Supply Chain Financial Analysis

MIT Center for Transportation & Logistics

Activity-Based Costing

This segment's objective

- Introduce you to Activity-Based Cost (ABC) Accounting
- Review the principles for use of ABC
- Make you aware of the ABC method
- Not intended to make you ABC experts

Why Activity-Based Cost Accounting?

- Traditional method to allocate overhead: labor hours or volume as proxy for OH use
  - That made sense when labor represented a large part of the product cost
- Product costs today include some labor, but more material and overhead costs. Using labor hours or volume would not serve as a good proxy for overhead use

Why ABC? An Illustration

- Example: Children's Book Company makes a popular book called Curious Giovanni, and also a custom version of the book that is tailored to a child for an additional $10. The books are customized at the distribution center.
  - The DC has a small staff that does all of the handling, shipping and any customization required. The customization requires about 10 minutes to download software, 15 minutes of coding, and 10 minutes of relabeling. Each custom book is shipped direct to the consumer at no additional cost to the consumer. All the other books are shipped in bulk via LTL to retail outlets for sale.
  - Last month, the company sold 1900 standard and 100 custom books.
  - Standard Curious Giovanni book price → $20, volume → 1,900
  - Customized Curious Giovanni books price → $30, volume → 100
  - The overhead costs for all the operations are $2740, includes some costs that are specific to standard books (LTL shipment costs) and to custom books (book prep, direct shipment)

Why ABC? Allocating by Activity

- Allocate overhead cost of DC using simple traditional method (use volume)
  - Overhead cost/unit = $2740/2000 → $1.37 per unit
  - This spreads standard and custom book expenses across all books
- But Different Activities have different costs
  - Custom books utilize $1475 of DC activities specifically for custom books
  - Standard books utilize $190 of DC activities specifically for standard books
  - Standard and custom books use $1075 ($1010 and $65 respectively) of the receiving and handling activity in close proportion to their volume, totaling $1200 and $1540 for each
- Allocate overhead DC costs by activities
  - Standard book DC costs = $1200, per unit allocation = $1200/1900 = $0.63
  - Custom book DC costs = $1540, per unit allocation = $15.40
- By traditional allocation method, custom cost is understated by >$14.00
- Custom book premium upcharge ($10) is less than actual cost to serve
- Traditional cost allocation method would lead business leaders to mistakenly believe that their custom book business was very profitable

Activity-Based Cost Accounting (ABC)

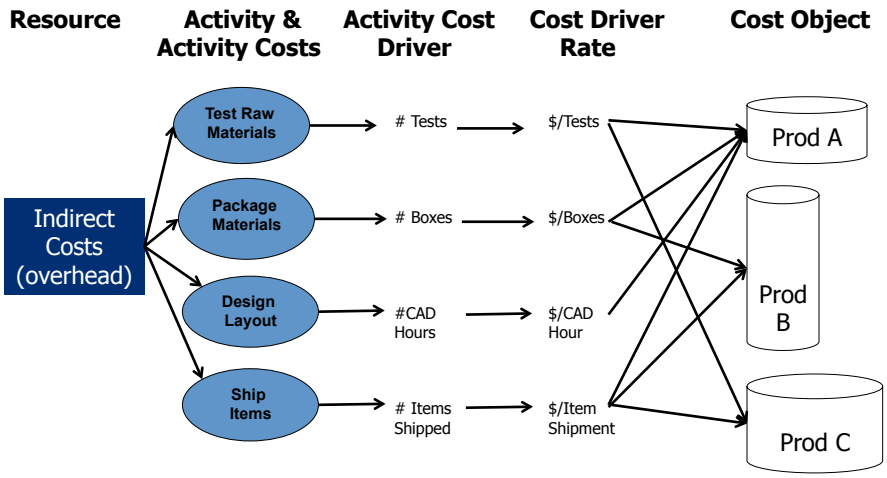
- A method of allocating overhead costs to cost objects based on the amount of resources they consume
- Costs are allocated using cost drivers
  - Cost drivers consider the activities involved in producing the product/ service and the resources used in those activities
- A cost object can be a product, service, customer or other segmentation that management desires to better understand

Activity-Based Costing Perspective

- Product costs are the results of activities (or "processes") – costs come from activities
- Each product (service) in the firm is thought in terms of the bundle of activities required to produce (provide) the product (service) - producing a product requires multiple activities
- The costs of a product are the sum of the costs for performing the activities in order to produce (provide) a product (service)
- ABC is especially useful when the variety and complexity of products, service and/or customers are high
- As a result of the improved accuracy, ABC has become the one of the more important methods for product and service decision support and process analysis

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

ABC Expenses Flow from Resources to Activities to Cost Objects (aka Products, Services and Customers)



Basic Steps to ABC

1. Identify all activities relevant to the creation of the product/service
2. Identify the resources consumed in performing the activities
3. Determine the costs of the activities
4. Determine cost-drivers of the activities
5. Determine cost-driver rate for the activities
6. Trace costs to (secondary) cost objects

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

1. Identify all relevant activities

- Usually, the activities are defined functionally, e.g. manufacturing, distribution, order management, etc.
- Activities often take the form of [verb] [direct object], e.g., schedule production, setup machines,…
- In our example:
  - Test Raw Materials
  - Package Materials
  - Design Layout
  - Ship Items

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

2. Identify the resources consumed in performing the activities

- For each identified activity, determine the resources used: labor, facilities, equipment, materials,…
- Unused capacity is not considered in the cost object allocation, but it should be considered in a separate assessment regarding the cost of carrying additional capacity.

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT 12

3. Determine the costs of the activities

- From Step 2, we know the resources consumed
- Identify the costs for each resource, and group those costs into activity groups or cost pools
- Put in a slightly different way….. determine which costs are associated with a particular activity and accumulate those costs by the activity

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

4. Determine cost-drivers

- Identify the basis for allocating the costs to the cost object – these are called cost drivers
- A cost-driver is a quantitative measure of the output of an activity
- Examples:
  - Ship product: Number of orders shipped
  - Store packages: Number of packages stored, number of storage runs
  - Test materials: Number of tests, amount of materials consumed in tests
- One cost driver is identified for each activity grouping or cost pool

- From our example:
  - # Tests (associated with Test Raw Materials activity)
  - # Boxes (associated with Package Materials activity)
  - # CAD Hours (associated with Design Layout activity)
  - # Items Shipped (associated with Ship Items activity)

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

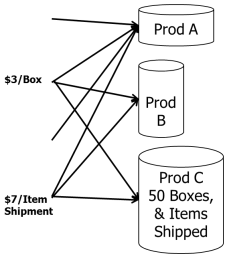
5. Determine cost-driver rate

- Calculate the cost-driver rate by dividing the cost of the activity by the cost driver
- It is the cost per unit of cost driver activity
  - From our example, divide the cost of Test Raw Materials by the number of tests → $/Test
  - If Test Raw Materials consumed $300 in costs, and there were a total of 50 tests → $300/50 = $6/test

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

6. Trace costs to cost objects

- Identify the amount of cost driver used by specific cost objects, and apply the cost driver rate to identify the cost for that specific cost object
  - From our example
    - Product C only uses two activities – Package Materials and Ship Items
    - Assume there are 50 boxes of Product C, and there are 5 shipments of Product C
    - Assume that the cost driver rates are $3/Box and $7/Item Shipped
    - The total cost to allocate to Product C would equal the sum of 50 boxes * $3/Box and 5 shipments * $7/Item Shipped for a total of $185



Key Points

17

Activity-based Costing

- Works in environments with
  - Large expenses in indirect and support resources
  - Multiple product, customer or process environments
- Less important with
  - High labor component of cost
  - Single product, limited diversity (products, customers, processes)
- Activity-Based Costing provides a different and potentially more accurate cost for producing products and providing services – but how much accuracy is enough?
- ABC can be helpful for decision makers assessing the profitability of various products, services or segmentations of those by customer or geography

Questions, Comments, Suggestions? Use the Discussion Area…..

MIT Center for Transportation & Logistics

jrice@mit.edu

Sources, Image & Reference Information

- **References**
- ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT
- HBS Introduction to Activity-Based Costing, Note 9-197-076

Now let's apply this to Dakota

21

1. Identify all relevant activities

- Usually, the activities are defined functionally, e.g. manufacturing, distribution, order management, etc.
- Activities often take the form of [verb] [direct object], e.g., schedule production, setup machines,…

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

Dakota Relevant Activities

Resource

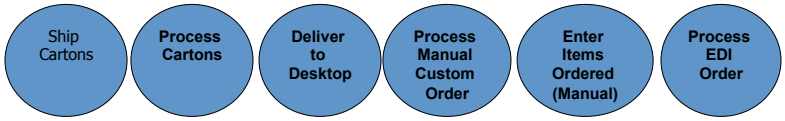
Activity

Activity Costs

Activity Cost Driver

Activity Cost Driver Rate

Cost Objects



Dakota – Relevant Activities

Ship Cartons	Process Cartons	Deliver to Desktop	Process Manual Custom Order	Enter Items Ordered (Manual)	Process EDI Order

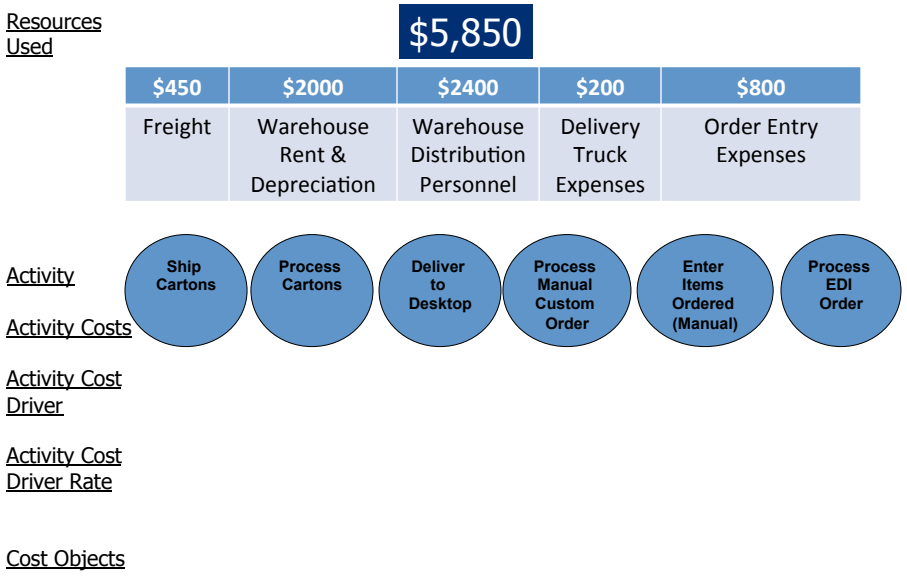
24

2. Identify the resources consumed in performing the activities

- For each identified activity determine the resources used: labor, facilities, equipment, materials,…
- Some resources are used to perform different activities (e.g. shipping and storing are performed by the same workers). In practice, the actual use of resources can be determined through interview and observation.
- Unused capacity is not considered in the cost object allocation, but it should be considered in a separate assessment regarding the cost of carrying additional capacity.

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

Dakota Resources Consumed Performing Activities

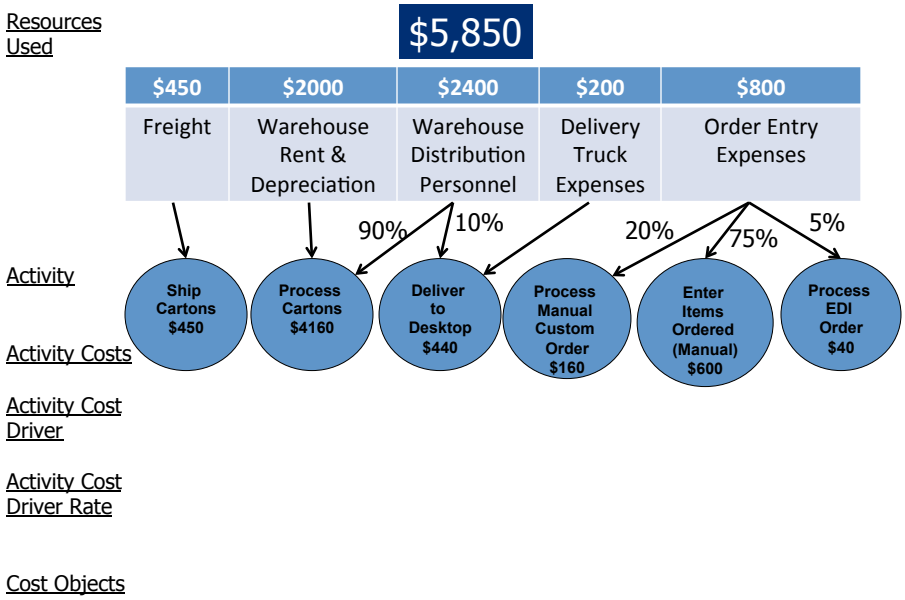


3. Determine the costs of the activities

- Generate activity groups or cost pools which collect all resource costs used by the activity
- Traditionally cost pools were functions or departments – this approach creates different groupings based on activities
- Basically determine which costs are associated with a particular activity and accumulate those costs by the activity

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

Dakota Resources Consumed Performing Activities

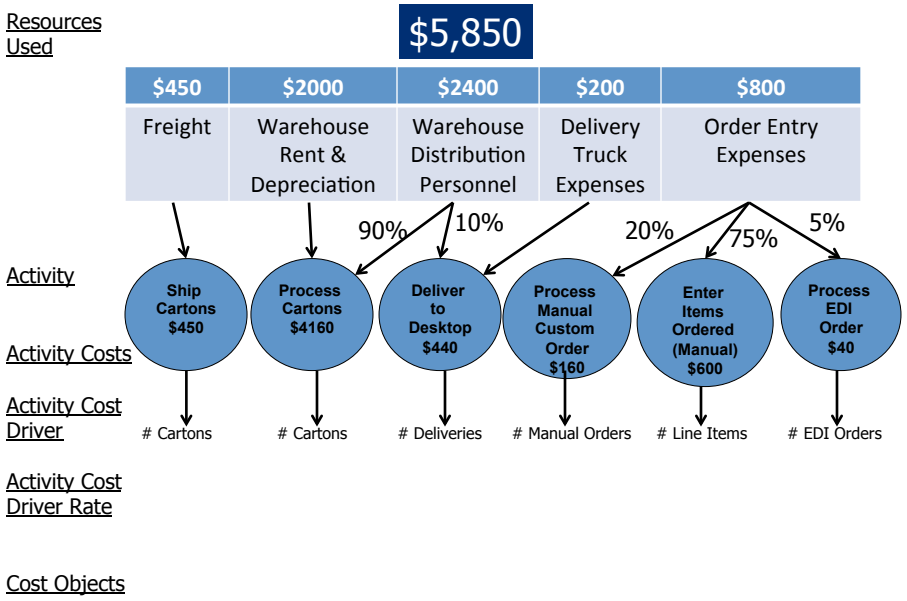


4. Determine cost-drivers

- Identify the basis for allocating the costs to the cost object – these are called cost drivers
- A cost-driver is a quantitative measure of the output of an activity
- Examples:
  - Ship product: Number of orders shipped
  - Sort packages: Number of sorting jobs, number of units sorted
  - Test materials: Number of tests, amount of materials consumed in tests
- One cost driver is identified for each activity grouping or cost pool

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

Dakota Resources Consumed Performing Activities

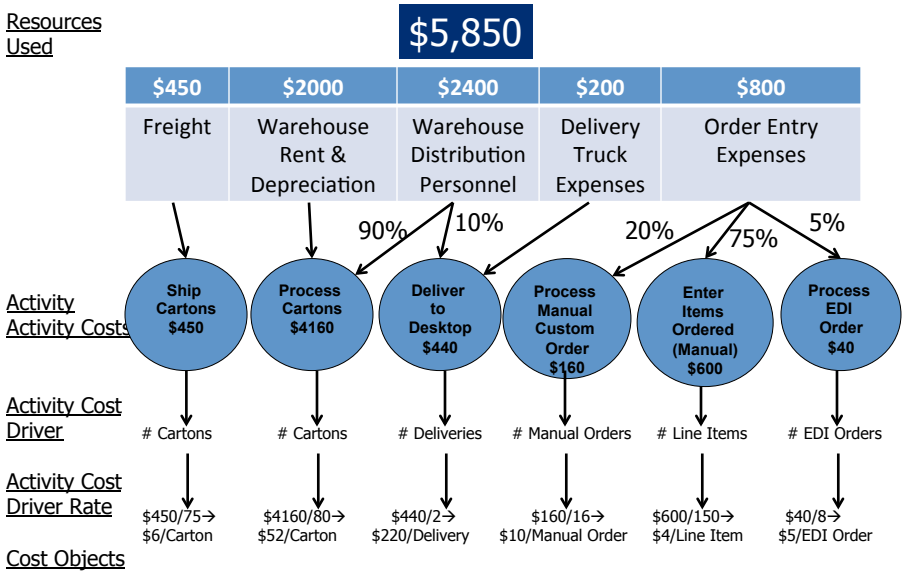


5. Determine cost-driver rate

- The cost-driver rate is the cost per unit of cost driver activity, calculated by dividing the cost of the activity by the cost driver
- For example, two activities, process orders and test materials:
  - If the cost driver of "process orders" activity was the number of orders processed, then the cost driver rate would be the "process orders" activity cost divided by the number of orders.
  - Assume the number of orders processed = 2,000 orders, and the cost of the activity "process orders" was $10,000; then the cost driver rate would be $10,000/2,000 or $5/order processed.
  - If the cost driver of the "test materials" activity was the number of hours of operation (500) and the cost of the activity "test materials" was $5,000, then the cost driver rate would be $5,000/500 or $10/ hour of operation.

Ref.:ESD.251 Class materials prepared by Dr. Jarrod Goentzel, MIT

Dakota Cost Drivers



Dakota Profitability Analysis

Comparative Customer Profitability

		Cust. A		Cust. B
Sales		$103,000		$104,000
Cost of items purchased		$85,000		$85,000
Gross margin		$18,000		$19,000
Operating Expenses				
Ship Cartons (Comm'l), # of cartons shipped	200	$1,200	150	$900
Process Cartons, # of cartons ordered	200	$10,400	200	$10,400
Deliver to Desktop, # of deliveries			25	$5,500
Process Manual Orders, # of manual orders	6	$60	100	$1,000
Enter Items Ordered (manual), # of line items	60	$240	180	$720
Process EDI orders, # EDI orders	6	$30		
Net customer profitability		$6,070		$480

Dakota Profitability Analysis

Comparative Customer Profitability

		Cust. A		Cust. B
Sales		$103,000		$104,000
Cost of items purchased		$85,000		$85,000
Gross margin		$18,000		$19,000
Operating Expenses				
Ship Cartons (Comm'l), # of cartons shipped	200	$1,200	150	$900
Process Cartons, # of cartons ordered	200	$10,400	200	$10,400
Deliver to Desktop, # of deliveries			25	$5,500
Process Manual Orders, # of manual orders	6	$60	100	$1,000
Enter Items Ordered (manual), # of line items	60	$240	180	$720
Process EDI orders, # EDI orders	6	$30		
Net customer profitability		$6,070		$480
Average Accounts Receivable	$9,000	$900	$30,000	$3,000
Total Customer Profitability (loss)		$5,170		-$2,520

34