CHAPTER 5
ACTIVITY-BASED COSTING AND ACTIVITY-BASED MANAGEMENT

5-1 What is broad averaging, and what consequences can it have on costs?

Broad averaging (or "peanut-butter costing") describes a costing approach that uses broad averages for assigning (or spreading, as in spreading peanut butter) the cost of resources uniformly to cost objects when the individual products or services, in fact, use those resources in non-uniform ways.

Broad averaging, by ignoring the variation in the consumption of resources by different cost objects, can lead to inaccurate and misleading cost data, which in turn can negatively impact the marketing and operating decisions made based on that information.

5-2 Inaccurate costing can result in two deviations. Name the two deviations and explain how they can impact a business.

These two deviations are overcosting and undercosting. Undercosting will cause underpricing which can lead to sales that actually result in losses, because the sales may bring in less revenue than the cost of resources, though the company is under the assumption that it is making a profit. Overcosting will lead to overpricing, causing a loss in market share to competitors producing similar products.

5-3 What is costing system refinement? Describe three guidelines for refinement.

Costing system refinement means making changes to a simple costing system that reduces the use of broad averages for assigning the cost of resources to cost objects and provides better measurement of the costs of overhead resources used by different cost objects.

Three guidelines for refinement are

1. Classify as many of the total costs as direct costs as is economically feasible.
2. Expand the number of indirect cost pools until each of these pools is more homogenous.
3. Use the cause-and-effect criterion, when possible, to identify the cost-allocation base for each indirect-cost pool.

5-4 What are the fundamental cost objects in activity-based costing? How does activity-based costing work?

Individual activities are the fundamental cost objects in activity-based costing. Activity-based costing first uses resource drivers to assign the costs of resources to individual activities and then it uses activity drivers to assign the cost of these activities to products or services (as final cost objects).

5-5 How can a cost hierarchy lead to a more accurate costing system?

A cost hierarchy can lead to a more accurate costing system by focusing on the levels of cause-and-effect relationships between various activity cost pools on the one hand and final cost objects on the other hand. It categorizes various activity cost pools into four individual levels on the basis of the different types of cost drivers, cost-allocation bases, or the different degrees of difficulty in determining cause-and-effect relationships. These four levels of a cost hierarchy

(from the highest to the lowest cause-and-effect relationship to cost objects) are: output unit-level costs, batch-level costs, product-sustaining costs or service-sustaining costs, and facility-sustaining costs.

5-6 Which levels of cost hierarchy (under activity-based costing) are not used in simple costing systems and why are they important?

Out of four levels of hierarchy costs in activity-based costing, only 'output unit-level costs' is used in simple costing systems. In other words, there are three additional levels of hierarchy costs in activity-based-costing systems which are not used in simple costing systems as follows: batch-level costs, product-sustaining costs or service-sustaining costs, and facility-sustaining costs. These three additional levels of hierarchy costs are important because not all cost-allocation bases are unit level. Some are batch-level costs, some are product-sustaining costs and some are facility-sustaining costs which have no direct link with the cost objects.

5-7 Differentiate between simple costing systems and ABC systems.

The main difference between simple costing systems and ABC systems is due to having different focuses. Activities are the fundamental cost objects in ABC systems, while departments, centers or cost pools are the main fundamental cost objects in simple costing systems. Simple costing systems have one or a few indirect cost pools, irrespective of the heterogeneity in the facility while ABC systems have multiple indirect cost pools. Under ABS systems, the costs of activities are assigned to cost objects to compute their costs. Under simple costing systems, the costs of departments, centers or cost pools are assigned to cost objects to compute their costs.

5-8 How can ABC help with cost reduction and process improvement decisions?

ABC can help with cost reduction and process improvement decisions by identifying individual activities and their relevant costs. This can help managers to eliminate non-added value activities, reduce costs and improve the overall process.

5-9 "The cost of cost objects under simple costing systems and under activity-based costing are never the same." Do you agree? Explain.

No. It depends on a number of factors such as the variety and number of activities, cost allocation bases, and cost objects/products. For example: if a company produces one single product then the product cost under both simple costing systems and activity-based-costing can be the same. Or, when different products use resources from different activities in the same proportions as with simple costing systems.

5-10 Describe the main barriers for adopting an ABC system.

The main restrictions towards adopting an ABC system include the need to use more resources (e.g., experts and software packages) as well as the requirement for gathering additional data/information and performing more measurements to implement it. One of the main complications of ABC is that it requires managers to estimate costs of activity pools in order to identify and measure cost drivers for specified cost pools to be used as cost-allocation bases. It needs many calculations to determine costs of cost objects and these measurements are

expensive. It needs to be updated regularly. As ABC systems get very detailed and more cost pools are created, more allocations are needed to calculate activity costs for each cost pool, and this could increases the chances of misidentifying the costs of different activity cost pools. Sometimes the data needed for the relevant allocation base is not readily available.

5-11 What are the main behavioral issues in implementing ABC systems?

Gaining support of top management and creating a sense of urgency for the ABC effort. Creating a guiding coalition of managers throughout the value chain for the ABC effort. Educating and training employees in ABC as a basis for employee empowerment. Seeking small short-run successes as proof that the ABC implementation is yielding results. Recognizing that ABC information is not perfect because it balances the need for better information against the costs of creating a complex system that few managers and employees can understand.

5-12 Explain why ABC is equally important for both manufacturing and service companies.

ABC systems can be used equally for product costing and service costing as well as for strategic decisions in manufacturing and service companies. ABC systems are more suited to service companies because a vast majority of their cost structure is composed of indirect costs.

5-13 "Activity-based costing is providing more accurate and detailed information and should replace simple costing." Do you agree? Explain.

No. The additional costs and resources needed may not exceed the benefits gained by having more accurate and detailed information provided by the ABC system. Thus, cost benefit analysis is always needed to make sure that expected benefits exceed expected costs to replace simple costing.

5-14 What are the main factors determining the number of indirect-cost pools in a costing system, to increase the accuracy of product or service costs. Explain.

The main factors for determining the number of indirect-cost pools are the homogeneity of cost pools as well as the similarity in proportions at which different products/services use cost pools. The higher the homogeneity of cost pools, and the similarity of proportions of using different activities by products/services, the lower the number of required indirect-cost pools.

5-15 The total annual production cost of a manufacturing company that produces three different USB devices is $10,000,000. The manager of the company states that the contribution margins of all three products guarantee and justify their productions and, therefore, there is no need to adopt ABC as the total manufacturing costs of the company would remain the same if the company did adopt ABC. How can you convince the manager to change his mind?

It can be argued that the adoption of ABC may result in reduction of the total manufacturing costs of the company. ABC can help with cost reduction and process improvement decisions by identifying individual activities and their relevant costs. This can help managers to eliminate non-added value activities, reduce costs and improve the overall process. So, it is not always true that total manufacturing cost remains the same if a company decides to adopt ABC as

eliminating non-added value activities can reduce the production costs. It can also be argued that by adopting the ABC system, the manager will be in a better position to make improved decisions in terms of pricing and product-mixed decisions. ABC could help to identify products that may be currently under-costed, and are being actually sold for losses, where the losses are masked by sales of very profitable product lines.

5-16 Conroe Company is reviewing the data provided by its management accounting system. Which of the following statements is/are correct?

I. A cost driver is a causal factor that increases the total cost of a cost object.
II. Cost drivers may be volume based or activity based.
III. Cost drivers are normally the largest cost in the manufacturing process.

1. I, II, and III are correct.
2. I and II only are correct.
3. I only is correct.
4. II and III only are correct.

SOLUTION

Explanation Choice "2" is correct.
The question asks which of a series of statements is/are correct. "None of the above" is not available, so one of the statements at least is correct.
Statement I says that a cost driver is a causal factor that increases the total cost of a cost object. Statement I is correct.
Statement II says that cost drivers may be volume based or activity based. Cost drivers may be volume-based, activity-based, or based on any number of other operational characteristics. So, that is two out of three. Statement II is correct.
Statement III says that cost drivers are normally the largest cost in the manufacturing process. Cost drivers are what cause the costs, not the costs themselves. Statement III is incorrect

5-17 Nobis Company uses an ABC system. Which of the following statements is/are correct with respect to ABC?

I. Departmental costing systems are a refinement of ABC systems.
II. ABC systems are useful in manufacturing, but not in merchandising or service industries.
III. ABC systems can eliminate cost distortions because ABC develops cost drivers that have a cause-and-effect relationship with the activities performed.

1. I, II, and III are correct.
2. II and III only are correct.
3. III only is correct.
4. None of the listed choices is correct.

SOLUTION

Explanation Choice "3" is correct.
The question asks which of a series of statements is/are correct with respect to ABC.
Statement I says that departmental costing systems are a refinement of ABC systems. Actually, ABC systems are a refinement of departmental costing systems. Statement I is incorrect.
Statement II says that ABC systems are useful in manufacturing, but not in merchandising or service industries. ABC systems are useful in all three of these business sectors. Statement II is incorrect.
Statement III says that ABC systems can eliminate cost distortions because ABC develops cost drivers that have a cause-and-effect relationship with the activities performed. Statement III is correct.

5-18 Cost hierarchy. SharpPitch, Inc., manufactures karaoke machines for several well-known companies. The machines differ significantly in their complexity and their manufacturing batch sizes. The following costs were incurred in 2014:

a. Indirect manufacturing labor costs such as supervision that supports direct manufacturing labor, $950,000
b. Procurement costs of placing purchase orders, receiving materials, and paying suppliers related to the number of purchase orders placed, $675,000
c. Cost of indirect materials, $180,000
d. Costs incurred to set up machines each time a different product needs to be manufactured, $450,000
e. Designing processes, drawing process charts, and making engineering process changes for products, $315,000
f. Machine-related overhead costs such as depreciation, maintenance, and production engineering, $975,500 (These resources relate to the activity of running the machines.)
g. Plant management, plant rent, and plant insurance, $578,000

Required:

1. Classify each of the preceding costs as output unit-level, batch-level, product-sustaining, or facility-sustaining. Explain each answer.
2. Consider two types of karaoke machines made by SharpPitch, Inc. One machine, designed for professional use, is complex to make and is produced in many batches. The other machine, designed for home use, is simple to make and is produced in few batches. Suppose that SharpPitch needs the same number of machine-hours to make each type of karaoke machine and that Forrester allocates all overhead costs using machine-hours as the only allocation base. How, if at all, would the machines be miscosted? Briefly explain why.
3. How is the cost hierarchy helpful to SharpPitch in managing its business?

SOLUTION

(20 min.) **Cost hierarchy.**

1. a. Indirect manufacturing labor costs of $$950,000 support direct manufacturing labor and are output unit-level costs. Direct manufacturing labor generally increases with output units and so will the indirect costs to support it.
   b. Batch-level costs are costs of activities that are related to a group of units of a product

rather than each individual unit of a product. Purchase order-related costs (including costs of receiving materials and paying suppliers) of $675,000 relate to a group of units of product and are batch-level costs.

c. Cost of indirect materials of $180,000 generally changes with labor hours or machine hours which are unit-level costs. Therefore, indirect material costs are output unit-level costs.
d. Setup costs of $450,000 are batch-level costs because they relate to a group of units of product produced after the machines are set up.
e. Costs of designing processes, drawing process charts, and making engineering changes for individual products, $315,000, are product sustaining because they relate to the costs of activities undertaken to support individual products regardless of the number of units or batches in which the product is produced.
f. Machine-related overhead costs (depreciation and maintenance) of $975,500 are output unit-level costs because they change with the number of units produced.
g. Plant management, plant rent, and insurance costs of $578,000 are facility-sustaining costs because the costs of these activities cannot be traced to individual products or services but support the organization as a whole.

2. The complex karaoke machine made in many batches will use significantly more batch-level overhead resources compared to the simple karaoke machine that is made in a few batches. In addition, the complex karaoke machine will use more product-sustaining overhead resources because it is complex. Since each karaoke machine requires the same amount of machine-hours, both the simple and the complex karaoke machine will be allocated the same amount of overhead costs per karaoke machine if SharpPitch uses only machine-hours to allocate overhead costs to karaoke machines. As a result, the complex karaoke machine will be undercosted (it consumes a relatively high level of resources but is reported to have a relatively low cost) and the simple karaoke machine will be overcosted (it consumes a relatively low level of resources but is reported to have a relatively high cost).

3. Using the cost hierarchy to calculate activity-based costs can help SharpPitch to identify both the costs of individual activities and the cost of activities demanded by individual products. SharpPitch can use this information to manage its business in several ways:

a. Pricing and product mix decisions. Knowing the resources needed to manufacture and sell different types of karaoke machines can help SharpPitch to price the different karaoke machines and also identify which karaoke machines are more profitable. It can then emphasize its more profitable products.
b. SharpPitch can use information about the costs of different activities to improve processes and reduce costs of the different activities. SharpPitch could have a target of reducing costs of activities (setups, order processing, etc.) by, say, 2% and constantly seek to eliminate activities and costs (such as engineering changes) that its customers perceive as not adding value.
c. SharpPitch management can identify and evaluate new designs to improve performance by analyzing how product and process designs affect activities and costs.
d. SharpPitch can use its ABC systems and cost hierarchy information to plan and manage activities. What activities should be performed in the period and at what cost?

5-19 ABC, cost hierarchy, service. (CMA, adapted) CoreTech Laboratories does heat testing

(HT) and stress testing (ST) on materials and operates at capacity. Under its current simple costing system, CoreTech aggregates all operating costs of $1,800,000 into a single overhead cost pool. CoreTech calculates a rate per test-hour of $20 ($1,800,000 ÷ 90,000 total test-hours). HT uses 50,000 test-hours, and ST uses 40,000 test-hours. Gary Celeste, CoreTech's controller, believes that there is enough variation in test procedures and cost structures to establish separate costing and billing rates for HT and ST. The market for test services is becoming competitive. Without this information, any miscosting and mispricing of its services could cause CoreTech to lose business. Celeste divides CoreTech's costs into four activity-cost categories.

a. Direct-labor costs, $276,000. These costs can be directly traced to HT, $204,000, and ST, $72,000.
b. Equipment-related costs (rent, maintenance, energy, and so on), $495,000. These costs are allocated to HT and ST on the basis of test-hours.
c. Setup costs, $630,000. These costs are allocated to HT and ST on the basis of the number of setuphours required. HT requires 15,000 setup-hours, and ST requires 6,000 setup-hours.
d. Costs of designing tests, $399,000. These costs are allocated to HT and ST on the basis of the time required for designing the tests. HT requires 4,000 hours, and ST requires 2,000 hours.

Required:

1. Classify each activity cost as output unit-level, batch-level, product- or service-sustaining, or facility-sustaining. Explain each answer.
2. Calculate the cost per test-hour for HT and ST. Explain briefly the reasons why these numbers differ from the $20 per test-hour that CoreTech calculated using its simple costing system.
3. Explain the accuracy of the product costs calculated using the simple costing system and the ABC system. How might CoreTech's management use the cost hierarchy and ABC information to better manage its business?

SOLUTION

(25 min.) **ABC, cost hierarchy, service.**

1. Output unit-level costs
   a. Direct-labor costs, $276,000
   b. Equipment-related costs (rent, maintenance, energy, and so on), $495,000
   These costs are output unit-level costs because they are incurred on each unit of materials tested, that is, for every hour of testing.

   Batch-level costs
   c. Setup costs, $630,000
   These costs are batch-level costs because they are incurred each time a batch of materials is set up for either HT or ST, regardless of the number of hours for which the tests are subsequently run.

   Service-sustaining costs
   d. Costs of designing tests, $399,000
   These costs are service-sustaining costs because they are incurred to design the HT and ST tests, regardless of the number of batches tested or the number of hours of test time.

EA

2.

	Heat Testing (HT)		Stress Testing (ST)	
	Total (1)	**Per Hour (2) = (1) ÷ 50,000**	**Total (3)**	**Per Hour (4) = (3) ÷ 40,000**
Direct labor costs (given)	$204,000	$4.08	$72,000	$1.80
Equipment-related costs				
$5.50 per hour* × 50,000 hours	275,000	5.50		
$5.50 per hour* × 40,000 hours			220,000	5.50
Setup costs				
$30 per setup-hour† × 15,000 setup-hours	450,000	9.00		
$30 per setup-hour† × 6,000 setup-hours			180,000	4.50
Costs of designing tests				
$66.50 per hour** × 4,000 hours	266,000	5.32		
$66.50 per hour** × 2,000 hours			133,000	3.33
Total costs	$1,195,000.00	$23.90	$605,000.00	$15.13

*$495,000 ÷ (50,000 + 40,000) hours = $5.50 per test-hour

†$630,000 ÷ (15,000 + 6,000) setup hours = $30 per setup-hour

**$399,000 ÷ (4,000 + 2,000) hours = $66.50 per hour

At a cost per test-hour of $20, the simple costing system undercosts heat testing ($23.90) and overcosts stress testing ($15.13). The reason is that heat testing uses direct labor, setup, and design resources per hour more intensively than stress testing. Heat tests are more complex, take longer to set up, and are more difficult to design. The simple costing system assumes that testing costs per hour are the same for heat testing and stress testing.

3. The ABC system better captures the resources needed for heat testing and stress testing because it identifies all the various activities undertaken when performing the tests and recognizes the levels of the cost hierarchy at which costs vary. Hence, the ABC system generates more accurate product costs.

CoreTech's management can use the information from the ABC system to make better pricing and product mix decisions. For example, it might decide to increase the prices charged for the more costly heat testing and consider reducing prices on the less costly stress testing. CoreTech should watch if competitors are underbidding CoreTech in stress testing and causing it to lose business. CoreTech can also use ABC information to reduce costs by eliminating processes and activities that do not add value, identifying and evaluating new methods to do testing that reduce the activities needed to do the tests, reducing the costs of doing various activities, and planning and managing activities.

5-20 Alternative allocation bases for a professional services firm. The Walliston Group (WG) provides tax advice to multinational firms. WG charges clients for (a) direct professional time (at an hourly rate) and (b) support services (at 30% of the direct professional costs billed). The three professionals in WG and their rates per professional hour are as follows:

Professional	Billing Rate per Hour
Max Walliston	$640
Alexa Boutin	220
Jacob Abbington	100

WG has just prepared the May 2017 bills for two clients. The hours of professional time spent on each client are as follows:

	Hours per Client	
Professional	San Antonio Dominion	Amsterdam Enterprises
Walliston	26	4
Boutin	5	14
Abbington	39	52
Total	70	70

Required:

1. What amounts did WG bill to San Antonio Dominion and Amsterdam Enterprises for May 2017?
2. Suppose support services were billed at $75 per professional labor-hour (instead of 30% of professional labor costs). How would this change affect the amounts WG billed to the two clients for May 2017? Comment on the differences between the amounts billed in requirements 1 and 2.
3. How would you determine whether professional labor costs or professional labor-hours is the more appropriate allocation base for WG's support services?

SOLUTION

(15 min.) **Alternative allocation bases for a professional services firm.**

1.

	Direct Professional Time			Support Services		Amount
Client (1)	Rate per Hour (2)	Number of Hours (3)	Total (4) = (2) × (3)	Rate (5)	Total (6) = (4) × (5)	Billed to Client (7) = (4) + (6)
SAN ANTONIO DOMINION						
Walliston	$640	26	$16,640	30%	$4,992	$21,632
Boutin	220	5	1,100	30	330	1,430
Abbington	100	39	3,900	30	1,170	5,070
						$28,132

AMSTERDAM ENTERPRISES						
Walliston	$640	4	$2,560	30%	$ 768	$ 3,328
Boutin	220	14	3,080	30	924	4,004
Abbington	100	52	5,200	30	1,560	6,760
						$14,092

2.

	Direct Professional Time			Support Services		
Client (1)	**Rate per Hour (2)**	**Number of Hours (3)**	**Total (4) = (2) × (3)**	**Rate per Hour (5)**	**Total (6) = (3) × (5)**	**Amount Billed to Client (7) = (4) + (6)**
SAN ANTONIO DOMINION						
Walliston	$640	26	$16,640	$75	$1,950	$18,590
Boutin	220	5	1,100	75	375	1,475
Abbington	100	39	3,900	75	2,925	6,825
						$26,890
AMSTERDAM ENTERPRISES						
Walliston	$640	4	$2,560	$75	$ 300	$ 2,860
Boutin	220	14	3,080	75	1,050	4,130
Abbington	100	52	5,200	75	3,900	9,100
						$16,090

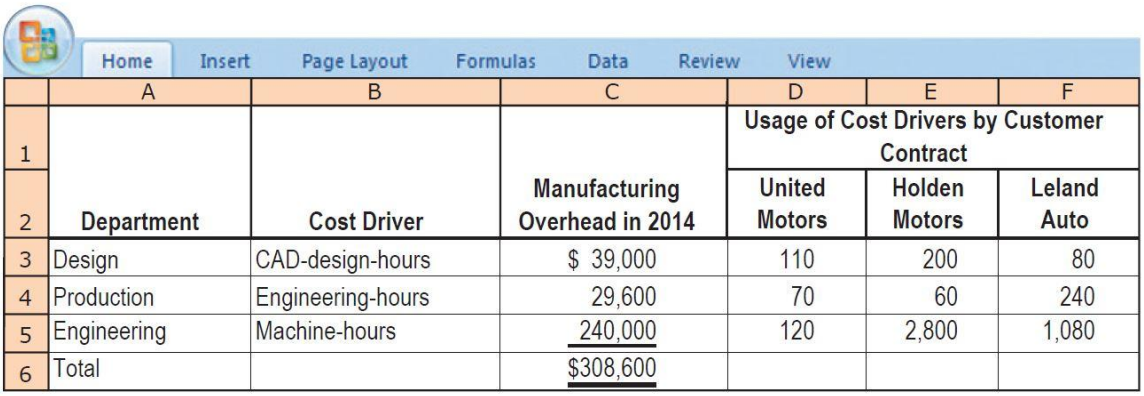
	Requirement 1	**Requirement 2**
San Antonio Dominion	$28,132	$26,890
Amsterdam Enterprises	14,092	16,090
	$42,224	$42,980

Both clients use 70 hours of professional labor time. However, San Antonio Dominion uses a higher proportion of Walliston's time (26 hours), which is more costly. This attracts the highest support-services charge when allocated on the basis of direct professional labor costs.

3. Assume that the Walliston Group uses a cause-and-effect criterion when choosing the allocation base for support services. You could use several pieces of evidence to determine whether professional labor costs or hours is the driver of support-service costs:

a. *Interviews with personnel*. For example, staff in the major cost categories in support services could be interviewed to determine whether Walliston requires more support per hour than, say, Abbington. The professional labor costs allocation base implies that an hour of Walliston's time requires 6.40 ($640 ÷ $100) times more support-service dollars than does an hour of Abbington's time.
b. *Analysis of tasks undertaken for selected clients*. For example, if computer-related costs are a sizable part of support costs, you could determine if there was a systematic relationship between the percentage involvement of professionals with high billing rates on cases and the computer resources consumed for those cases.

5-21 Plant-wide, department, and ABC indirect cost rates. Automotive Products (AP) designs and produces automotive parts. In 2017, actual variable manufacturing overhead is $308,600. AP's simple costing system allocates variable manufacturing overhead to its three customers based on machine-hours and prices its contracts based on full costs. One of its customers has regularly complained of being charged noncompetitive prices, so AP's controller Devon Smith realizes that it is time to examine the consumption of overhead resources more closely. He knows that there are three main departments that consume overhead resources: design, production, and engineering. Interviews with the department personnel and examination of time records yield the following detailed information:



	A	B	C	D	E	F
1				Usage of Cost Drivers by Customer Contract		
2	Department	Cost Driver	Manufacturing Overhead in 2014	United Motors	Holden Motors	Leland Auto
3	Design	CAD-design-hours	$ 39,000	110	200	80
4	Production	Engineering-hours	29,600	70	60	240
5	Engineering	Machine-hours	240,000	120	2,800	1,080
6	Total		$308,600			

Required:

1. Compute the manufacturing overhead allocated to each customer in 2014 using the simple costing system that uses machine-hours as the allocation base.
2. Compute the manufacturing overhead allocated to each customer in 2014 using department-based manufacturing overhead rates.
3. Comment on your answers in requirements 1 and 2. Which customer do you think was complaining about being overcharged in the simple system? If the new department-based rates are used to price contracts, which customer(s) will be unhappy? How would you respond to these concerns?
4. How else might AP use the information available from its department-by-department analysis of manufacturing overhead costs?
5. AP's managers are wondering if they should further refine the department-by-department costing system into an ABC system by identifying different activities within each department. Under what conditions would it not be worthwhile to further refine the department costing system into an ABC system?

SOLUTION

(20 min.) **Plantwide, department, and ABC indirect cost rates.**
1.

Actual plantwide variable MOH rate based on machine hours, $308,600 ÷ 4,000	$77.15 per machine hour

	United Motors	Holden Motors	Leland Auto	Total
Variable manufacturing overhead, allocated based on machine hours ($77.15 × 120; $77.15 × 2,800; $77.15 × 1,080)	$9,258	$216,020	$83,322	$308,600

2.

Department	MOH in 2014	Total Driver Units	Rate	
Design	$39,000	390	$100	per CAD-design hour
Production	29,600	370	$ 80	per engineering hour
Engineering	240,000	4,000	$ 60	per machine hour

	United Motors	Holden Motors	Leland Auto	Total
Design-related overhead, allocated on CAD-design hours (110 × $100; 200 × $100; 80 × $100)	$11,000	$ 20,000	$ 8,000	$ 39,000
Production-related overhead, allocated on engineering hours (70 × $80; 60 × $80; 240 × $80)	5,600	4,800	19,200	29,600
Engineering-related overhead, allocated on machine hours (120 × $60; 2,800 × $60; 1,080 × $60)	7,200	168,000	64,800	240,000
Total	$23,800	$192,800	$92,000	$308,600

3.

	United Motors	Holden Motors	Leland Auto
a. Department rates (Requirement 2)	$23,800	$192,800	$92,000
b. Plantwide rate (Requirement 1)	$ 9,258	$216,020	$83,322
Ratio of (a) ÷ (b)	2.57	0.89	1.10

The manufacturing overhead allocated to United Motors increases by 157% under the department rates, the overhead allocated to Holden decreases by about 11%, and the overhead allocated to Leland increases by about 10%.

The three contracts differ sizably in the way they use the resources of the three departments.

The percentage of total driver units in each department used by the companies is:

Department	Cost Driver	United Motors	Holden Motors	Leland Auto

Design	CAD-design hours	28%	51%	21%
Engineering	Engineering hours	19	16	65
Production	Machine hours	3	70	27

The United Motors contract uses only 3% of total machines hours in 2011, yet uses 28% of CAD design-hours and 19% of engineering hours. The result is that the plantwide rate, based on machine hours, will greatly underestimate the cost of resources used on the United Motors contract. This explains the 157% increase in indirect costs assigned to the United Motors contract when department rates are used. The Leland Auto contract also uses far fewer machine-hours than engineering-hours and is also undercosted.

In contrast, the Holden Motors contract uses less of design (51%) and engineering (16%) than of machine-hours (70%). Hence, the use of department rates will report lower indirect costs for Holden Motors than does a plantwide rate.

Holden Motors was probably complaining under the use of the simple system because its contract was being overcosted relative to its consumption of MOH resources. United and Leland, on the other hand, were having their contracts undercosted and underpriced by the simple system. Assuming that AP is an efficient and competitive supplier, if the new department-based rates are used to price contracts, United and Leland will be unhappy. AP should explain to United and Leland how the calculation was done, and point out United's high use of design and engineering resources and Leland's high use of engineering resources relative to production machine hours. Discuss ways of reducing the consumption of those resources, if possible, and show willingness to partner with them to do so. If the price rise is going to be steep, perhaps offer to phase in the new prices.

4. Other than for pricing, AP can also use the information from the department-based system to examine and streamline its own operations so that there is maximum value-added from all indirect resources. It might set targets over time to reduce both the consumption of each indirect resource and the unit costs of the resources. The department-based system gives AP more opportunities for targeted cost management.

5. It would not be worthwhile to further refine the cost system into an ABC system if (1) a single activity accounts for a sizable proportion of the department's costs or (2) significant costs are incurred on different activities within a department, but each activity has the same cost driver or (3) there wasn't much variation among contracts in the consumption of activities within a department. If, for example, most activities within the design department were, in fact, driven by CAD-design hours, then the more refined system would be more costly and no more accurate than the department-based cost system. Even if there was sufficient variation, considering the relative sizes of the three department cost pools, it may only be cost-effective to further analyze the engineering cost pool, which consumes 78% ($240,000 ÷ $308,600) of the manufacturing overhead.

5-22 Plant-wide, department, and activity-cost rates. Triumph Trophies makes trophies and plaques and operates at capacity. Triumph does large custom orders, such as the participant trophies for the Minnetonka Little League. The controller has asked you to compare plant-wide, department, and activity-based cost allocation.

Triumph Trophies Budgeted Information for the Year Ended November 30, 2014

Forming Department	Trophies	Plaques	Total
Direct materials	$26,000	$22,500	$48,500
Direct manufacturing labor	31,200	18,000	49,200
Overhead costs			
Setup			24,000
General overhead			20,772
Assembly Department	**Trophies**	**Plaques**	**Total**
Direct materials	$ 5,200	$18,750	$23,950
Direct manufacturing labor	15,600	21,000	36,600
Overhead costs			
Set up			46,000
Supervision			21,920

Other information follows:
Setup costs in each department vary with the number of batches processed in each department. The budgeted number of batches for each product line in each department is as follows:

	Trophies	Plaques
Forming department	40	116
Assembly department	43	103

Supervision costs in each department vary with direct manufacturing labor costs in each department.

Required:

1. Calculate the budgeted cost of trophies and plaques based on a single plant-wide overhead rate, if total overhead is allocated based on total direct costs.
2. Calculate the budgeted cost of trophies and plaques based on departmental overhead rates, where forming department overhead costs are allocated based on direct manufacturing labor costs of the forming department and assembly department overhead costs are allocated based on total direct costs of the assembly department.
3. Calculate the budgeted cost of trophies and plaques if Triumph allocates overhead costs in each department using activity-based costing.
4. Explain how the disaggregation of information could improve or reduce decision quality.

SOLUTION

(50 min.) **Plantwide, department, and activity-cost rates.**

1.

	Trophies	Plaques	Total
Direct materials			
Forming	$26,000	$22,500	
Assembly	5,200	18,750	

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Total	31,200	41,250	
Direct manufacturing labor			
Forming	31,200	18,000	
Assembly	15,600	21,000	
Total	46,800	39,000	
Total direct costs	$78,000	$80,250	$158,250

$$\text{Budgeted overhead rate} = \frac{(\$24,000 + \$20,772 + \$46,000 + \$21,920)}{\$158,250} = \frac{\$112,692}{\$158,250} = \$0.712114 \text{ per dollar of direct cost}$$

	Trophies	Plaques	Total
Direct materials	$ 31,200	$ 41,250	$ 72,450
Direct labor	46,800	39,000	85,800
Total direct cost	78,000	80,250	158,250
Allocated overhead*	55,544	57,148	112,692
Total costs	$133,544	$137,398	$270,942

*Allocated overhead = Total direct cost × Budgeted overhead rate (0.712114).

2. $$\text{Budgeted overhead rate — Forming Dept.} = \frac{\text{Budgeted Forming Department overhead costs}}{\text{Budgeted Forming Department direct manufacturing labor costs}} = \frac{\$24,000 + \$20,772}{\$31,200 + \$18,000} = \frac{\$44,772}{\$49,200} = \$0.91 \text{ per Forming Department direct manuf.-labor dollar}$$

$$\text{Budgeted overhead rate — Assembly Dept.} = \frac{\text{Budgeted Assembly Department overhead costs}}{\text{Budgeted Assembly Department direct costs}} = \frac{\$46,000 + \$21,920}{(\$5,200 + \$18,750 + \$15,600 + \$21,000)} = \frac{\$67,920}{\$60,550} = \$1.121718 \text{ per Assembly Department direct cost dollar}$$

	Trophies	Plaques	Total
Direct materials	$ 31,200	$ 41,250	$ 72,450
Direct labor	46,800	39,000	85,800

EA

Total direct cost	78,000	80,250	158,250
Allocated overhead			
Forming Dept.[a]	28,392	16,380	44,772
Assembly Dept.[b]	23,332	44,588	67,920
Total costs	$129,724	$141,218	$270,942

	Trophies	Plaques	Total
[a] **Forming Dept.**			
Direct manufacturing labor costs	$31,200	$18,000	$49,200
Allocated overhead (0.91 × $31,200; $18,000)	$28,392	$16,380	$44,772
[b] **Assembly Dept.**			
Total direct costs ($5,200 + $15,600; $18,750 + $21,000)	$20,800	$39,750	$60,550
Allocated overhead (1.121718 × $20,800; $39,750)	$11,666	$22,294	$33,960

3.

Forming Department

$$\text{Budgeted setup rate} = \frac{\$24,000}{156 \text{ batches}} = \$153.84615 \text{ per batch}$$

$$\text{Budgeted supervision rate} = \frac{\$20,772}{\$49,200} = \$0.422195 \text{ per direct-labor dollar}$$

Assembly Department

$$\text{Budgeted set up rate} = \frac{\$46,000}{146 \text{ batches}} = \$315.06849 \text{ per batch}$$

$$\text{Budgeted supervision rate} = \frac{\$21,920}{\$36,600} = \$0.598907 \text{ per direct manuf.-labor dollar}$$

	Trophies	Plaques	Total
Direct material costs	$ 31,200	$ 41,250	$ 72,450
Direct labor costs	46,800	39,000	85,800

Total direct costs	78,000	80,250	158,250
Forming Dept. overhead			
Set up			
$153.84615 × 40; 116	6,154	17,846	24,000
Supervision			
0.422195 × $31,200; $18,000	13,172	7,600	20,772
Assembly Department overhead			
Set up			
$315.06849 × 43; 103	13,548	32,452	46,000
Supervision			
0.598907 × $15,600; $21,000	9,343	12,577	21,920
Total costs	$120,217	$150,725	$270,942

4. As Triumph uses more refined cost pools, the costs of trophies decreases, and costs of plaques increases. This is because plaques use a higher proportion of cost drivers (batches of set ups and direct manufacturing labor costs) than trophies, whereas the direct costs (the allocation base used in the simple costing system) are slightly smaller for plaques compared to trophies. This results in plaques being undercosted and trophies overcosted in the simple costing system.

Department costing systems increase the costs of plaques relative to trophies because the forming department costs are allocated based on direct manufacturing labor costs in the forming department and plaques use more direct manufacturing labor in this department compared to trophies.

Disaggregated information can improve decisions by allowing managers to see the details that help them understand how different aspects of cost influence total cost per unit. Managers can also understand the drivers of different cost categories and use this information for pricing and product-mix decisions, cost reduction and process-improvement decisions, design decisions, and to plan and manage activities. However, too much detail can overload managers who don't understand the data or what it means. Also, managers looking at per-unit data may be misled when considering costs that aren't unit-level costs.

5-23 ABC, process costing. Parker Company produces mathematical and financial calculators and operates at capacity. Data related to the two products are presented here:

	Mathematical	**Financial**
Annual production in units	60,000	120,000
Direct material costs	$240,000	$480,000
Direct manufacturing labor costs	$75,000	$150,000
Direct manufacturing labor-hours	5,000	10,000
Machine-hours	40,000	80,000
Number of production runs	60	60
Inspection hours	1,500	750

Total manufacturing overhead costs are as follows:

	Total
Machining costs	$720,000
Setup costs	150,000
Inspection costs	135,000

Required:

1. Choose a cost driver for each overhead cost pool and calculate the manufacturing overhead cost per unit for each product.
2. Compute the manufacturing cost per unit for each product.
3. How might Parker's managers use the new cost information from its activity-based costing system to better manage its business?

SOLUTION

(10–15 min.) **ABC, process costing.**

1. Rates per unit cost driver.

Activity	Cost Driver	Rate
Machining	Machine-hours	$720,000 ÷ (40,000 + 80,000) = $6 per machine hour
Set up	Production runs	$150,000 ÷ (60 + 60) = $1,250 per production run
Inspection	Inspection-hours	$135,000 ÷ (1,500 + 750) = $60 per inspection hour

Overhead cost per unit:

	Mathematical	Financial
Machining: $6 × 40,000; 80,000	**$240,000**	**$480,000**
Set up: $1,250 × 60; $1,250 × 60	75,000	75,000
Inspection: $60 × 1,500; $60 × 750	90,000	45,000
Total manufacturing overhead costs	$405,000	$600,000
Divide by number of units	÷ 60,000	÷120,000
Manufacturing overhead cost per unit	$ 6.75	$ 5.00

2.

	Mathematical	Financial
Manufacturing cost per unit:		
Direct materials		
$240,000 ÷ 60,000	$4.00	
$480,000 ÷ 120,000		$4.00
Direct manufacturing labor		
$75,000 ÷ 60,000	1.25	
$150,000 ÷ 120,000		1.25
Manufacturing overhead (from requirement 1)	6.75	5.00

Manufacturing cost per unit	$12.00	$10.25

3. Disaggregated information can improve decisions by allowing managers to see the details that help them understand how different aspects of cost influence total cost per unit. Managers can also understand the drivers of different cost categories and use this information for pricing and product-mix decisions, cost reduction and process-improvement decisions, design decisions, and to plan and manage activities. However, too much detail can overload managers who don't understand the data or what it means. Also, managers looking at per-unit data may be misled when considering costs that aren't unit-level costs.

5-24 Department costing, service company. CKM is an architectural firm that designs and builds buildings. It prices each job on a cost plus 20% basis. Overhead costs in 2017 are $4,011,780. CKM's simple costing system allocates overhead costs to its jobs based on number of jobs. There were three jobs in 2017. One customer, Sanders, has complained that the cost of its building in Chicago was not competitive. As a result, the controller has initiated a detailed review of the overhead allocation to determine if overhead costs are charged to jobs in proportion to consumption of overhead resources by jobs. She gathers the following information:

			Quantity of Cost Drivers Used by Each Project		
Department	Cost Driver	Overhead Costs in 2017	Sanders	Hanley	Stanley
Design	Design department hours	$1,500,000	1,000	5,000	4,000
Engineering	Number of engineering hours	$ 500,030	2,000	2,000	2,200
Construction	Labor-hours	$2,011,750	20,800	21,500	19,600
		$4,011,780			

Required:

1. Compute the overhead allocated to each project in 2017 using the simple costing system.
2. Compute the overhead allocated to each project in 2017 using department overhead cost rates.
3. Do you think Sanders had a valid reason for dissatisfaction with the cost? How does the allocation, based on department rates, change costs for each project?
4. What value, if any, would CKM get by allocating costs of each department based on the activities done in that department?

SOLUTION

(20 mins.) **Department costing, service company**

Note: The cost driver for engineering is number of engineering-hours, not number of engineers. This change does not, however, affect the solution itself.

1. Using the simple costing system, total overhead costs are equally allocated to projects. There were 3 projects in 2017, so the overhead cost per project is

Overhead cost per project in 2017 = $4,011,780 ÷ 3 = $1,337,260 per project

2. Rates per unit cost driver.

Activity	Cost Driver	Rate
Design	Design department hours	$1,500,000 ÷ (1,000 + 5,000 + 4,000) = $150 per design-hour
Engineering	Engineering department hours	$500,030 ÷ (2,000 + 2,000 + 2,200) = $80.65 per engineering-hour
Construction	Labor-hours	$2,011,750 ÷ (20,800 + 21,500 + 19,600) = $32.50 per labor-hour

Overhead cost allocated to each project using department overhead cost rates:

	Sanders	Hanley	Stanley
Design: $150 × 1,000; 5,000; 4,000	$150,000	$ 750,000	$ 600,000
Engineering: $80.65 × 2,000; 2,000; 2,200	161,300	161,300	177,430
Construction: $32.50 × 20,800; 21,500; 19,600	676,000	698,750	637,000
Total overhead costs	$987,300	$1,610,050	$1,414,430

3.

	Sanders	Hanley	Stanley
a. Department rates (Requirement 2)	$ 987,300	$1,610,050	$1,414,430
b. Plantwide rate (Requirement 1)	$1,337,260	$1,337,260	$1,337,260
Ratio of (a) ÷ (b)	0.74	1.20	1.06

The overhead allocated to Sanders decreases by 26% under the department rates, the overhead allocated to Hanley increases by about 20%, and the overhead allocated to Stanley increases by about 6%.

The three projects differ sizably in the way they use the resources of the three departments. The percentage of total driver units in each department used by the companies is:

Department	Cost Driver	Sanders	Hanley	Stanley
Design	Design-hours	10%	50%	40%
Engineering	Engineering-hours	32	32	36
Construction	Labor-hours	33	35	32

The Sanders project uses only 10% of design-hours in 2017 and uses 32% of engineering-hours and 33% of construction hours. The result is that the overhead rate, based on allocating costs equally to all projects (33%), will greatly overestimate the cost of resources used on the Sanders

project, which uses very few design-hours. This explains the 26% decrease in indirect costs assigned to the Sanders project when department rates are used.

In contrast, the Hanley and Stanley projects use more of design (50% and 40%, respectively). Hence, the use of department rates will report higher indirect costs for Hanley and Stanley than does a single overhead rate.

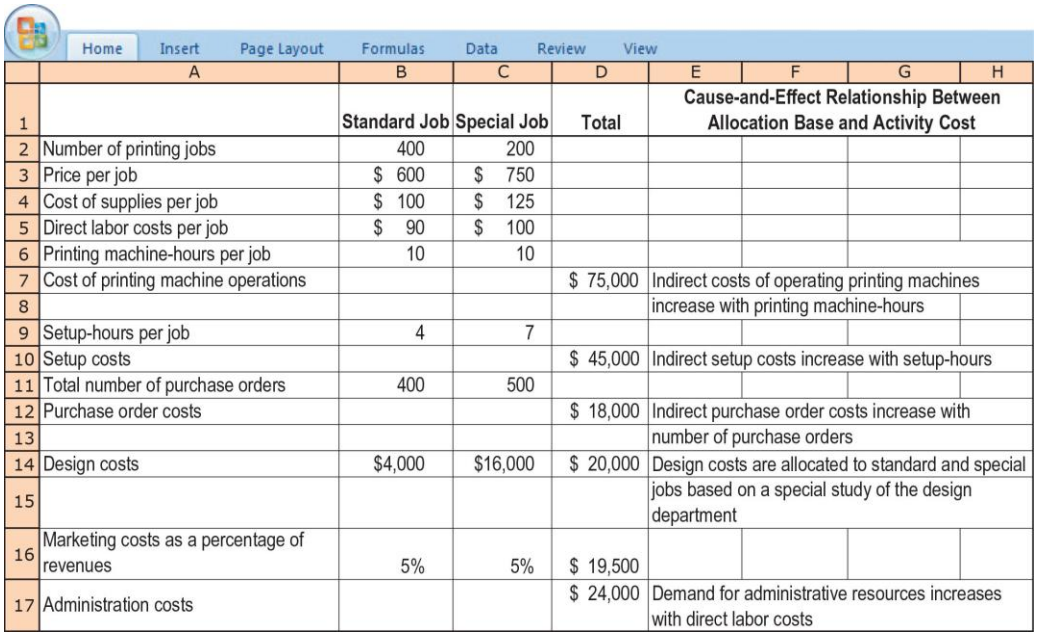
Sanders was probably complaining about the costs resulting from using the simple system because its project was being overcosted relative to its consumption of overhead resources. Hanley and Stanley, on the other hand, were having their projects undercosted and underpriced by the simple system. If the new department-based rates are used to price projects, Hanley and Stanley will be unhappy. CKM should explain to Hanley and Stanley how the calculations were done and point out their high use of design resources. CKM should discuss ways of reducing the consumption of design resources, if possible, and show willingness to partner with them to do so. CKM could even offer to phase in the new prices.

4. It would not be worthwhile to further refine the cost system into an ABC system if (1) a single activity accounts for a sizable proportion of the department's costs or (2) significant costs are incurred on different activities within a department, but each activity has the same cost driver or (3) there wasn't much variation among contracts in the consumption of activities within a department. If, for example, most activities within the design department were, in fact, driven by design-hours, then the more refined system would be more costly and no more accurate than the department-based cost system.

5-25 Activity-based costing, service company. Speediprint Corporation owns a small printing press that prints leaflets, brochures, and advertising materials. Speediprint classifies its various printing jobs as standard jobs or special jobs. Speediprint's simple job-costing system has two direct-cost categories (direct materials and direct labor) and a single indirect-cost pool. Speediprint operates at capacity and allocates all indirect costs using printing machine-hours as the allocation base.

Speediprint is concerned about the accuracy of the costs assigned to standard and special jobs and therefore is planning to implement an activity-based costing system. Speediprint's ABC system would have the same direct-cost categories as its simple costing system. However, instead of a single indirect-cost pool there would now be six categories for assigning indirect costs: design, purchasing, setup, printing machine operations, marketing, and administration. To see how activity-based costing would affect the costs of standard and special jobs, Speediprint collects the following information for the fiscal year 2017 that just ended.

EA



	A	B	C	D	E	F	G	H
1		Standard Job	Special Job	Total	Cause-and-Effect Relationship Between Allocation Base and Activity Cost			
2	Number of printing jobs	400	200					
3	Price per job	$ 600	$ 750					
4	Cost of supplies per job	$ 100	$ 125					
5	Direct labor costs per job	$ 90	$ 100					
6	Printing machine-hours per job	10	10					
7	Cost of printing machine operations			$ 75,000	Indirect costs of operating printing machines			
8					increase with printing machine-hours			
9	Setup-hours per job	4	7					
10	Setup costs			$ 45,000	Indirect setup costs increase with setup-hours			
11	Total number of purchase orders	400	500					
12	Purchase order costs			$ 18,000	Indirect purchase order costs increase with			
13					number of purchase orders			
14	Design costs	$4,000	$16,000	$ 20,000	Design costs are allocated to standard and special			
15					jobs based on a special study of the design department			
16	Marketing costs as a percentage of revenues	5%	5%	$ 19,500				
17	Administration costs			$ 24,000	Demand for administrative resources increases with direct labor costs			

Required

1. Calculate the cost of a standard job and a special job under the simple costing system.
2. Calculate the cost of a standard job and a special job under the activity-based costing system.
3. Compare the costs of a standard job and a special job in requirements 1 and 2. Why do the simple and activity-based costing systems differ in the cost of a standard job and a special job?
4. How might Speediprint use the new cost information from its activity-based costing system to better manage its business?

SOLUTION

(30 min.) **Activity-based costing, service company.**

1. Total indirect costs = $75,000 + $45,000 + $18,000 + $20,000 + $19,500 + $24,000

= $201,500

Total machine-hours = (400 × 10) + (200 × 10) = 6,000

Indirect cost rate per machine-hour = $201,500 ÷ 6,000

= $33.583 per machine-hour

Simple Costing System	Standard Job	Special Job
Cost of supplies per job	$100.00	$125.00
Direct labor cost per job	90.00	100.00
Indirect cost allocated to each job (10 machine hours × $33.583 per machine hour)	335.83	335.83
Total costs	$525.83	$560.83

2. Activity-based costing system

Activity	Cost Driver	Quantity of Cost Driver Consumed during 2017 (see column (1))		Total Cost of Activity (given)	Allocation Rate	
		Standard Job	Special Job		(6) = (5) ÷ ((3) + (4)), or given	
(1)	(2)	(3)	(4)	(5)		
Machine operations (400 jobs × 10 mach. hrs. per job; 200 jobs × 10 mach. hrs. per job)	Machine hours	4,000	2,000	$75,000	$ 12.50	per machine hour
Setups (4 × 400; 7 × 200)	Setup hours	1,600	1,400	$45,000	$ 15.00	per setup hour
Purchase orders (given)	No. of purchase orders	400	500	$18,000	$ 20.00	per purchase order
Design				$20,000		
Marketing	Percentage of revenue	$240,000[1]	$150,000[1]	$19,500	$ 0.05	per dollar of sales
Administration	Dir. labor costs	$36,000[2]	$20,000[2]	$24,000	$0.42857	per dollar of direct manuf. labor cost

[1]Revenue from standard jobs, $600 × 400 = $240,000; Revenue from special jobs, $750 × 200 = $150,000

[2]Direct labor costs of standard jobs, $90 × 400 jobs = $36,000; Direct labor costs of special jobs, $100 × 200 jobs = $20,000

	Total Costs	
	Standard Job	Special Job
Cost of supplies ($100 × 400; $125 × 200)	$ 40,000	$ 25,000
Direct labor costs ($90 × 400; $100 × 200)	36,000	20,000
Indirect costs allocated:		
Machine operations ($12.50 per mach. hr. × 4,000; 2,000)	50,000	25,000
Setups ($15 per setup hr. × 1,600; 1,400)	24,000	21,000
Purchase orders ($20 per order × 400; 500)	8,000	10,000
Design	4,000	16,000
Marketing (0.05×$240,000; 0.05 × $150,000)	12,000	7,500
Administration (0.42857 × $36,000; $20,000)	15,429	8,571
Total costs	$189,429	$133,071
Cost of each job ($189,429 ÷ 400; $133,071 ÷ 200)	$ 473.57	$ 665.36

3.

Cost per job	Standard Job	Special Job
Simple Costing System	$525.83	$560.83
Activity-based Costing System	$473.57	$665.36
Difference (Simple – ABC)	$ 52.26	$(104.53)

Relative to the ABC system, the simple costing system overcosts standard jobs and undercosts special jobs. Both types of jobs need 10 machine hours per job, so in the simple system, they are each allocated $335.83 in indirect costs. But, the ABC study reveals that each standard job consumes less of the indirect resources such as setups, purchase orders, and design costs than a special job, and this is reflected in the lower indirect costs allocated to the standard jobs and higher indirect costs allocated to special jobs in the ABC system.

4. Speediprint can use the information revealed by the ABC system to change its pricing based on the ABC costs. Under the simple system, Speediprint was making a gross margin of 12% on each standard job ([$600 – $525.83] ÷ $600) and 25% on each special job ([$750 – $560.83] ÷ $750). But, the ABC system reveals that it is actually making a gross margin of 21% ([$600 – $473.57] ÷ $600) on each standard job and about 11% ([$750 – $665.36] ÷ $750) on each special job. Depending on the market competitiveness, Speediprint may either want to reprice the different types of jobs, or it may choose to market standard jobs more aggressively than before.

Speediprint can also use the ABC information to improve its own operations. It could examine each of the indirect cost categories and analyze whether it would be possible to deliver the same level of service, but consume fewer indirect resources, or find a way to reduce the per-unit-cost-driver cost of some of those indirect resources.

5-26 Activity-based costing, manufacturing. Decorative Doors, Inc., produces two types of doors, interior and exterior. The company's simple costing system has two direct-cost categories (materials and labor) and one indirect-cost pool. The simple costing system allocates indirect costs on the basis of machine-hours. Recently, the owners of Decorative Doors have been concerned about a decline in the market share for their interior doors, usually their biggest seller. Information related to Decorative Doors production for the most recent year follows:

	Interior	Exterior
Units sold	3,200	1,800
Selling price	$ 125	$ 200
Direct material cost per unit	$ 30	$ 45
Direct manufacturing labor cost per hour	$ 16	$ 16
Direct manufacturing labor-hours per unit	1.50	2.25
Production runs	40	85
Material moves	72	168
Machine setups	45	155
Machine-hours	5,500	4,500
Number of inspections	250	150

The owners have heard of other companies in the industry that are now using an activity-based costing system and are curious how an ABC system would affect their product costing decisions.

After analyzing the indirect-cost pool for Decorative Doors, the owners identify six activities as generating indirect costs: production scheduling, material handling, machine setup, assembly, inspection, and marketing. Decorative Doors collected the following data related to the indirect-cost activities:

Activity	Activity Cost	Activity Cost Driver
Production scheduling	$95,000	Production runs
Material handling	$45,000	Material moves
Machine setup	$25,000	Machine setups
Assembly	$60,000	Machine-hours
Inspection	$ 8,000	Number of inspections

Marketing costs were determined to be 3% of the sales revenue for each type of door.

Required

1. Calculate the cost of an interior door and an exterior door under the existing simple costing system.
2. Calculate the cost of an interior door and an exterior door under an activity-based costing system.
3. Compare the costs of the doors in requirements 1 and 2. Why do the simple and activity-based costing systems differ in the cost of an interior door and an exterior door?
4. How might Decorative Doors, Inc., use the new cost information from its activity-based costing system to address the declining market share for interior doors?

SOLUTION

(30 min.) **Activity-based costing, manufacturing.**

1. Simple costing system:

Total indirect costs = $95,000 + $45,000 + $25,000 + $60,000 + $8,000 + 3%[($125 × 3,200) + ($200 × 1,800)]
= $255,800

Total machine-hours = 5,500 + 4,500 = 10,000

Indirect cost rate per machine-hour = $255,800 ÷ 10,000
= $25.58 per machine-hour

Simple Costing System	Interior	Exterior
Direct materials[a]	$ 96,000	$ 81,000
Direct manufacturing labor[b]	76,800	64,800
Indirect cost allocated to each job ($25.58 × 5,500; 4,500 machine hours)	140,690	115,110
Total costs	$313,490	$260,910
Total cost per unit ($313,490 ÷ 3,200; $260,910 ÷ 1,800)	$ 97.97	$ 144.95

[a] $30 × 3,200 units; $45 × 1,800 units

EA

[b] $16 × 1.5 × 3,200 units; $16 × 2.25 × 1,800 units

2. Activity-based costing system

Activity (1)	Total Cost of Activity (2)	Cost Driver (3)	Cost Driver Quantity (4)	Allocation Rate (5) = (2) ÷ (4)	
Product scheduling	$95,000	Production runs	125[c]	$760.00	per production run
Material handling	$45,000	Material moves	240[d]	$187.50	per material move
Machine setup	$25,000	Machine setups	200[e]	$125.00	per setup
Assembly	$60,000	Machine hours	10,000	$ 6.00	per machine hour
Inspection	$ 8,000	Inspections	400[f]	$ 20.00	per inspection
Marketing		Percentage of revenues		$ 0.03	per dollar of sales

[c] 40 + 85 = 125; [d] 72 + 168 = 240; [e] 45 + 155 = 200; [f] 250 + 150 = 400

ABC System	Interior	Exterior
Direct materials	$ 96,000	$ 81,000
Direct manufacturing labor	76,800	64,800
Indirect costs allocated:		
Production scheduling ($760 per run × 40; 85)	30,400	64,600
Material handling ($187.50 per move × 72; 168)	13,500	31,500
Machine setup ($125 per setup × 45; 155)	5,625	19,375
Assembly ($6 per MH × 5,500; 4,500)	33,000	27,000
Inspection ($20 per inspection × 250; 150)	5,000	3,000
Marketing (0.03 × $125 × 3,200; 0.03 × $200 × 1,800)	12,000	10,800
Total costs	$272,325	$302,075
Total cost per unit ($272,325 ÷ 3,200 units; $302,075 ÷ 1,800 units)	$ 85.10	$ 167.82

3.

Cost per unit	Interior	Exterior
Simple Costing System	$97.97	$144.95
Activity-based Costing System	$85.10	$167.82
Difference (Simple – ABC)	$12.87	$ (22.87)

Relative to the ABC system, the simple costing system overcosts interior doors and undercosts exterior doors. Interior doors require 1.72 machine-hours per unit (5,500 hours ÷ 3,200 units) while exterior doors require 2.5 machine-hours per unit (4,500 hours ÷ 1,800 units). In the simple-costing system, overhead costs are allocated to the interior and exterior doors on the basis

of the machine-hours used by each type of door. The ABC study reveals that the ratio of the cost of production runs, material moves, and setups for each exterior door versus each interior door is even higher than the ratio of 2.5 to 1.72 machine-hours for each exterior relative to each interior door. This higher ratio results in higher indirect costs allocated to exterior doors relative to interior doors in the ABC system.

4. Decorative Doors, Inc. can use the information revealed by the ABC system to change its pricing based on the ABC costs. Under the simple system, Decorative Doors was making an operating margin of 21.6% on each interior door ([$125 – $97.97] ÷ $125) and 27.5% on each exterior door ([$200 – $144.95] ÷ $200). But, the ABC system reveals that it is actually making an operating margin of about 32% ([$125 – $85.10]÷$125) on each interior door and about 16% ([$200 – $167.82] ÷ $200) on each exterior door. Decorative Doors, Inc., should consider decreasing the price of its interior doors to be more competitive. Decorative Doors should also consider increasing the price of its exterior doors, depending on the competition it faces in this market.

Decorative Doors can also use the ABC information to improve its own operations. It could examine each of the indirect cost categories and analyze whether it would be possible to deliver the same level of service, but consume fewer indirect resources, or find a way to reduce the per-unit-cost-driver cost of some of those indirect resources. Making these operational improvements can help Decorative Doors to reduce costs, become more competitive, and reduce prices to gain further market share while increasing its profits.

5-27 ABC, retail product-line profitability. Henderson Supermarkets (HS) operates at capacity and decides to apply ABC analysis to three product lines: baked goods, milk and fruit juice, and frozen foods. It identifies four activities and their activity cost rates as follows:

Ordering	$104	per purchase order
Delivery and receipt of merchandise	$80	per delivery
Shelf-stocking	$22	per hour
Customer support and assistance	$0.25	per item sold

The revenues, cost of goods sold, store support costs, activities that account for the store support costs, and activity-area usage of the three product lines are as follows:

	Baked Goods	Milk and Fruit Juice	Frozen Products
Financial data			
Revenues	$63,000	$68,500	$54,000
Cost of goods sold	$39,000	$52,000	$36,000
Store support	$11,700	$15,600	$10,800
Activity-area usage (cost-allocation base)			
Ordering (purchase orders)	21	18	13
Delivery (deliveries)	88	32	26
Shelf-stocking (hours)	185	176	38
Customer support (items sold)	12,200	16,400	7,600

Under its simple costing system, HS allocated support costs to products at the rate of 30% of cost of goods sold.

Required:
1. Use the simple costing system to prepare a product-line profitability report for HS.
2. Use the ABC system to prepare a product-line profitability report for HS.
3. What new insights does the ABC system in requirement 2 provide to HS managers?

SOLUTION

(30 min.) **ABC, retail product-line profitability.**

1. The simple costing system (Panel A of Solution Exhibit 5-25) reports the following:

	Baked Goods	Milk and Fruit Juice	Frozen Products	Total
Revenues	$63,000	$68,500	$54,000	$185,500
Costs				
Cost of goods sold	39,000	52,000	36,000	127,000
Store support (30% of COGS)	11,700	15,600	10,800	38,100
Total costs	50,700	67,600	46,800	165,100
Operating income	$12,300	$900	$7,200	$20,400
Operating income ÷ Revenues	19.52%	1.31%	13.33%	11.00%

2. The ABC system (Panel B of Solution Exhibit 5-25) reports the following:

	Baked Goods	Milk and Fruit Juice	Frozen Products	Total
Revenues	$63,000	$68,500	$54,000	$185,500
Costs				
Cost of goods sold	39,000	52,000	36,000	127,000
Ordering ($104 × 21; 18; 13)	2,184	1,872	1,352	5,408
Delivery ($80 × 88; 32; 26)	7,040	2,560	2,080	11,680
Shelf-stocking ($22 × 185; 176; 38)	4,070	3,872	836	8,778
Customer support ($0.25 × 12,200; 16,400; 7,600)	3,050	4,100	1,900	9,050
Total costs	55,344	64,404	42,168	161,916
Operating income	$7,656	$4,096	$11,832	$23,584

Operating income ÷ Revenues	12.15%	5.98%	21.91%	12.71%

These activity costs are based on the following:

Activity	Cost Allocation Rate		Baked Goods	Milk and Fruit Juice	Frozen Products
Ordering	$104	per purchase order	21	18	13
Delivery	$80	per delivery	88	32	26
Shelf-stocking	$22	per hour	185	176	38
Customer support	$0.25	per item sold	12,200	16,400	7,600

3. The rankings of products in terms of relative profitability are:

Simple Costing System		ABC System	
1. Baked goods	19.52%	Frozen products	21.91%
2. Frozen products	13.33%	Baked goods	12.15%
3. Milk and fruit juice	1.31%	Milk & fruit juice	5.98%

The percentage revenue, COGS, and activity costs for each product line are:

	Baked Goods	Milk and Fruit Juice	Frozen Products	Total
Revenues	33.96%	36.93%	29.11%	100
COGS	30.71%	40.94%	28.35%	100
Activity areas:				
Ordering	40.38%	34.62%	25.00%	100
Delivery	60.27%	21.92%	17.81%	100
Shelf-stocking	46.37%	44.11%	9.52%	100
Customer support	33.70%	45.30%	20.99%	100

The baked goods line drops sizably in profitability when ABC is used. Although it constitutes 30.71% of COGS, it uses a higher percentage of total resources in each activity area, especially the high-cost delivery activity area. In contrast, frozen products draw a much lower percentage of total resources used in each activity area than its percentage of total COGS. Hence, under ABC, frozen products are much more profitable.

Henderson Supermarkets may want to explore ways to increase sales of frozen products. It may also want to explore price increases on baked goods.

5-28 ABC, wholesale, customer profitability. Ramirez Wholesalers operates at capacity and sells furniture items to four department-store chains (customers). Mr. Ramirez commented, "We apply ABC to determine product-line profitability. The same ideas apply to customer profitability, and we should find out our customer profitability as well." Ramirez Wholesalers sends catalogs to corporate purchasing departments on a monthly basis. The customers are entitled to return unsold merchandise within a six-month period from the purchase date and receive a full purchase price refund. The following data were collected from last year's operations:

	Chain			
	1	**2**	**3**	**4**
Gross sales	$50,000	$30,000	$100,000	$70,000
Sales returns:				
Number of items	100	26	60	40
Amount	$10,000	$5,000	$7,000	$6,000
Number of orders:				
Regular	40	150	50	70
Rush	10	50	10	30

Ramirez has calculated the following activity rates:

Activity	**Cost-Driver Rate**
Regular order processing	$20 per regular order
Rush order processing	$100 per rush order
Returned items processing	$10 per item
Catalogs and customer support	$1,000 per customer

Required:

1. Customers pay the transportation costs. The cost of goods sold averages 80% of sales.
2. Determine the contribution to profit from each chain last year. Comment on your solution.

SOLUTION

(15–20 min.) **ABC, wholesale, customer profitability.**

1.

	Chain			
	1	2	3	4
Gross sales	$50,000	$30,000	$100,000	$70,000
Sales returns	10,000	5,000	7,000	6,000
Net sales	40,000	25,000	93,000	64,000
Cost of goods sold (80%)	32,000	20,000	74,400	51,200
Gross margin	8,000	5,000	18,600	12,800

Customer-related costs:				
Regular orders				
$20 × 40; 150; 50; 70	800	3,000	1,000	1,400
Rush orders				
$100 × 10; 50; 10; 30	1,000	5,000	1,000	3,000
Returned items				
$10 × 100; 26; 60; 40	1,000	260	600	400
Catalogs and customer support	1,000	1,000	1,000	1,000
Customer related costs	3,800	9,260	3,600	5,800
Contribution (loss) margin	$4,200	$(4,260)	$15,000	$7,000
Contribution (loss) margin as percentage of gross sales	8.4%	(14.2%)	15.0%	10.0%

Chain

	1	**2**	**3**	**4**
Gross sales	$50,000	$30,000	$100,000	$70,000
Sales returns	10,000	5,000	7,000	6,000
Net sales	40,000	25,000	93,000	64,000
Cost of goods sold (80%)	32,000	20,000	74,400	51,200
Gross margin	8,000	5,000	18,600	12,800
Customer-related costs:				
Regular orders				
$20 × 40; 150; 50; 70	800	3,000	1,000	1,400
Rush orders				
$100 × 10; 50; 10; 30	1,000	5,000	1,000	3,000
Returned items				
$10 × 100; 26; 60; 40	1,000	260	600	400
Catalogs and customer support	1,000	1,000	1,000	1,000
Customer related costs	3,800	9,260	3,600	5,800
Contribution (loss) margin	$ 4,200	$(4,260)	$ 15,000	$ 7,000
Contribution (loss) margin as percentage of gross sales	8.4%	(14.2%)	15.0%	10.0%

The analysis indicates that customers' profitability (loss) contribution varies widely from (14.2%) to 15.0%. Immediate attention to Chain 2 is required which is currently showing a loss contribution. The chain has a disproportionate number of both regular orders and rush orders. Ramirez should work with the management of Chain 2 to find ways to reduce the number of orders while maintaining or increasing the sales volume. If this is not possible, Ramirez should consider dropping Chain 2 if it can save the customer-related costs.

Chain 1 has a disproportionate number of the items returned as well as sale returns. The causes of these should be investigated so that the profitability contribution of Chain 1 could be improved.

5-29 Activity-based costing. The job costing system at Sheri's Custom Framing has five indirect-cost pools (purchasing, material handling, machine maintenance, product inspection, and packaging). The company is in the process of bidding on two jobs: Job 215, an order of 15 intricate personalized frames, and Job 325, an order of 6 standard personalized frames. The controller wants you to compare overhead allocated under the current simple job-costing system and a newly designed activity-based job-costing system. Total budgeted costs in each indirect-cost pool and the budgeted quantity of activity driver are as follows:

	Budgeted Overhead	Activity Driver	Budgeted Quantity of Activity Driver
Purchasing	$35,000	Purchase orders processed	2,000
Material handling	43,750	Material moves	5,000
Machine maintenance	118,650	Machine-hours	10,500
Product inspection	9,450	Inspections	1,200
Packaging	19,950	Units produced	3,800
	$226,800		

Information related to Job 215 and Job 325 follows. Job 215 incurs more batch-level costs because it uses more types of materials that need to be purchased, moved, and inspected relative to Job 325.

	Job 215	Job 325
Number of purchase orders	25	8
Number of material moves	10	4
Machine-hours	40	60
Number of inspections	9	3
Units produced	15	6

Required:

1. Compute the total overhead allocated to each job under a simple costing system, where overhead is allocated based on machine-hours.
2. Compute the total overhead allocated to each job under an activity-based costing system using the appropriate activity drivers.
3. Explain why Sheri's Custom Framing might favor the ABC job-costing system over the simple job-costing system, especially in its bidding process.

SOLUTION

(50 min.) **Activity-based costing.**

1. Overhead allocation using a simple job-costing system, where overhead is allocated based on machine hours:

   Overhead allocation rate = $226,800 ÷ 10,500 machine-hours = $21.60 per machine-hour

	Job 215	Job 325
Overhead allocated[a]	$ 864	$1,296

[a] $21.60 per machine-hour × 40 hours; 60 hours

2. Overhead allocation using an activity-based job-costing system:

	Budgeted Overhead (1)	Activity Driver (2)	Budgeted Activity Driver (3)	Activity Rate (4) = (1) ÷ (3)
Purchasing	$ 35,000	Purchase orders processed	2,000	$17.50
Material handling	$ 43,750	Material moves	5,000	$ 8.75
Machine maintenance	$ 118,650	Machine hours	10,500	$11.30
Product inspection	$ 9,450	Inspections	1,200	$7.875
Packaging	$ 19,950	Units produced	3,800	$ 5.25
	$ 226,800			

	Job 215	Job 325
Overhead allocated		
Purchasing ($17.50 × 25; 8 orders)	$ 437.50	$140.00
Material handling ($8.75 × 10; 4 moves)	87.50	35.00
Machine maintenance ($11.30 × 40; 60 hours)	452.00	678.00
Product inspection ($7.875 × 9; 3 inspections)	70.88	23.63
Packaging ($5.25 × 15; 6 units)	78.75	31.50
Total	$1,126.63	$908.13

3. The manufacturing manager likely would find the ABC job-costing system more useful in cost management. Unlike direct manufacturing labor costs, the five indirect cost pools are systematically linked to the activity areas at the plant. The result is more accurate product costing. The manufacturing manager can seek to reduce both the level of activity (fewer purchase orders, less material handling) and the cost of each activity (such as the cost per inspection).

Marketing managers can use ABC information to bid for jobs more competitively because ABC provides managers with a more accurate reflection of the resources used for and the costs of each job.

5-30 ABC, product costing at banks, cross-subsidization. Legion Bank (LB) is examining the profitability of its Star Account, a combined savings and checking account. Depositors receive a 6% annual interest rate on their average deposit. LB earns an interest rate spread of 3% (the difference between the rate at which it lends money and the rate it pays depositors) by lending money for home-loan purposes at 9%. Thus, LB would gain $150 on the interest spread if a depositor had an average Star Account balance of $5,000 in 2017 ($5,000 × 3% = $150).

The Star Account allows depositors unlimited use of services such as deposits, withdrawals, checking accounts, and foreign currency drafts. Depositors with Star Account balances of $1,000 or more receive unlimited free use of services. Depositors with minimum balances of less than $1,000 pay a $25-a-month service fee for their Star Account.

EA

LB recently conducted an activity-based costing study of its services. It assessed the following costs for six individual services. The use of these services in 2017 by three customers is as follows:

	Activity-Based Cost per "Transaction"	Lindell	Welker	Colston
Deposit/withdrawal with teller	$2.75	46	53	5
Deposit/withdrawal with automatic teller machine (ATM)	0.75	14	25	12
Deposit/withdrawal on prearranged monthly basis	0.6	0	16	55
Bank checks written	8.5	10	3	4
Foreign currency drafts	12.25	7	2	7
Inquiries about account balance	1.8	8	14	5
Average Star Account balance for 2017		$1,500	$800	$26,600

Assume Lindell and Colston always maintain a balance above $1,000, whereas Welker always has a balance below $1,000.

Required:

1. Compute the 2017 profitability of the Lindell, Welker, and Colston Star Accounts at LB.

2. Why might LB worry about the profitability of individual customers if the Star Account product offering is profitable as a whole?

3. What changes would you recommend for LB's Star Account?

SOLUTION

(30 min.) **ABC, product-costing at banks, cross-subsidization.**

1.

	Lindell	Welker	Colston	Total
Revenues				
Spread revenue on annual basis				
(3% ×; $1,500, $800, $26,600)	$45.00	$24.00	$798.00	$867.00
Monthly fee charges				
($25 ×; 0, 12, 0)	0	300	0	300
Total revenues	45.00	324.00	798.00	1,167
Costs				
Deposit/withdrawal with teller				
$2.75 ×; 46; 53; 5	126.50	145.75	13.75	286.00
Deposit/withdrawal with ATM				
$0.75 × 14; 25; 12	10.50	18.75	9.00	38.25
Deposit/withdrawal on prearranged basis				
$0.60 × 0; 16; 55	0	9.60	33.00	42.60
Bank checks written				

$8.50 × 10; 3; 4	85.00	25.50	34.00	144.50
Foreign currency drafts				
$12.25 × 7; 2; 7	85.75	24.50	85.75	196.00
Inquiries				
$1.80 × 8; 14; 5	14.40	25.20	9.00	48.60
Total costs	$322.15	$249.30	$184.50	$755.95
Operating income (loss)	($277.15)	$74.70	$613.50	$411.05

The assumption that the Lindell and Colston accounts exceed $1,000 every month and the Welker account is less than $1,000 each month means the monthly charges apply only to Welker.

One student with a banking background noted that in this solution 100% of the spread is attributed to the "depositor side of the bank." He noted that often the spread is divided between the "depositor side" and the "lending side" of the bank.

2. Cross-subsidization across individual Star Accounts occurs when profits made on some accounts are offset by losses on other accounts. The aggregate profitability on the three customers is $425.55. The Colston account is highly profitable, $614.75, while the Lindell account is sizably unprofitable. The Welker account shows a small profit but only because of the $300 monthly fees. It is unlikely that Welker will keep paying these high fees and that LB would want Welker to pay such high fees from a customer relationship standpoint.

The facts also suggest that the customers do not use the bank services uniformly. For example, Lindell and Welker have a lot of transactions with the teller and also inquire about their account balances more often than Colston. This suggests cross-subsidization. LB should be very concerned about the cross-subsidization. Competition likely would "understand" that high-balance low-activity type accounts (such as Colston) are highly profitable. Offering free services to these customers is not likely to retain these accounts if other banks offer higher interest rates. Competition likely will reduce the interest rate spread LB can earn on the high-balance low-activity accounts they are able to retain.

3. Possible changes LB could make are:
   a. Offer higher interest rates on high-balance accounts to increase LB's competitiveness in attracting and retaining these accounts.
   b. Introduce charges for individual services. The ABC study reports the cost of each service. LB has to decide if it wants to price each service at cost, below cost, or above cost. If it prices above cost, it may use advertising and other means to encourage additional use of those services by customers. Of course, in determining its pricing strategy, LB would need to consider how other competing banks are pricing their products and services.

5-31 Job costing with single direct-cost category, single indirect-cost pool, law firm. Bradley Associates is a recently formed law partnership. Emmit Harrington, the managing partner of Bradley Associates, has just finished a tense phone call with Martin Omar, president of Campa Coal. Omar strongly complained about the price Bradley charged for some legal work done for Campa Coal.

Harrington also received a phone call from its only other client (St. Edith's Glass), which was very pleased with both the quality of the work and the price charged on its most recent job.

Bradley Associates operates at capacity and uses a cost-based approach to pricing (billing) each job. Currently it uses a simple costing system with a single direct-cost category (professional labor-hours) and a single indirect-cost pool (general support). Indirect costs are allocated to cases on the basis of professional labor-hours per case. The job files show the following:

	Campa Coal	St. Edith's Glass
Professional labor	150 hours	100 hours

Professional labor costs at Bradley Associates are $80 an hour. Indirect costs are allocated to cases at $100 an hour. Total indirect costs in the most recent period were $25,000.

Required:

1. Why is it important for Bradley Associates to understand the costs associated with individual jobs?
2. Compute the costs of the Campa Coal and St. Edith's Glass jobs using Bradley's simple costing system.

SOLUTION

(15 min.) **Job costing with single direct-cost category, single indirect-cost pool, law firm.**

1. Pricing decisions at Bradley Associates are heavily influenced by reported cost numbers. Suppose Bradley is bidding against another firm for a client with a job similar to that of Campa Coal. If the costing system overstates the costs of these jobs, Bradley may bid too high and fail to land the client. If the costing system understates the costs of these jobs, Bradley may bid low, land the client, and then lose money in handling the case.

2.

	Campa Coal	St. Edith's Glass	Total
Direct professional labor $80 × 150; $80 × 100	$12,000	$8,000	$20,000
Indirect costs allocated $100 × 150; $100 × 100	15,000	10,000	25,000
	$27,000	$18,000	$45,000

5-32 Job costing with multiple direct-cost categories, single indirect-cost pool, law firm (continuation of 5-31). Harrington asks his assistant to collect details on those costs included in the $25,000 indirect-cost pool that can be traced to each individual job. After analysis, Bradley is able to reclassify $15,000 of the $25,000 as direct costs:

Other Direct Costs	Campa Coal	St. Edith's Glass
Research support labor	$1,800	$3,850
Computer time	400	1,600
Travel and allowances	700	4,200
Telephones/faxes	250	1,200

Photocopying	300	700
Total	$3,450	$11,550

Harrington decides to calculate the costs of each job as if Bradley had used six direct-cost pools and a single indirect-cost pool. The single indirect-cost pool would have $10,000 of costs and would be allocated to each case using the professional labor-hours base.

Required:

1. Calculate the revised indirect-cost allocation rate per professional labor-hour for Bradley Associates when total indirect costs are $10,000.
2. Compute the costs of the Campa and St. Edith's jobs if Bradley Associates had used its refined costing system with multiple direct-cost categories and one indirect-cost pool.
3. Compare the costs of Campa and St. Edith's jobs in requirement 2 with those in requirement 2 of Problem 5-30. Comment on the results.

SOLUTION

(20–25 min.) **Job costing with multiple direct-cost categories, single indirect-cost pool, law firm (continuation of 5-31).**

1.

Indirect costs = $10,000

Total professional labor-hours = 250 hours (150 hours on Campa Coal + 100 hours on St. Edith's Glass)

Indirect cost allocated per professional labor-hour (revised) = $10,000 ÷ 250 = $40 per hour

2.

	Campa Coal	St. Edith's Glass	Total
Direct costs:			
Direct professional labor $80×150; $80×100	$12,000	$8,000	$20,000
Research support labor	1,800	3,850	5,650
Computer time	400	1,600	2,000
Travel and allowances	700	4,200	4,900
Telephones/faxes	250	1,200	1,450
Photocopying	300	700	1,000
Total direct costs	15,450	19,550	35,000
Indirect costs allocated $40×150; $40×100	6,000	4,000	10,000
Total costs to be billed	$21,450	$23,550	$45,000

3.

	Campa Coal	St. Edith's Glass	Total
Problem 5-31	$27,000	$18,000	$45,000

EA

Problem 5-32	21,450	23,50	45,000

The Problem 5-32 approach directly traces $15,000 of general support costs to the individual jobs. In Problem 5-31, these costs are allocated on the basis of direct professional labor-hours. The averaging assumption implicit in the Problem 5-31 approach appears incorrect—for example, the St. Edith's Glass job has travel costs six times higher than the Campa Coal case despite having lower direct professional labor-hours.

5-33 Job costing with multiple direct-cost categories, multiple indirect-cost pools, law firm (continuation of 5-31 and 5-32). Bradley has two classifications of professional staff: partners and associates. Harrington asks his assistant to examine the relative use of partners and associates on the recent Campa Coal and St. Edith's jobs. The Campa job used 50 partner-hours and 100 associate-hours. The St. Edith's job used 75 partner-hours and 25 associate-hours. Therefore, totals of the two jobs together were 125 partner-hours and 125 associate-hours. Harrington decides to examine how using separate direct-cost rates for partners and associates and using separate indirect-cost pools for partners and associates would have affected the costs of the Campa and St. Edith's jobs. Indirect costs in each indirect-cost pool would be allocated on the basis of total hours of that category of professional labor. From the total indirect-cost pool of $10,000, $6,000 is attributable to the activities of partners and $4,000 is attributable to the activities of associates. The rates per category of professional labor are as follows:

Category of Professional Labor	Direct Cost per Hour	Indirect Cost per Hour
Partner	$100	$6,000 ÷ 125 hours = $48
Associate	$60	$4,000 ÷ 125 hours = $32

Required:

1. Compute the costs of the Campa and St. Edith's cases using Bradley's further refined system, with multiple direct-cost categories and multiple indirect-cost pools.
2. For what decisions might Bradley Associates find it more useful to use this job-costing approach rather than the approaches in Problem 5-31 or 5-32?

SOLUTION

(30 min.) **Job costing with multiple direct-cost categories, multiple indirect-cost pools, law firm (continuation of 5-31 and 5-32).**

1.

	Campa Coal	St. Edith's Glass	Total
Direct costs:			
Partner professional labor			
$100 × 50; $100 × 75 $ 5,000	$5,000	$7,500	$12,500
Associate professional labor			
$60 × 100; $60 × 25	6,000	1,500	7,500
Research support labor	1,800	3,850	5,650
Computer time	400	1,600	2,000
Travel and allowances	700	4,200	4,900

Telephones/faxes	250	1,200	1,450
Photocopying	300	700	1,000
Total direct costs	14,450	20,550	35,000
Indirect costs allocated:			
Indirect costs for partners			
$48 × 50; $48 × 75	2,400	3,600	6,000
Indirect costs for associates			
$32 × 100; $32 × 25	3,200	800	4,000
Total indirect costs	5,600	4,400	10,000
Total costs to be billed	$20,050	$24,950	$45,000

Comparison	Campa Coal	St. Edith's Glass	Total
Single direct cost/			
Single indirect cost pool	$27,000	$18,000	$45,000
Multiple direct costs/			
Single indirect cost pool	$21,450	$23,550	$45,000
Multiple direct costs/			
Multiple indirect cost pools	$20,050	$24,950	$45,000

The higher the percentage of costs directly traced to each case, and the greater the number of homogeneous indirect cost pools linked to the cost drivers of indirect costs, the more accurate the product cost of each individual case.

The Campa and St. Edith's cases differ in how they use "resource areas" of Bradley Associates:

	Campa Coal	**St. Edith's Glass**
Partner professional labor	40.0%	60.0%
Associate professional labor	80.0	20.0
Research support labor	31.9	68.1
Computer time	20.0	80.0
Travel and allowances	14.3	85.7
Telephones/faxes	17.2	82.8
Photocopying	30.0	70.0

The Campa Coal case makes relatively low use of the higher-cost partners but relatively higher use of the lower-cost associates than does St. Edith's Glass. As a result, it also uses less of the higher indirect costs required to support partners compared to associates. The Campa Coal case also makes relatively lower use of the support labor, computer time, travel, phones/faxes, and photocopying resource areas than does the St. Edith's Glass case.

2. The specific areas where the multiple direct/multiple indirect (MD/MI) approach can provide better information for decisions at Bradley Associates include the following:

Pricing and product (case) emphasis decisions. In a bidding situation using single direct/single indirect (SD/SI) or multiple direct/single indirect (MD/SI) data, Bradley may win bids for legal cases on which it will subsequently lose money. It may also not win bids on which it would make money with a lower-priced bid.

From a strategic viewpoint, SD/SI or MD/SI exposes Bradley Associates to cherry-picking by competitors. Other law firms may focus exclusively on Campa Coal-type cases and take sizable amounts of "profitable" business from Bradley Associates. MD/MI reduces the likelihood of Bradley Associates losing cases on which it would have made money.

Client relationships. MD/MI provides a better "road map" for clients to understand how costs are accumulated at Bradley Associates. Bradley can use this road map when meeting with clients to plan the work to be done on a case before it commences. Clients can negotiate ways to get a lower-cost case from Bradley, given the information in MD/MI—for example, (a) use a higher proportion of associate labor time and a lower proportion of a partner time, and (b) use fax machines more and air travel less. If clients are informed in advance how costs will be accumulated, there is less likelihood of disputes about bills submitted to them after the work is done.

Cost control. The MD/MI approach better highlights the individual cost areas at Bradley Associates than does the SD/SI or MD/SI approaches:

	MD/MI	SD/SI	MD/SI
Number of direct cost categories	7	1	7
Number of indirect cost categories	2	1	1
Total	9	2	8

MD/MI is likely to promote better cost-control practices than SD/SI or MD/SI, as the nine cost categories in MD/MI give Bradley a better handle on how to effectively manage different categories of both direct and indirect costs.

5-34 First-stage allocation, time-driven activity-based costing, manufacturing sector. Marshall's Devices uses activity-based costing to allocate overhead costs to customer orders for pricing purposes. Many customer orders are won through competitive bidding. Direct material and direct manufacturing labor costs are traced directly to each order. Marshall's Devices direct manufacturing labor rate is $25 per hour. The company reports the following yearly overhead costs:

Wages and salaries	$ 600,000
Depreciation	72,000
Rent	128,000
Other overhead	280,000
Total overhead costs	$1,080,000

Marshall's Devices has established four activity cost pools:

Activity Cost Pool	Activity Measure	Budgeted Total Activity for the Year
Direct manufacturing labor support	Number of direct manufacturing labor-hours	32,000 direct manufacturing labor-hours
Order processing	Number of customer orders	440 orders
Design support	Number of custom design-hours	2,500 custom design-hours
Other	Facility-sustaining costs allocated to orders based on direct manufacturing labor-hours	32,000 direct manufacturing labor-hours

Some customer orders require more complex designs, while others need simple designs. Marshall estimates that it will do 100 complex designs during a year, which will each take 13 hours for a total of 1,300 design-hours. It estimates it will do 150 simple designs, which will each take 8 hours for a total of 1,200 design-hours.

Paul Napoli, Marshall's Devices' controller, has prepared the following estimates for distribution of the over- head costs across the four activity cost pools:

	Direct Manufacturing Labor Support	Order Processing	Design Support	Other	Total
Wages	35%	30%	25%	10%	100%
Depreciation	20%	15%	15%	50%	100%
Rent	25%	30%	15%	30%	100%
Other	25%	25%	40%	10%	100%

Order 277100 consists of six different metal products. Four products require a complex design and two require a simple design. Order 277100 requires $5,500 of direct materials and 100 direct manufacturing labor-hours.

Required:

1. Allocate the overhead costs to each activity cost pool. Calculate the activity rate for each pool.
2. Determine the cost of Order 277100.
3. How does activity-based costing enhance Marshall's Devices' ability to price its orders? Suppose Marshall's Devices used a traditional costing system to allocate all overhead costs to orders on the basis of direct manufacturing labor-hours. How might this have affected Marshall's Devices' pricing decisions?
4. When designing its activity-based costing system, Marshall uses time-driven activity-based costing (TDABC) system for its design department. What does this approach allow Marshall to do? How would the cost of Order 277100 have been different if Marshall has used the number of customer designs rather than the number of custom design-hours to allocate costs to different customer orders? Which cost driver do you prefer for design support? Why?

SOLUTION

(30 min.) **First stage allocation, time-driven activity-based costing, manufacturing sector.**

1.

	Direct Manuf. Labor Support	Order Processing	Design Support	Other	Total
Wages and salaries	$210,000	$180,000	$150,000	$60,000	$600,000
Depreciation	$14,400	$10,800	$10,800	$36,000	$72,000
Rent	$32,000	$38,400	$19,200	$38,400	$128,000
Other overhead	$70,000	$70,000	$112,000	$28,000	$280,000
Total	$326,400	$299,200	$292,000	$162,400	$1,080,000

	Cost	Allocation Base	Allocation Rate
Direct Manuf. Labor Support	$326,400	32,000 DMLHs	$10.20/DMLH
Order Processing	$299,200	440 orders	$680/order
Design Support	$292,000	2,500 custom designs hours	$116.80/custom design hour
Other	$162,400	32,000 DMLHs	$5.075/DMLH

2.

Direct materials	$5,500.00
Direct manuf. labor (100 hrs. × $25/hr.)	2,500.00
Direct manuf. labor support (100 dir. manuf. lbr-hrs. × $10.20/hr.)	1,020.00
Order processing (1 order × $680/order)	680.00
Design support	
Complex design (4 parts × 13 hours × $116.80/custom design-hour)	6,073.60
Simple design (2 parts × 8 hours × $116.80/custom design-hour)	1,868.80
Other overhead (100 dir. manuf. lbr-hrs. × $5.075/hr.)	507.50
Total overhead costs	$18,149.90

3. Because only some of the orders that Marshall's Devices receives require custom designs (complex design and simple design), it is important that the costs generated by custom designs are not allocated to non-custom orders. Activity-based costing allows Marshall's Devices to only assign resources used by orders to the orders. Similarly, order processing costs of $680/order are assigned to each order, regardless of the size of the order. Activity-based costing leads to more accurate costing of orders. This, in turn, leads to more competitive pricing. If Marshall's Devices allocated all overhead costs to orders on the basis of direct manufacturing labor hours, they would tend to overprice larger, non-custom orders and underprice smaller, custom orders. They would likely lose bids on the overpriced orders and win the underpriced orders, but then lose money on the bids they won because the actual costs would be much greater than the estimated costs. The underpriced bids have small direct manufacturing labor hours relative to the resources needed to support custom designs and order processing costs for small orders.

4. When designing its activity-based costing system, Marshall uses time-driven activity-based costing (TDABC) system for its design department which carry out complex designs and simple designs. Complex designs require more design hours than simple designs. Complex designs require 13 design hours in comparison to 8 design hours required for simple designs. TDABC systems allow Marshall to charge its customers based on the accurate number of custom design hours required depending upon the complexity of a particular order. Hence, the orders which are more complex in nature requiring more design hours are charged more whereas the orders which are not complex in nature requiring less design hours are not charged excessively.

If Marshall would have used the number of customer designs rather than the number of custom design-hours to allocate costs to different customer orders (complex and simple), the cost of Order 277100 would have been different. If the costs of design support department are allocated on the basis of number of custom designs (ignoring complexity of a particular order), allocation rate per custom design will be $1,168 ($292,000 ÷ 250 custom designs).

The cost of Order 277100 shall be determined as below:

Direct materials	$5,500.00
Direct manuf. labor (100 hrs. × $25/hr.)	2,500.00
Direct manuf. labor support (100 dir. manuf. lbr-hrs. × $10.20/hr.)	1,020.00
Order processing (1 order × $680/order)	680.00
Design support (6 custom designs × $1,168/custom design)	7,008.00
Other overhead (100 dir. manuf. lbr-hrs. × $5.075/hr.)	507.50
Total overhead costs	$17,215.50

If the cost of Order 277100 is determined taking number of designs as a cost driver, the cost of this order is $17,125.50. Whereas the cost of Order 277100 becomes $18,149.90 if the number of designs hours are taken as a cost driver. Under this circumstance, number of custom design hours as a cost driver is better than number of designs as a cost driver. Because the later cost driver ignores the complexity of a particular order and allows all the orders whether requiring more or less design hours to be charged as same. If Mashall uses number of designs as cost driver, it will overprice the orders requiring simple design and underprice the orders requiring complex designs.

5-35 First-stage allocation, time-driven activity-based costing, service sector. LawnCare USA provides lawn care and landscaping services to commercial clients. LawnCare USA uses activity-based costing to bid on jobs and to evaluate their profitability. LawnCare USA reports the following budgeted annual costs:

Wages and salaries	$360,000
Depreciation	72,000
Supplies	120,000
Other overhead	288,000
Total overhead costs	$840,000

John Gilroy, controller of LawnCare USA, has established four activity cost pools and the following budgeted activity for each cost pool:

Activity Cost Pool	Activity Measure	Total Activity for the Year
Estimating jobs	Number of job estimates	250 estimates
Lawn care	Number of direct labor-hours	10,000 direct labor-hours
Landscape design	Number of design hours	500 design hours
Other	Facility-sustaining costs that are not allocated to jobs	Not applicable

Gilroy estimates that LawnCare USA's costs are distributed to the activity-cost pools as follows:

EA

	Estimating Jobs	Lawn Care	Landscape Design	Other	Total
Wages and salaries	5%	70%	15%	10%	100%
Depreciation	10%	65%	10%	15%	100%
Supplies	0%	100%	0%	0%	100%
Other overhead	15%	50%	20%	15%	100%

Sunset Office Park, a new development in a nearby community, has contacted LawnCare USA to provide an estimate on landscape design and annual lawn maintenance. The job is estimated to require a single landscape design requiring 40 design hours in total and 250 direct labor-hours annually. LawnCare USA has a policy of pricing estimates at 150% of cost.

Required

1. Allocate LawnCare USA's costs to the activity-cost pools and determine the activity rate for each pool.
2. Estimate total cost for the Sunset Office Park job. How much would LawnCare USA bid to perform the job?
3. LawnCare USA does 30 landscape designs for its customers each year. Estimate the total cost for the Sunset Office park job if LawnCare USA allocated costs of the Landscape Design activity based on the number of landscape designs rather than the number of landscape design-hours. How much would LawnCare USA bid to perform the job? Which cost driver do you prefer for the Landscape Design activity? Why?
4. Sunset Office Park asks LawnCare USA to give an estimate for providing its services for a 2-year -period. What are the advantages and disadvantages for LawnCare USA to provide a 2-year estimate?

SOLUTION

(30 min.) **First stage allocation, time-driven activity-based costing, service sector.**

1.

	Estimating Jobs	Lawn Care	Landscape Design	Other	Total
Wages and salaries	$18,000	$252,000	$ 54,000	$36,000	$360,000
Depreciation	7,200	46,800	7,200	10,800	72,000
Supplies	0	120,000	0	0	120,000
Other overhead	43,200	144,000	57,600	43,200	288,000
Total	$68,400	$562,800	$118,800	$90,000	$840,000

	Cost	Allocation Base	Allocation Rate
Estimating Jobs	$ 68,400	250 estimates	$273.60/estimate
Lawn Care	$562,800	10,000 DLHs	$ 56.28/DLH
Landscape Design	$118,800	500 design hours	$237.60/design hour

Other costs are facility-sustaining costs and not allocated to jobs when estimating total costs of a job. The mark up is set sufficiently high so that the price and revenue earned can cover these costs.

2.

Estimating jobs (1 estimate × $273.60/estimate.)	$ 273.60
Lawn care (250 DLHs × $56.28/DLH)	14,070.00
Landscape design (40 design hours × $237.60/design hour)	9,504.00
Total costs	$23,847.60
Markup	× 150%
Bid price	$35,771.40

4. If LawnCare USA had used the number of landscape designs rather than the number of landscape design-hours to allocate costs to different jobs, it would have calculated the landscape design allocation rate as follows:

Total number of landscape designs = 30

Landscape-design allocation rate = $118,800 ÷ 30 landscape designs = $3,960 per landscape design

Sunset Office Park required a single landscape design so it would be allocated $3,960 of landscape design costs.

Allocating costs on the basis of the number of landscape designs ignores the fact that some complex designs take much longer than simple designs and so will place greater demands on design support resources. The Sunset Office Park design is one of 30 designs budgeted to be done by LawnCare USA (which accounts for 3.33% (1÷30) of landscape design costs). However, based on landscape design-hours, the Sunset Office Park job is much more complex than the average design and accounts for 8% (40 ÷ 500 budgeted design hours). As a result design support costs allocated to the Sunset Office park job ($3,960) is lower if LawnCare USA uses the number of landscape designs as the allocation base compared to the $9,504 allocated when LawnCare USA uses time-driven activity-based costing (TDABC) that uses landscape-design hours and takes into account that complex landscape designs require more hours and hence more landscape design resources. I would recommend that LawnCare USA uses TDABC and landscape-design hours to allocate design support resources to jobs. The main advantage of this approach is that it helps distinguish the costs and demands placed on resources by complex landscape designs relative to simple landscape designs.

5. Because the landscape design and estimating costs are only incurred once for the entire job, bidding on 2 years of service may allow LawnCare USA to be more competitive on a yearly basis. However, submitting an estimate for 2 years would lock LawnCare USA into the same price for both years, regardless of possible increases in their costs.

5-36 Department and activity-cost rates, service sector. Vital Dimension's Radiology Center (VDRC) performs X-rays, ultrasounds, computer tomography (CT) scans, and magnetic resonance imaging (MRI). VDRC has developed a reputation as a top radiology center in the state. VDRC has achieved this status because it constantly reexamines its processes and procedures. VDRC has been using a single, facilitywide overhead allocation rate. The vice

president of finance believes that VDRC can make better process improvements if it uses more disaggregated cost information. She says, "We have state-of-the-art medical imaging technology. Can't we have state-of-the-art accounting technology?"

	X-rays	Ultrasound	CT Scan	MRI	Total
Technician labor	$ 74,000	$122,000	$178,000	$ 118,000	$ 492,000
Depreciation	45,230	264,320	432,550	895,900	1,638,000
Materials	24,500	21,400	26,300	36,800	109,000
Administration					24,000
Maintenance					275,500
Sanitation					276,200
Utilities					162,300
	$143,730	$407,720	$636,850	$1,050,700	$2,977,000
Number of procedures	4,254	4,024	3,344	2,698	
Minutes to clean after each procedure	10	15	20	30	
Minutes for each procedure	15	20	30	35	

VDRC operates at capacity. The proposed allocation bases for overhead are:

Administration	Number of procedures
Maintenance (including parts)	Capital cost of the equipment (use depreciation)
Sanitation	Total cleaning minutes
Utilities	Total procedure minutes

Required:

1. Calculate the budgeted cost per service for X-rays, ultrasounds, CT scans, and MRI using direct technician labor costs as the allocation basis.
2. Calculate the budgeted cost per service of X-rays, ultrasounds, CT scans, and MRI if VDRC allocated overhead costs using activity-based costing.
3. Explain how the disaggregation of information could be helpful to VDRC's intention to continuously improve its services.

SOLUTION

(30-40 min.) **Department and activity-cost rates service sector.**

1. Overhead costs = $24,000 + $275,500 + $276,200 + $162,300 = $738,000

Budgeted overhead rate = $\frac{\$738,000}{\$492,000} = \$1.50$ per direct labor dollar

	X-rays	Ultrasound	CT scan	MRI	Total
Technician labor	$74,000	$122,000	$178,000	$118,000	$492,000
Depreciation	45,230	264,320	432,550	895,900	1,638,000

EA

Materials	24,500	21,400	26,300	36,800	109,000
Allocated overhead*	111,000	183,000	267,000	177,000	738,000
Total budgeted costs	$254,730	$590,720	$903,850	$1,227,700	$2,977,000
Budgeted number of procedures	÷ 4,254	÷ 4,024	÷ 3,344	÷ 2,698	
Budgeted cost per service	$59.88	$146.80	$270.29	$455.04	

*Allocated overhead = Budgeted overhead rate × Technician labor costs = $1.50 × Technician labor costs

2. Budgeted Information

	X-rays	**Ultrasound**	**CT scan**	**MRI**	**Total**
Number of procedures	4,254	4,024	3,344	2,698	14,320
Cleaning minutes per procedure	×10	×15	×20	×30	
Total cleaning minutes	42,540	60,360	66,880	80,940	250,720
Number of procedures	4,254	4,024	3,344	2,698	14,320
Minutes for each procedure	×15	×20	×30	×35	
Total procedure minutes	63,810	80,480	100,320	94,430	339,040

Activity	**Budgeted Cost (1)**	**Cost Driver (2)**	**Units of Cost Driver(3)**	**Activity Rate (4) = (1) ÷ (3)**
Administration	$24,000	Total number of procedures	14,320	$1.67598 per procedure
Maintenance	$275,500	Total dollars of depreciation	$1,638,000	$0.16819 per dollar of depreciation
Sanitation	$276,200	Total cleaning Minutes	250,720	$1.10163 per cleaning minute
Utilities	$162,300	Total procedure minutes	339,040	$0.4787 per procedure minute

	X-rays	**Ultrasound**	**CT Scan**	**MRI**	**Total**
Technician labor	$74,000	$122,000	$178,000	$118,000	$492,000

EA

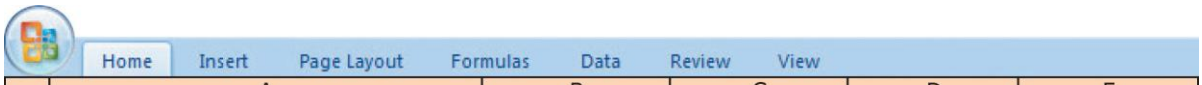
Depreciation	45,230	264,320	432,550	895,900	1,638,000
Materials	24,500	21,400	26,300	36,800	109,000
Allocated activity costs:					
Administration (1.67598× 4,254; 4024; 3,344; 2,698)	7,130	6,744	5,604	4,522	24,000
Maintenance (0.16819× $45,230; $264,320; 432,550; 895,900)	7,607	44,456	72,751	150,681	275,495
Sanitation (1.10163× 42,540; 60,360; 66,880; 80,940)	46,863	66,494	73,677	89,166	276,201
Utilities (0.4787× 63,810; 80,480; 100,320; 94,430)	30,546	38,526	48,023	45,204	162,299
Total budgeted cost	$235,876	$563,940	$836,905	$1,340,273	$2,976,995
Budgeted number of procedures	÷ 4,254	÷ 4,024	÷ 3,344	÷ 2,698	
Budgeted cost per service	$55.45	$140.14	$250.27	$496.77	

3. Using the disaggregated activity-based costing data, managers can see that the MRI actually costs substantially more and x-rays, ultrasounds, and CT scans substantially less than the traditional system indicated. In particular, the MRI activity generates a lot of maintenance activity and sanitation activity. Managers should examine the use of these two activities to search for ways to reduce the activity consumption and ultimately its cost.

5-37 Activity-based costing, merchandising. Pharmahelp, Inc., a distributor of special pharmaceutical products, operates at capacity and has three main market segments:

a. General supermarket chains
b. Drugstore chains
c. Mom-and-pop single-store pharmacies

Rick Flair, the new controller of Pharmahelp, reported the following data for 2017.



	A	B	C	D	E
1					
2	**Pharmahelp, 2017**	**General**			
3		**Supermarket**	**Drugstore**	**Mom-and-Pop**	**Total For**
4		**Chains**	**Chains**	**Single Stores**	**Pharmahelp**
5	Revenues	$3,708,000	$3,150,000	$1,980,000	$8,838,000
6	Cost of goods sold	3,600,000	3,000,000	1,800,000	8,400,000
7	Gross margin	$ 108,000	$ 150,000	$ 180,000	438,000
8	Other operating costs				301,080
9	Operating income				$ 136,920

For many years, Pharmahelp has used gross margin percentage [(Revenue - Cost of goods sold) ÷ Revenue] to evaluate the relative profitability of its market segments. But Flair recently attended a seminar on -activity-based costing and is considering using it at Pharmahelp to analyze and allocate "other operating costs." He meets with all the key managers and several of his operations and sales staff, and they agree that there are five key activities that drive other operating costs at Pharmahelp:

Activity Area	Cost Driver
Order processing	Number of customer purchase orders
Line-item processing	Number of line items ordered by customers
Delivering to stores	Number of store deliveries
Cartons shipped to store	Number of cartons shipped
Stocking of customer store shelves	Hours of shelf-stocking

Each customer order consists of one or more line items. A line item represents a single product (such as Extra-Strength Tylenol Tablets). Each product line item is delivered in one or more separate cartons. Each store delivery entails the delivery of one or more cartons of products to a customer. Pharmahelp's staff stacks cartons directly onto display shelves in customers' stores. Currently, there is no additional charge to the customer for shelf-stocking and not all customers use Pharmahelp for this activity. The level of each activity in the three market segments and the total cost incurred for each activity in 2017 is as follows:

	A	B	C	D	E
13					
14	**Activity-based Cost Data**		**Activity Level**		
15	**Pharmahelp 2017**	**General**			**Total Cost**
16		**Supermarket**	**Drugstore**	**Mom-and-Pop**	**of Activity**
17	**Activity**	**Chains**	**Chains**	**Single Stores**	**in 2017**
18	Orders processed (number)	140	360	1,500	$ 80,000
19	Line-items ordered (number)	1,960	4,320	15,000	63,840
20	Store deliveries made (number)	120	360	1,000	71,000
21	Cartons shipped to stores (number)	36,000	24,000	16,000	76,000
22	Shelf stocking (hours)	360	180	100	10,240
23					$301,080

Required

1. Compute the 2017 gross-margin percentage for each of Pharmahelp's three market segments.
2. Compute the cost driver rates for each of the five activity areas.
3. Use the activity-based costing information to allocate the $301,080 of "other operating costs" to each of the market segments. Compute the operating income for each market segment.
4. Comment on the results. What new insights are available with the activity-based costing information?

SOLUTION

(30–40 min.) **Activity-based costing, merchandising.**

EA

1.

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
Revenues	$3,708,000	$3,150,000	$1,980,000	$8,838,000
Cost of goods sold	3,600,000	3,000,000	1,800,000	8,400,000
Gross margin	$ 108,000	$ 150,000	$ 180,000	$ 438,000
Other operating costs				301,080
Operating income				$ 136,920
Gross margin %	2.91%	4.76%	9.09%	

The gross margin of Pharmahelp, Inc., was 4.96% ($438,000 ÷ $8,838,000). The operating income margin of Pharmahelp, Inc., was 1.55% ($136,920 ÷ $8,838,000).

2. The per-unit cost driver rates are:

1. Customer purchase order processing,
   $80,000 ÷ 2,000 (140 + 360 + 1,500) orders = $40 per order
2. Line item ordering,
   $63,840 ÷ 21,280 (1,960 + 4,320 + 15,000) line items = $ 3 per line item
3. Store delivery,
   $71,000 ÷ 1,480 (120 + 360 + 1,000) deliveries = $47.973 per delivery
4. Cartons shipped,
   $76,000 ÷ 76,000 (36,000 + 24,000 + 16,000) cartons = $ 1 per carton
5. Shelf-stocking,
   $10,240 ÷ 640 (360 + 180 + 100) hours = $16 per hour

3. The activity-based costing of each distribution market for 2017 is:

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
1. Customer purchase order processing				
($40 × 140; 360; 1,500)	$ 5,600	$14,400	$ 60,000	$ 80,000
2. Line item ordering				
($3 × 1,960; 4,320; 15,000)	5,880	12,960	45,000	63 ,840
3. Store delivery				
($47.973 × 120; 360; 1,000)	5,757	17,270	47,973	71,000
4. Cartons shipped				
($1 × 36,000; 24,000; 16,000)	36,000	24,000	16,000	76,000
5. Shelf-stocking				
($16 × 360; 180; 100)	5,760	2,880	1,600	10,240
	$58,997	$71,510	$170,573	$301,080

The revised operating income statement is:

	General Supermarket Chains	Drugstore Chains	Mom-and-Pop Single Stores	Total
Revenues	$3,708,000	$3,150,000	$1,980,000	$8,838,000
Cost of goods sold	3,600,000	3,000,000	1,800,000	8,400,000
Gross margin	108,000	150,000	180,000	438,000
Operating costs	58,997	71,510	170,573	301,080
Operating income	$ 49,003	$ 78,490	$ 9,427	$ 136,920
Operating income margin	1.32%	2.49%	0.48%	1.55%

4. The ranking of the three markets are:

Using Gross Margin		Using Operating Income	
1. Mom-and-Pop Single Stores	9.09%	1. Drugstore Chains	2.49%
2. Drugstore Chains	4.76%	2. General Supermarket Chains	1.32%
3. General Supermarket Chains	2.91%	3. Mom-and-Pop Single Stores	0.48%

The activity-based analysis of costs highlights how the Mom-and-Pop Single Stores use a larger amount of Pharmahelp's resources per revenue dollar than do the other two markets. The ratio of the operating costs to revenues across the three markets is:

General Supermarket Chains	1.59%	($58,997 ÷ $3,708,000)
Drugstore Chains	2.27%	($71,510 ÷ $3,150,000)
Mom-and-Pop Single Stores	8.61%	($170,573 ÷ $1,980,000)

This is a classic illustration of the maxim that "all revenue dollars are not created equal." The analysis indicates that the Mom-and-Pop Single Stores are the least profitable market. Pharmahelp should work to increase profits in this market through (1) a possible surcharge, (2) decreasing the number of orders, (3) offering discounts for quantity purchases, etc.

Other issues for Pharmahelp to consider include:

a. *Choosing the appropriate cost drivers for each area.* The problem gives a cost driver for each chosen activity area. However, it is likely that over time further refinements in cost drivers would be necessary. For example, not all store deliveries are equally easy to make, depending on parking availability, accessibility of the storage/shelf space to the delivery point, etc. Similarly, not all cartons are equally easy to deliver—their weight, size, or likely breakage component are factors that can vary across carton types.

b. *Developing a reliable data base on the chosen cost drivers.* For some items, such as the number of orders and the number of line items, this information likely would be available in machine readable form at a high level of accuracy. Unless the delivery personnel have handheld computers that they use in a systematic way, estimates of shelf-stocking time are likely to be unreliable. Advances in information technology likely will reduce problems in this area over time.

c. *Deciding how to handle costs that may be common across several activities.* For

example, (3) store delivery and (4) cartons shipped to stores have the common cost of the same trip. Some organizations may treat (3) as the primary activity and attribute only incremental costs to (4). Similarly, (1) order processing and (2) line item ordering may have common costs.

d. *Behavioral factors are likely to be a challenge for Flair.* He must now tell those salespeople who specialize in Mom-and-Pop accounts that they have been less profitable than previously thought.

5-38 Choosing cost drivers, activity-based costing, activity-based management. Shades & Hues (S&H) is a designer of high-quality curtains and bedsheets. Each design is made in small batches. Each spring, S&H comes out with new designs for the curtains and for the bedsheets. The company uses these designs for a year and then moves on to the next trend. The products are all made on the same fabrication equipment that is expected to operate at capacity. The equipment must be switched over to a new design and set up to prepare for the production of each new batch of products. When completed, each batch of products is immediately shipped to a wholesaler. Shipping costs vary with the number of shipments. Budgeted information for the year is as follows:

Shades & Hues
Budget for Costs and Activities
For the Year Ended February 28, 2017

Direct materials—bedsheets	$3,82,260
Direct materials—curtains	5,10,425
Direct manufacturing labor—bedsheets	1,12,500
Direct manufacturing labor—curtains	1,26,000
Setup	78,250
Shipping	84,500
Design	1,93,200
Plant utilities and administration	2,55,775
Total	$17,42,910

Other budget information follows:

	Curtains	Bedsheets	Total
Number of products	6,240	3,075	9,315
Hours of production	1,755	2,655	4,410
Number of batches	150	100	250
Number of designs	4	6	10

[Required]

1. Identify the cost hierarchy level for each cost category.
2. Identify the most appropriate cost driver for each cost category. Explain briefly your choice of cost driver.
3. Calculate the budgeted cost per unit of cost driver for each cost category.

4. Calculate the budgeted total costs and cost per unit for each product line.
5. Explain how you could use the information in requirement 4 to reduce costs.

SOLUTION

(30-40 min.) **Choosing cost drivers, activity-based costing, activity-based management**.

1.

Direct materials—bedsheets	Output unit-level costs
Direct materials—curtains	Output unit-level costs
Direct manufacturing labor—bedsheets	Output unit-level costs
Direct manufacturing labor—curtains	Output unit-level costs
Setup	Batch-level costs
Shipping	Batch-level costs
Design	Product-sustaining costs
Plant utilities and administration	Facility-sustaining costs

2.

Direct materials—bedsheets	Number of bedsheets
Direct materials—curtains	Number of curtains
Direct manufacturing labor—bedsheets	Number of bedsheets
Direct manufacturing labor—curtains	Number of curtains
Setup	Number of batches
Shipping	Number of batches
Design	Number of designs
Plant utilities and administration	Hours of production

Direct material and direct manufacturing labor are costs that can be easily traced to output, which in this case is the number of bedsheets or curtains produced.
Setup and shipping are both a function of the number of batches produced.
Design is related to the number of designs created for each product.
Plant utilities and administration result from general activity level in the plant. Thus, hours of production seems to be an appropriate cost driver.

3.

Direct materials—bedsheets	$3,82,260	÷	3,075	bedsheets	$124.31	per bedhseet
Direct materials—curtains	$5,10,425	÷	6,240	curtains	$81.80	per curtain
Direct manufacturing labor—bedsheets	$1,12,500	÷	3,075	bedsheets	$36.59	per bedhseet
Direct manufacturing labor—curtains	$1,26,000	÷	6,240	curtains	$20.19	per curtain
Setup	$78,250	÷	250	batches	$313.00	per batch
Shipping	$84,500	÷	250	batches	$338.00	per batch
Design	$1,93,200	÷	10	designs	$19,320.00	per design
Plant utilities and administration	$2,55,775	÷	4,410	hours	$58.00	per hour

EA

4.

	Curtains	Bedsheets	Total
Direct materials	$5,10,425	$3,82,260	$8,92,685
Direct manufacturing labor	1,26,000	1,12,500	2,38,500
Setup ($313 × 150; 100 batches)	46,950	31,300	78,250
Shipping ($3,38 × 150; 100 batches)	50,700	33,800	84,500
Design ($19,320 × 4; 6 designs)	77,280	1,15,920	1,93,200
Plant utilities and administration ($58 × 1,755; 2,655 hours)	1,01,790	1,53,990	2,55,780
Budgeted total costs	$9,13,145	$8,29,770	$17,42,915
Divided by number of curtains/bedsheets	÷ 6240	÷ 3075	
Budgeted cost per curtain/bedsheet	$146.34	$269.84	

5. Based on this analysis, more than 50% of product cost relates to direct material. Managers should determine whether the material costs can be reduced. Producing in small lots increases the setup and shipping costs. While both are relatively small components of product cost, management may want to evaluate ways to reduce the number of setups and the cost per setup. Of the indirect costs, the product- and facility-sustaining costs are the highest. Management should review the design process for cost savings and examine why it takes so long to produce bedsheets relative to curtains.

5-39 ABC, health care. Crosstown Health Center runs two programs: drug addict rehabilitation and aftercare (counseling and support of patients after release from a mental hospital). The center's budget for 2017 follows.

EA

Professional salaries:		
4 physicians × $150,000	$600,000	
12 psychologists × $75,000	900,000	
16 nurses × $30,000	480,000	$1,980,000
Medical supplies		242,000
Rent and clinic maintenance		138,600
Administrative costs to manage patient charts, food, laundry		484,000
Laboratory services		92,400
Total		$2,937,000

Kim Yu, the director of the center, is keen on determining the cost of each program. Yu compiles the following data describing employee allocations to individual programs:

	Drug	Aftercare	Total Employees
Physicians	4		4
Psychologists	4	8	12
Nurses	6	10	16

Yu has recently become aware of activity-based costing as a method to refine costing systems. She asks her accountant, Gus Gates, how she should apply this technique. Gates obtains the following budgeted information for 2017:

	Drug	Aftercare	Total
Square feet of space occupied by each program	9,000	12,000	21,000
Patient-years of service	50	60	110
Number of laboratory tests	1,400	700	2,100

Required

1. a. Selecting cost-allocation bases that you believe are the most appropriate for allocating indirect costs to programs, calculate the budgeted indirect cost rates for medical supplies; rent and clinic maintenance; administrative costs for patient charts, food, and laundry; and laboratory services.

b. Using an activity-based costing approach to cost analysis, calculate the budgeted cost of each program and the budgeted cost per patient-year of the drug program.

c. What benefits can Crosstown Health Center obtain by implementing the ABC system?

2. What factors, other than cost, do you think Crosstown Health Center should consider in allocating resources to its programs?

SOLUTION

(40 min.) **ABC, health care.**

$$\text{1a. Medical supplies rate} = \frac{\text{Medical supplies costs}}{\text{Total number of patient-years}} = \frac{\$242,000}{110}$$
$$= \$2,200 \text{ per patient-year}$$

$$\text{Rent and clinic, maintenance rate} = \frac{\text{Rent and clinic maint. costs}}{\text{Total amount of square feet of space}} = \frac{\$138,600}{21,000}$$

$$= \$6.60 \text{ per square foot}$$

$$\text{Admin. cost rate for, patient-charts, food, and laundry} = \frac{\text{Admin. costs to manage patient charts, food, laundry}}{\text{Total number of patient-years}} = \frac{\$484,000}{110}$$

$$= \$4,400 \text{ per patient-year}$$

$$\text{Laboratory services rate} = \frac{\text{Laboratory services costs}}{\text{Total number of laboratory tests}} = \frac{\$92,400}{2,100}$$

$$= \$44 \text{ per test}$$

These cost drivers are chosen as the ones that best match the descriptions of why the costs arise. Other answers are acceptable, provided that clear explanations are given.

1b. Activity-based costs for each program and cost per patient-year of the alcohol and drug program follow:

	Drug	After-Care	Total
Direct labor			
Physicians at $150,000 × 4; 0	$ 600,000	——	$ 600,000
Psychologists at $75,000 × 4; 8	300,000	$ 600,000	900,000
Nurses at $30,000 × 6; 10	180,000	300,000	480,000
Direct labor costs	1,080,000	900,000	1,980,000
Medical supplies[1] $2,200 × 50; 60	110,000	132,000	242,000
Rent and clinic maintenance[2] $6.60 × 9,000; 12,000	59,400	79,200	138,600
Administrative costs to manage patient charts, food, and laundry[3] $4,400 × 50; 60	220,000	264,000	484,000
Laboratory services[4] $44 × 1,400; 700	61,600	30,800	92,400
Total costs	$1,531,000	$1,406,000	$2,937,000

$$\text{Cost per patient-year} \quad \frac{\$1,531,000}{50} = \$30,620$$

[1]Allocated using patient-years
[2]Allocated using square feet of space
[3]Allocated using patient-years
[4]Allocated using number of laboratory tests

1c. The ABC system more accurately allocates costs because it identifies better cost drivers. The ABC system chooses cost drivers for overhead costs that have a cause-and-effect relationship between the cost drivers and the costs. Of course, Yu should continue to evaluate if better cost drivers can be found than the ones they have identified so far.

By implementing the ABC system, Yu can gain a more detailed understanding of costs

and cost drivers. This is valuable information from a cost management perspective. The system can yield insight into the efficiencies with which various activities are performed. Yu can then examine if redundant activities can be eliminated. Yu can study trends and work toward improving the efficiency of the activities.

In addition, the ABC system will help Yu determine which programs are the most costly to operate. This will be useful in making long-run decisions as to which programs to offer or emphasize. The ABC system will also assist Yu in setting prices for the programs that more accurately reflect the costs of each program.

2. The concern with using costs per patient-year as the rule to allocate resources among its programs is that it emphasizes "input" to the exclusion of "outputs" or effectiveness of the programs. After-all, Yu's goal is to cure patients while controlling costs, not minimize costs per-patient year. The problem, of course, is measuring outputs.

Unlike many manufacturing companies, where the outputs are obvious because they are tangible and measurable, the outputs of service organizations are more difficult to measure. Examples are "cured" patients as distinguished from "processed" or "discharged" patients, "educated" as distinguished from "partially educated" students, and so on.

5-40 Unused capacity, activity-based costing, activity-based management. Zarson's Netballs is a manufacturer of high-quality basketballs and volleyballs. Setup costs are driven by the number of setups. Equipment and maintenance costs increase with the number of machine-hours, and lease rent is paid per square foot. Capacity of the facility is 14,000 square feet, and Zarson is using only 80% of this capacity. Zarson records the cost of unused capacity as a separate line item and not as a product cost. The following is the budgeted information for Zarson:

Zarson's Netballs
Budgeted Costs and Activities
For the Year Ended December 31, 2017

Direct materials—basketballs	$ 168,100
Direct materials—volleyballs	303,280
Direct manufacturing labor—basketballs	111,800
Direct manufacturing labor—volleyballs	100,820
Setup	157,500
Equipment and maintenance costs	115,200
Lease rent	210,000
Total	$1,166,700

Other budget information follows:

	Basketballs	Volleyballs
Number of balls	58,000	85,000
Machine-hours	13,500	10,500
Number of setups	450	300
Square footage of production space used	3,200	8,000

Required

1. Calculate the budgeted cost per unit of cost driver for each indirect cost pool.
2. What is the budgeted cost of unused capacity?
3. What is the budgeted total cost and the cost per unit of resources used to produce (a) basketballs and (b) volleyballs?

4. Why might excess capacity be beneficial for Zarson? What are some of the issues Zarson should consider before increasing production to use the space?

SOLUTION

(25 min.) **Unused capacity, activity-based costing, activity-based management**.

1.

	Basketballs	Volleyballs	Total
Number of batches	450	300	750
Machine-hours	13,500	10,500	24,000

Setup cost per batch = $157,500 ÷ 750 batches = $210 per batch.

Equipment and maintenance = $115,200 ÷ 24,000 machine-hours = $4.80 per machine-hour.
Lease rent, insurance, utilities = $210,000 ÷ 14,000 sq. ft. of capacity = $15 per sq. ft.

2. $$\text{Unused capacity} = \text{Total capacity} - \text{Capacity used for basketball production} - \text{Capacity used for volleyball production}$$
$$= 14,000 - 3,200 - 8,000 = 2,800 \text{ sq. ft.}$$

Cost of unused capacity = $15 per sq. ft × 2,800 sq. ft. = $42,000

3.

	Basketballs	Volleyballs	Total
Direct materials	$168,100	$303,280	$ 471,380
Direct manufacturing labor	111,800	100,820	212,620
Setup ($210 × 450; 300)	94,500	63,000	157,500
Equipment and maintenance ($4.80 × 13,500; 10,500)	64,800	50,400	115,200
Lease rent, etc. ($15 × 3,200; 8,000)	48,000	120,000	168,000
Budgeted total costs	$487,200	$637,500	$1,124,700
Divided by number of units	÷ 58,000	÷ 85,000	
Budgeted cost per unit	$ 8.40	$ 7.50	

4. Currently, Zarson's only utilizes 80% of its available capacity. The excess capacity is currently costing Zarson's $42,000 annually, so Zarson's would need to consider using the excess capacity to expand production of either of the existing models, or add a new product line in the future. Zarson's should only do so if there is available skilled labor and machine capacity, as well as demand for the product to justify higher costs and the capital investment needed. Zarson's may also consider renting out the available space to a compatible outside user, with the option to take the space back if needed.

On the other hand having excess capacity might also be beneficial to Zarson's. It allows the company to accept special orders if they are received and to reduce the confusion and complexity that occurs when a plant is operating at full capacity.

5-41 Unused capacity, activity-based costing, activity-based management. Whitewater Adventures manufactures two models of kayaks, Basic and Deluxe, using a combination of machining and hand finishing. Machine setup costs are driven by the number of setups. Indirect manufacturing labor costs increase with direct manufacturing labor costs. Equipment and maintenance costs increase with the number of machine-hours, and facility rent is paid per square foot. Capacity of the facility is 6,250 square feet, and Whitewater is using only 80% of this capacity. Whitewater records the cost of unused capacity as a separate line item and not as a product cost. For the current year, Whitewater has budgeted the following:

Whitewater Adventures
Budgeted Costs and Activities
For the Year Ended December 31, 2017

Direct materials—Basic kayaks	$ 325,000
Direct materials—Deluxe kayaks	240,000
Direct manufacturing labor—Basic kayaks	110,000
Direct manufacturing labor—Deluxe kayaks	130,000
Indirect manufacturing labor costs	72,000
Machine setup costs	40,500
Equipment and maintenance costs	235,000
Facility Rent	200,000
Total	$1,352,500

Other budget information follows:

	Basic	Deluxe
Number of kayaks	5,000	3,000
Machine-hours	11,000	12,500
Number of setups	300	200
Square footage of production space used	2,860	2,140

Required:

1. Calculate the cost per unit of each cost-allocation base.
2. What is the budgeted cost of unused capacity?
3. Calculate the budgeted total cost and the cost per unit for each model.
4. Why might excess capacity be beneficial for Whitewater? What are some of the issues Whitewater should consider before increasing production to use the space?

SOLUTION

(30 min.) **Unused capacity, activity-based costing, activity-based management.**

1.

	Cost	Allocation Base	Allocation Rate
Indirect manufacturing labor costs	$ 72,000	$240,000 direct labor cost	30% of direct labor cost
Machine setup costs	$ 40,500	500 batches	$81/batch
Equipment and	$235,000	23,500 MH	$10/MH

maintenance costs			
Facility rent costs	$200,000	6,250 sq. ft.	$32/sq. ft.

2. Budgeted cost of unused capacity = $32 per sq. ft. (6,250 – 2,860 −2,140) sq. ft.
= $32 × 1,250 sq. ft. = $40,000

3.

	Basic	Deluxe
Direct materials	$325,000	$240,000
Direct manufacturing labor	110,000	130,000
Indirect manuf. labor ($110,000 and $130,000 × 30%)	33,000	39,000
Machine setup (300 and 200 batches × $81/batch)	24,300	16,200
Equipment and maintenance costs (11,000 and 12,500 MH × $10/MH)	110,000	125,000
Facility rent (2,860 and 2,140 sq. ft. × $32/sq. ft.)	91,520	68,480
Total cost	$693,820	$618,680
Divided by number of units	÷ 5,000	÷ 3,000
Cost per unit	$ 138.76	$ 206.23

4. Although the excess capacity is currently costing Whitewater $40,000 annually, having excess capacity allows for the company to accept special orders if they are received, expand production of either of the existing models, or add a new product line in the future. Whitewater should consider if there is available labor and machine hours before increasing production to use the space, as well as demand for the product. Whitewater may also consider renting out the available space to a compatible outside user, with the option to take the space back if needed.

5-42 ABC, implementation, ethics. (CMA, adapted) Plum Electronics, a division of Berry Corporation, manufactures two large-screen television models: the Mammoth, which has been produced since 2013 and sells for $990, and the Maximum, a newer model introduced in early 2015 that sells for $1,254. Based on the following income statement for the year ended November 30, 2017, senior management at Berry have decided to concentrate Plum's marketing resources on the Maximum model and to begin to phase out the Mammoth model because Maximum generates a much bigger operating income per unit.

Plum Electronics
Income Statement for the
Fiscal Year Ended November 30, 2017

	Mammoth	Maximum	Total
Revenues	$21,780,000	$5,016,000	$26,796,000
Cost of goods sold	13,794,000	3,511,200	17,305,200
Gross margin	7,986,000	1,504,800	9,490,800
Selling and administrative expense	6,413,000	1,075,800	7,488,800
Operating income	$ 1,573,000	$ 429,000	$ 2,002,000
Units produced and sold	22,000	4,000	
Operating income per unit sold	$ 71.50	$ 107.25	

Details for cost of goods sold for Mammoth and Maximum are as follows:

	Mammoth		Maximum	
	Total	Per Unit	Total	Per Unit
Direct materials	$ 5,033,600	$ 228.80	$2,569,600	$642.40
Direct manufacturing labor[a]	435,600	19.80	184,800	46.20
Machine costs[b]	3,484,800	158.40	316,800	79.20
Total direct costs	$ 8,954,000	$ 407.00	$3,071,200	$767.80
Manufacturing overhead costs[c]	$ 4,840,000	$ 220.00	$ 440,000	$110.00
Total cost of goods sold	$13,794,000	$ 627.00	$3,511,200	$877.80

[a] Mammoth requires 1.5 hours per unit and Maximum requires 3.5 hours per unit. The direct manufacturing labor cost is $13.20 per hour.
[b] Machine costs include lease costs of the machine, repairs, and maintenance. Mammoth requires 8 machine-hours per unit and Maximum requires 4 machine-hours per unit. The machine-hour rate is $19.80 per hour.
[c] Manufacturing overhead costs are allocated to products based on machine-hours at the rate of $27.50 per hour.

Plum's controller, Steve Jacobs, is advocating the use of activity-based costing and activity-based management and has gathered the following information about the company's manufacturing overhead costs for the year ended November 30, 2017.

		Units of the Cost-Allocation Base		
Activity Center (Cost-Allocation Base)	Total Activity Costs	Mammoth	Maximum	Total
Soldering (number of solder points)	$1,036,200	1,185,000	385,000	1,570,000
Shipments (number of shipments)	946,000	16,200	3,800	20,000
Quality control (number of inspections)	1,364,000	56,200	21,300	77,500
Purchase orders (number of orders)	1,045,440	80,100	109,980	190,080
Machine power (machine-hours)	63,360	176,000	16,000	192,000
Machine setups (number of setups)	825,000	16,000	14,000	30,000
Total manufacturing overhead	$5,280,000			

After completing his analysis, Jacobs shows the results to Charles Clark, the Plum division president. Clark does not like what he sees. "If you show headquarters this analysis, they are going to ask us to phase out the Maximum line, which we have just introduced. This whole costing stuff has been a major problem for us. First Mammoth was not profitable and now Maximum.

"Looking at the ABC analysis, I see two problems. First, we do many more activities than the ones you have listed. If you had included all activities, maybe your conclusions would be different. Second, you used number of setups and number of inspections as allocation bases. The numbers would be different had you used setup-hours and inspection-hours instead. I know that measurement problems precluded you from using these other cost-allocation bases, but I believe you ought to make some adjustments to our current numbers to compensate for these issues. I know you can do better. We can't afford to phase out either product."

Jacobs knows that his numbers are fairly accurate. As a quick check, he calculates the profitability of Maximum and Mammoth using more and different allocation bases. The set of activities and activity rates he had used results in numbers that closely approximate those based on more detailed analyses. He is confident that headquarters, knowing that Maximum was introduced only recently, will not ask Plum to phase it out. He is also aware that a sizable portion of Clark's bonus is based on division revenues. Phasing out either product would adversely affect his bonus. Still, he feels some pressure from Clark to do something.

Required

1. Using activity-based costing, calculate the gross margin per unit of the Maximum and Mammoth models.
2. Explain briefly why these numbers differ from the gross margin per unit of the Maximum and Mammoth models calculated using Plum's existing simple costing system.
3. Comment on Clark's concerns about the accuracy and limitations of ABC.
4. How might Plum find the ABC information helpful in managing its business?
5. What should Steve Jacobs do in response to Clark's comments?

SOLUTION

(50 min.) **ABC, implementation, ethics.**

1. Plum Electronics should not emphasize the Maximum model and should not phase out the Mammoth model. Under activity-based costing, the Maximum model has an operating income percentage of less than 3%, while the Mammoth model has an operating income percentage of nearly 43%.

Cost driver rates for the various activities identified in the activity-based costing (ABC) system are as follows:

Soldering	$ 1,036,200	÷	1,570,000	= $	0.66 per solder point
Shipments	946,000	÷	20,000	=	47.30 per shipment
Quality control	1,364,000	÷	77,500	=	17.60 per inspection
Purchase orders	1,045,440	÷	190,080	=	5.50 per order
Machine power	63,360	÷	192,000	=	0.33 per machine-hour
Machine setups	825,000	÷	30,000	=	27.50 per setup

Plum Electronics
Calculation of Costs of Each Model
under Activity-Based Costing

	Mammoth	Maximum
Direct materials ($228.80 × 22,000; $642.40 × 4,000)	$ 5,033,600	$2,569,600
Direct manuf. labor ($13.20 × 1.5 hrs. × 22,000; $13.20 × 3.5hrs. × 4,000)	435,600	184,800
Machine costs ($19.80 × 8 hrs. × 22,000; $19.80 × 4 hrs. × 4,000)	3,484,800	316,800
Total direct costs	8,954,000	3,071,200
Indirect costs		
Soldering ($0.66 × 1,185,000; $0.66 × 385,000)	782,100	254,100
Shipments ($47.30 × 16,200; $47.30 × 3,800)	766,260	179,740
Quality control ($17.60 × 56,200; $17.60 × 21,300)	989,120	374,880
Purchase orders ($5.50 × 80,100; $5.50 × 109,980)	440,550	604,890
Machine power ($0.33 × 176,000; $0.33 × 16,000)	58,080	5,280
Machine setups ($27.50 × 16,000; $27.50 × 14,000)	440,000	385,000
Total indirect costs	3,476,110	1,803,890
Total costs	$12,430,110	$4,875,090

Profitability analysis

	Mammoth	Maximum	Total
Revenues	$21,780,000	$5,016,000	$26,796,000
Cost of goods sold	12,430,110	4,875,090	17,305,200
Gross margin	$ 9,349,890	$ 140,910	$ 9,490,800
Per-unit calculations:			
Units sold	22,000	4,000	
Selling price ($21,780,000 ÷ 22,000; $5,016,000 ÷ 4,000)	$990.00	$1,254.00	
Cost of goods sold ($12,430,110 ÷ 22,000; $4,875,090 ÷ 4,000)	565.01	1,218.77	
Gross margin	$424.99	$ 35.23	
Gross margin percentage	42.9%	2.8%	

2. Plum's simple costing system allocates all manufacturing overhead other than machine costs on the basis of machine-hours, an output unit-level cost driver. Consequently, the more machine-hours per unit that a product needs, the greater the manufacturing overhead allocated to it. Because Mammoth uses twice the number of machine-hours per unit compared to Maximum, a large amount of manufacturing overhead is allocated to Mammoth.

The ABC analysis recognizes several batch-level cost drivers such as purchase orders, shipments, and setups. Maximum uses these resources much more intensively than Mammoth. The ABC system recognizes Maximum's use of these overhead resources. Consider, for example, purchase order costs. The simple system allocates these costs on the basis of machine-hours. As a result, each unit of Mammoth is allocated twice the purchase order costs of each unit of Maximum. The ABC system allocates $440,550 of purchase order costs to Mammoth (equal to $20.02 [$440,550 ÷ 22,000] per unit) and $604,890 of purchase order costs to Maximum (equal to $151.23 [$604,890 ÷ 4,000] per unit). Each unit of Maximum uses 8.31 ($151.23 ÷ $20.02) times the purchases order costs of each unit of Mammoth.

Recognizing Maximum's more intensive use of manufacturing overhead results in Maximum showing a much lower profitability under the ABC system. By the same token, the ABC analysis shows that Mammoth is quite profitable. The simple costing system overcosted Mammoth and so made it appear less profitable.

3. Clark's comments about ABC implementation are valid. When designing and implementing ABC systems, managers and management accountants need to trade off the costs of the system against its benefits. Adding more activities would make the system harder to understand and more costly to implement, but it would probably improve the accuracy of cost information, which, in turn, would help Plum make better decisions. Similarly, using inspection-hours and setup-hours as allocation bases would also probably lead to more accurate cost information, but it would increase measurement costs.

4. Activity-based management (ABM) is the use of information from activity-based costing to make improvements in a firm. For example, a firm could revise product prices on the basis of

revised cost information. For the long term, activity-based costing can assist management in making decisions regarding the viability of product lines, distribution channels, marketing strategies, etc. ABM highlights possible improvements, including reduction or elimination of non-value-added activities, selecting lower cost activities, sharing activities with other products, and eliminating waste. ABM is an integrated approach that focuses management's attention on activities with the ultimate aim of continuous improvement. As a whole-company philosophy, ABM focuses on strategic, as well as tactical and operational activities of the company.

5. Incorrect reporting of ABC costs with the goal of retaining both the Mammoth and Maximum product lines is unethical. In assessing the situation, the specific "Standards of Ethical Conduct for Management Accountants" that the management accountant should consider are listed below.

Competence
Clear reports using relevant and reliable information should be prepared. Preparing reports on the basis of incorrect costs in order to retain product lines violates competence standards. It is unethical for Jacobs to change the ABC system with the specific goal of reporting different product cost numbers that Clark favors.

Integrity
The management accountant has a responsibility to avoid actual or apparent conflicts of interest and advise all appropriate parties of any potential conflict. Jacobs may be tempted to change the product cost numbers to please Clark, the division president. This action, however, would violate the responsibility for integrity. The Standards of Ethical Conduct require the management accountant to communicate favorable as well as unfavorable information.

Credibility
The management accountant's standards of ethical conduct require that information should be fairly and objectively communicated and that all relevant information should be disclosed. From a management accountant's standpoint, adjusting the product cost numbers to make both the Mammoth and Maximum lines look profitable would violate the standard of objectivity.

Jacobs should indicate to Clark that the product cost calculations are, indeed, appropriate. If Clark still insists on modifying the product cost numbers, Jacobs should raise the matter with one of Clark's superiors. If, after taking all these steps, there is continued pressure to modify product cost numbers, Jacobs should consider resigning from the company rather than engage in unethical behavior.

5-43 Activity-based costing, activity-based management, merchandising. Main Street Books and Café (MSBC) is a large city bookstore that sells books and music CDs and has a café. MSBC operates at capacity and allocates selling, general, and administration (S, G, & A) costs to each product line using the cost of merchandise of each product line. MSBC wants to optimize the pricing and cost management of each product line. MSBC is wondering if its accounting system is providing it with the best information for making such decisions.

Main Street Books and Café
Product Line Information
For the Year Ended December 31, 2017

	Books	CDs	Café
Revenues	$3,720,480	$2,315,360	$736,216
Cost of merchandise	$2,656,727	$1,722,311	$556,685
Cost of café cleaning			$ 18,250
Number of purchase orders placed	2,800	2,500	2,000
Number of deliveries received	1,400	1,700	1,600
Hours of shelf stocking time	15,000	10,000	10,000
Items sold	124,016	115,768	368,108

Main Street Books and Café incurs the following selling, general, and administration costs:

Main Street Books and Café
Selling, General, and Administration (S, G, & A) Costs
For the Year Ended December 31, 2017

Purchasing department exercise	$ 474,500
Receiving department expense	432,400
Shelf stocking labor expense	487,500
Customer support expense (cashiers and floor employees)	91,184
	$1,485,584

Required:

1. Suppose MSBC uses cost of merchandise to allocate all S, G, & A costs. Prepare product line and total company income statements.
2. Identify an improved method for allocating costs to the three product lines. Explain. Use the method for allocating S, G, & A costs that you propose to prepare new product line and total company income statements. Compare your results to the results in requirement 1.
3. Write a memo to MSBC management describing how the improved system might be useful for managing the store.

SOLUTION

(30-40 mins.) **Activity-based costing, activity-based management, merchandising**.

1.

Main Street Books and Café
Income Statement
For the Year Ended 31 December, 2017

	Books	CDs	Café	Total
Revenues	$3,720,480	$2,315,360	$736,216	$6,772,056
Cost of Merchandise	2,656,727	1,722,311	556,685	4,935,723

Cost of Café Cleaning			18,250	18,250
Allocated Selling, General and Administration Costs[a] (0.300986 × $2,656,727; $1,722,311; $556,685)	799,638	518,392	167,554	1,485,584
Operating income	$ 264,115	$ 74,657	$ (6,273)	$ 332,499

[a]Overhead rate = $1,485,584 ÷ $4,935,723 = 0.300986 per cost of merchandise dollar

2. Selling, general, and administration (S, G, & A) is comprised of a variety of costs that are unlikely to be consumed uniformly across product lines based on the cost of merchandise. Main Street Books and Café should consider an activity-based costing system to clarify how each product line uses these S, G, & A resources.

	Books	CDs	Café	Total
Number of purchase orders	2,800	2,500	2,000	7,300
Number of deliveries received	1,400	1,700	1,600	4,700
Hours of shelf-stocking time	15,000	14,000	10,000	39,000
Items sold	124,016	115,768	368,108	607,892

Purchasing	$474,500 ÷ 7,300 orders placed = $65 per purchase order
Receiving	$432,400 ÷ 4,700 deliveries = $92 per delivery
Stocking	$487,500 ÷ 39,000 hours = $12.50 per stocking hour
Customer support	$91,184 ÷ 607,892 items sold = $0.15 per item sold

	Books	CDs	Café	Total
Revenues	$3,720,480	$2,315,360	$ 736,216	$6,772,056
Cost of Merchandise	2,656,727	1,722,311	556,685	4,935,723
Gross margin	1,063,753	593,049	179,531	1,836,333
Cost of Café Cleaning			18,250	18,250
Purchasing ($65 × 2,800; 2,500; 2,000)	182,000	162,500	130,000	474,500
Receiving ($92 × 1,400; 1,700; 1,600)	128,800	156,400	147,200	432,400
Shelf-stocking ($12.50 × 15,000; 14,000; 10,000)	187,500	175,000	125,000	487,500
Customer support ($0.15 × 124,016; 115,768; 368,108	18,603	17,365	55,216	91,184
Total S, G, & A costs	516,903	511,265	475,666	1,503,834
Operating income	$ 546,850	$ 81,784	$(296,135)	$ 332,499

Comparing product line income statements in requirements 1 and 2, it appears that books are much more profitable and café loses a lot more money under the ABC system compared to the simple system. The reason is that books use far fewer S, G, & A resources relative to its merchandise costs, and café uses far greater S, G, & A resources relative to its merchandise costs.

3.

To: Main Street Books and Café Management Team
From: Cost Analyst
Re: Costing System

The current accounting system allocates indirect costs (S, G, & A) to product lines based on the Cost of Merchandise sold. Using this method, the S, G, & A costs are assigned 54%, 35%, and 11%, to the Books, CDs, and Café product lines, respectively.

I recommend that the organization switch to an activity-based costing (ABC) method. With ABC, the product lines are assigned indirect costs based on their consumption of the activities that give rise to the costs. An ABC analysis reveals that the Café consumes considerably more than 11% of indirect costs. Instead, the café generally requires 25–35% of the purchasing, receiving, and stocking activity and 60% of the customer support.

`The current accounting technique masks the losses being produced by the café because it assumes all indirect costs are driven by the dollar amount of merchandise sold. By adopting ABC, management can evaluate the costs of operating the three product lines and make more informed pricing and product mix decisions. For example, management may want to consider increasing prices of the food and drinks served in the café. Before deciding whether to increase prices or to close the café, management must consider the beneficial effect that having a cafe has on the other product lines.

An ABC analysis can also help Main Street Books and Café manage its costs by reducing the number of activities that each product line demands and by reducing the cost of each activity. These actions will improve the profitability of each product line. ABC analysis can also be used to plan and manage the various activities.

Try It 5-1 Solution

We first calculate the budgeted indirect cost rate for the overhead cost pool

Total budgeted direct manufacturing labor-hours = 0.5hrs. × 20,000 + 0.6 hrs. × 5,000 = 13,000 hours

$$\text{Budgeted indirect-cost rate} = \frac{\text{Budgeted total costs in indirect-cost pool}}{\text{Budgeted total quantity of cost-allocation base}}$$
$$= \frac{\$234,000}{13,000 \text{ direct manufacturing labor-hours}}$$
$$= \$18 \text{ per direct manufacturing labor-hour}$$

	20,000 Basic Lamps		5,000 Designer Lamps		
	Total	**per Unit**	**Total**	**per Unit**	**Total**
	(1)	**(2)=(1)÷20,000**	**(3)**	**(4)=(3)÷5,000**	**(5)=(1)+(3)**

		EA			
Direct materials	$180,000	$ 9	$ 75,000	$15.00	$255,000
Direct manufacturing labor (Basic: $20 × 0.5hrs. × 20,000; Designer: $20 × 0.6hrs. × 5,000)	200,000	10	60,000	12.00	260,000
Total direct costs (Step 2)	380,000	19	135,000	27.00	515,000
Indirect costs allocated (Step 6)					
$18×10,000 hours;$18×3,000 hours	180,000	9	54,000	10.80	234,000
Total costs	$560,000	$28	$189,000	$37.80	$749,000

Try It Solution 5-2

We first calculate the overhead rates for each indirect cost pool.

	Basic Lamps	Designer Lamps	Total
1 Quantity of lamps produced	20,000 lamps	5,000 lamps	
2 Number of lamps produced per batch	250 lamps per batch	50 lamps per batch	
3 = (1)÷(2) Number of batches	80 batches	100 batches	
4 Setup time per batch	1 hour per batch	3 hours per batch	$114,000
5 = (3)×(4) Total setup-hours	80 setup-hours	300 setup-hours	380 setup-hours
6 General manufacturing overhead costs			$120,000
7 Direct manufacturing labor-hours per lamp	0.5 hours	0.6 hours	
8 = (1)×(7) Total direct manufacturing labor-hours	10,000 hours	3,000 hours	13,000 hours

EA

$$\text{Budgeted indirect-cost rate} = \frac{\text{Budgeted total costs in indirect-cost pool}}{\text{Budgeted total quantity of cost-allocation base}}$$
$$= \frac{\$114,000}{380 \text{ setup labor-hours}}$$
$$= \$300 \text{ per setup labor-hour}$$

$$\text{Budgeted indirect-cost rate} = \frac{\text{Budgeted total costs in indirect-cost pool}}{\text{Budgeted total quantity of cost-allocation base}}$$
$$= \frac{\$120,000}{13,000 \text{ direct manufacturing labor-hours}}$$
$$= \$9.2308 \text{ per direct manufacturing labor-hour}$$

EA

	20,000 Basic Lamps		5,000 Designer Lamps		
	Total (1)	**per Unit (2)=(1)÷20,000**	**Total (3)**	**per Unit (4)=(3)÷5,000**	**Total (5)=(1)+(3)**
Direct materials	$180,000	$ 9.00	$ 75,000	$15.00	$255,000
Direct manufacturing labor (Basic:$20×0.5 hrs.×20,000; Designer: $20×0.6 hrs.×5,000)	200,000	10.00	60,000	12.00	260,000
Total direct costs (Step 2)	380,000	19.00	135,000	27.00	515,000
Indirect costs of activities					
Setup of machines					
Basic: $300 × 80setup-hours					
Designer: $300×300 setup-hours	24,000	1.20	90,000	18.00	114,000
General manufacturing overhead					
Basic: $9.2308×10,000 labor-hrs.			27,692	5.54	120,000
Designer: $9.2308 × 3,000 labor-hrs.	92,308	4.62			
Indirect costs allocated (Step 6)	116,308	5.82	117,692	23.54	234,000
Total costs	$496,308	$24.82	$252,692	$50.54	$749,000