibly eliminate five or six employees, but nothing in between. Since eliminating six employees would leave the Customer Service Department a little short-handed, we round down to five employees. Given the average salary per employee of $29,952, the impact on expenses of matching labor capacity with demand is a savings of $149,760 (= 5.00 × $29,952).

"What-If" Analysis

The data inputs in Exhibit 7A–1 also enable Ridley to answer some interesting "what if" questions. For example, what if the company was able to lower its credit review time from 40 minutes to 30 minutes? How would this effect the costs assigned to customers A, B, and C? To answer this question, we would change cell D14 in Exhibit 7A–1 from 40 minutes to 30 minutes. The revised customer cost analysis that would be instantly generated is shown in Exhibit 7A–4.

Notice that cell D19 shows 30 minutes per credit review instead of the 40 minutes shown in the same cell in Exhibit 7A–2. This in turn lowers the cost per credit review to $9.00 (as shown in cell D21) rather than the $12.00 shown in the same cell in Exhibit 7A–2. The lower time-driven activity rate of $9.00 carries forward to cells B33 through D33 and in turn lowers each customer's total customer service costs by $3. For example, customer A's total customer service cost is $252 in cell B36 of Exhibit 7A–4, whereas the corresponding total in cell B36 of Exhibit 7A–2 is $255.

Let's further assume that Ridley Company wants to answer the question: What if we also increase the number of orders processed from 200,000 (as shown in cell E17 in Exhibit 7A–1) to 265,000? How would the projected increase in the number of orders processed affect our staffing needs in the Customer Service Department? After making the appropriate change in cell E17 of Exhibit 7A–1, Exhibit 7A–5 provides the answer to this question—Ridley Company would need to hire one more employee at an estimated cost of $29,952.

EXHIBIT 7A–4
Ridley Company's Customer Cost Analysis: A "What If" Analysis

	A	B	C	D
1	Ridley Company			
2	Customer Service Department			
3	Customer Cost Analysis			
4				
5	Step 1: Calculate the cost per minute of the resource supplied			
6				
7	*Customer Service Department:*			
8	Number of employees (a)	30		
9	Average salary per employee (b)	$ 29,952		
10	Total cost of resources supplied (a) × (b)	$ 898,560		
11				
12	Practical capacity per employee (in minutes) (a)	99,840		
13	Number of employees (b)	30		
14	Practical capacity of resources supplied (in minutes) (a) × (b)	2,995,200		
15				
16	Cost per minute of the resource supplied	$ 0.30		
17				
18	**Step 2: Calculate the time-driven activity rate**	**Order processing**	**Query resolution**	**Credit reviews**
19	Minutes per unit of the activity (a)	10	30	30
20	Cost per minute of the resource supplied (b)	$ 0.30	$ 0.30	$ 0.30
21	Time-driven activity rate (a) × (b)	$ 3.00	$ 9.00	$ 9.00
22				
23	**Step 3: Assign costs to cost objects**	**Customer A**	**Customer B**	**Customer C**
24	Number of orders processed (a)	30	18	7
25	Time-driven activity rate (b)	$ 3.00	$ 3.00	$ 3.00
26	Order processing costs assigned (a) × (b)	$ 90.00	$ 54.00	$ 21.00
27				
28	Number of customer queries (a)	17	10	8
29	Time-driven activity rate (b)	$ 9.00	$ 9.00	$ 9.00
30	Query resolution costs assigned (a) × (b)	$ 153.00	$ 90.00	$ 72.00
31				
32	Number of credit checks (a)	1	1	1
33	Time-driven activity rate (b)	$ 9.00	$ 9.00	$ 9.00
34	Credit review costs assigned (a) × (b)	$ 9.00	$ 9.00	$ 9.00
35				
36	Total customer service costs assigned	$ 252.00	$ 153.00	$ 102.00
37				

Exhibit 7A-4　　Exhibit 7A-5　　Exerc

To understand how this answer is derived, let's start with Step 1 within Exhibit 7A–5, which shows 265,000 orders processed in cell B6. This increase in the number of orders processed increases the number of customer service minutes needed to meet customer demand to 3,052,000 (cell E8). Step 2 shows that the total customer service minutes available of 2,995,200 (cell B11) is now less than the number of minutes used to meet demand of 3,052,000 (cell B12), which results in unused capacity of (56,800) minutes as shown in cell B13. Because the unused capacity is a negative number, it implies that Ridley does not have enough capacity available to satisfy the estimated customer demand. Step 3 in Exhibit 7A–5 translates the shortage in minutes to a shortfall stated in terms of number of employees—or (0.57) employees as shown in cell B18. Given that Ridley cannot hire slightly more than one-half of an employee, cell B21 rounds this number to 1.00 and then cell B23 translates the estimated cost of hiring one additional employee to $29,952.

This concludes our introduction to TDABC. The strengths of this methodology include (1) it is easy to update because it does not require employee interviews, (2) it quantifies unused capacity costs in an objective fashion that does not require employees to self-report their own idle time, and (3) it helps companies estimate the financial impact of aligning capacity with demand, particularly with respect to step-fixed resources such as the customer service employees in the Ridley Company example.

EXHIBIT 7A-5
Ridley Company's Capacity Analysis: A "What If" Analysis

	A	B	C	D	E
1	Ridley Company				
2	Customer Service Department				
3	Capacity Analysis				
4					
5	Step 1: Calculate the used capacity in minutes	Order processing	Query resolution	Credit reviews	Total
6	Customer demand for each activity (a)	265,000	4,500	8,900	
7	Customer service minutes required per unit of each activity (b)	10	30	30	
8	Customer service minutes used to meet demand (a) × (b)	2,650,000	135,000	267,000	3,052,000
9					
10	Step 2: Calculate the unused capacity in minutes				
11	Total customer service minutes available to meet demand (a)	2,995,200			
12	Total customer service minutes used to meet demand (b)	3,052,000			
13	Unused capacity in minutes (a) – (b)	(56,800)			
14					
15	Step 3: Calculate the unused capacity in number of employees				
16	Unused capacity in minutes (a)	(56,800)			
17	Practical capacity per employee (in minutes) (b)	99,840			
18	Unused capacity in number of employees (a) ÷ (b)	(0.57)			
19					
20	Step 4: Calculate the financial impact of matching capacity with demand				
21	Potential adjustment in number of employees (rounded) (a)	1.00			
22	Average salary per employee (b)	$ 29,952			
23	Impact on expenses of matching capacity with demand (a) × (b)	$ 29,952			
24					
25	Note: Cell B21 uses the formula =If(B18>0,rounddown(-B18,0),roundup(-B18,0))				
26					

Exhibit 7A-4 | Exhibit 7A-5 | Exercise 7A-1 Inputs