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Costs, Budgeting, and Financial Decision Making

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OBJECTIVES

To learn the types and behaviors of costs, how to measure them, what data are needed to generate a cost analysis, and how to cost a basic laboratory test

To understand the relationships among cost, volume, and profits and calculate contribution margin and break-even point

To apply time value of money concepts to capital acquisition plans using net present value

To understand the three common types of budgets, the budgeting process, and how budgets are used to measure financial performance and to control costs

To be able to analyze the causes of differences in actual financial performance from budgeted amounts and understand how this information is used for management control

To learn about the three primary financial statements: the balance sheet, the income statement, and the cash flow statement

To learn how to calculate key financial ratios that reveal information about an organization's financial health

Accounting is the most useful "information system" for managers, because it organizes and accumulates related information over time and aligns it with initial objectives and requirements, called "budgets." Principles of accounting must be applied to other types of information managers use in order to make "information technology" useful.

Peter F. Drucker, at the Forbes CEO Forum
"Management in the 21st Century," June 1997

Too often the financial aspects of the laboratory business can intimidate managers who have a scientific background. However, managers must understand and participate in cost accounting and budgeting. In addition, they must understand the principles of financial accounting and financial analysis in order to gauge performance, because "what gets measured gets managed." This chapter will provide an overview of these extensive and complex activities (1–4).

A note on accounting conventions:

- Variances that are "favorable" are depicted unmodified. A favorable variance is an expense that is less than budgeted or revenue that is greater than budgeted.

Clinical Laboratory Management, 2nd Edition
Edited by L. S. Garcia

doi:10.1128/9781555817282.ch33

- Variances that are "unfavorable" are depicted in parentheses. An unfavorable variance is an expense that is greater than budgeted or revenue that is less than budgeted.
- Profit is depicted unmodified and in black ink; loss is depicted in parentheses and in red if a color document is employed.
- "Productive" labor is labor that actually produces a product directly (be it a physical product or an intellectual one).
- "Nonproductive" labor may be necessary for proper functioning of the organization but is not *directly* involved in production of the product. Vacation, conferences, sick time, all management functions, and support activities such as financial analysis and marketing are examples of nonproductive labor. Note that "nonproductive" is not a pejorative term in accounting lingo.

Cost Accounting

Cost accounting is a system of measuring and reporting information about costs. Its purpose is to generate information sufficient for managers to make intelligent decisions. A common challenge of cost accounting systems is balancing the degree of specificity needed with the amount of work required to reach that specificity in light of the decisions to be made. A good system does not require unnecessarily detailed information.

Cost accounting is useful for several purposes:

- *Profitability analysis.* Cost accounting enables managers to determine whether a laboratory division or a market segment is generating revenues in excess of expenses.
- *Cost control.* Cost accounting helps define the relationship between cost and activity and can help align responsibilities with incurred costs.
- *Planning.* Cost accounting helps us understand what happens to costs as activity changes.
- *Decision making.* Cost accounting aids in setting prices, negotiating reimbursement or capitation rates, and making staffing decisions and make-versus-buy decisions (for example, whether to perform a laboratory test in-house or send it to a reference laboratory).

Classification of Costs

Costs can be categorized in many different ways, but the most critical distinction is direct cost versus indirect cost. Direct costs are those costs clearly associated with the item being costed (be it a patient, a service, a department, or an individual assay). In the laboratory, direct costs include testing supplies and reagents, instrument depreciation, maintenance and repairs, and the labor involved in performing testing. Indirect costs are those costs that are not directly associated with the item being costed. The most common types of indirect costs are general laboratory supplies; labor costs associated with supervision, administration, and training; and hospital overhead. The full, or total, cost of an item includes its direct costs and an allocated portion of indirect expenses.

Behavior of Costs

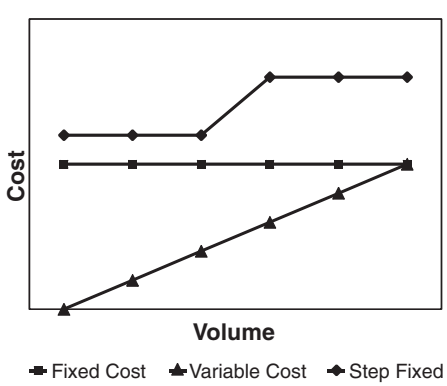
Costs behave in four basic ways depending on their relationship to the relevant range of activity. Variable costs vary in direct proportion to the volume or level of activity, such as reagent cost. Therefore, variable costs are constant per unit of service (UOS), which is whatever the logical measure of work for a given area is. Fixed costs, such as rent, are constant regardless of changes in levels of activity. Therefore, fixed costs per UOS change with volume. Semivariable costs have a fixed and a variable cost component. An example is telephone service, for which customers are usually charged a fixed amount per month that may include a specified amount of service above which a per-unit charge is incurred. Step-fixed costs are fixed over a relatively small range of activity and then change to a new fixed level over another relatively small range of activity. Labor costs often exhibit step-fixed behavior, as a certain staffing level supports a range of activity beyond which additional staffing must be added. The behaviors of most costs are fairly intuitive. Figure 33.1 illustrates these behaviors.

Measuring Full Cost

There are four steps to the process of measuring full costs:

1. Identify the responsibility centers into which costs may be appropriately grouped. For a hospital, these areas might be laboratory, radiology, laundry, etc. Within the laboratory, these centers might be chemistry, hematology, microbiology, central receiving, etc. Within chemistry, the centers might be individual analyzers or testing modalities.
2. Trace all revenues and expenses to the responsibility center incurring them.

Figure 33.1 Cost behavior. doi:10.1128/9781555817282.ch33.f1



3. Allocate the costs of supporting responsibility centers to the revenue-producing centers. There are several techniques by which this allocation may be accomplished:
   - Direct allocation
   - Step-down allocation (which usually entails starting with allocating the costs of centers that provide the most services to all other centers, then allocating the costs of those that provide the next level of service, including those costs that were just allocated in the first round, to all others, etc.)
   - Algebraic allocation (used by sophisticated cost accounting systems)

   Allocation also requires some sort of basis, such as cause and effect, or facilities provided or ability to bear the allocated costs. Examples of bases include square footage, utilization, visits, number of personnel, revenues, and payroll expense.
4. Determine the average cost of each procedure or service by dividing the responsibility center's costs by the measure of activity (in the laboratory, the measure is usually the number of procedures or billed tests). The average cost per procedure for the laboratory center might be $10, while the average cost per procedure for the chemistry center might be $5, and the average cost per procedure for a specific analyzer center within chemistry might be $2.

Average versus Marginal Costs

As noted above, the average cost equals the full costs divided by the UOS. Marginal cost equals the change in total cost relative to the change in volume. It is the variable cost plus any additional fixed costs incurred because the volume change exceeds the relevant range. In most instances, there are no additional fixed costs. Marginal costs are also called incremental costs. Over the long run, average revenues must be greater than or equal to average costs for an organization to survive, but in the short run, decisions should be made based on marginal costs. For example, the incremental cost of adding another sample to a chemistry analyzer that is running below capacity is very low. If adding another sample requires the purchase of another analyzer, however, its incremental cost is very high.

Actual Cost versus Standard Cost

Standard costs represent what a given item should cost under normal circumstances. Standard costs are useful for comparison to actual cost experience when analyzing cost variances and for budgeting.

Costing Issues

When performing cost accounting, it is always worthwhile to examine the results and ask, Is it fair? Is it equitable? Is it understandable? Do the benefits justify the effort required to ascertain cost?

A Formula for Developing Laboratory Costs

Direct costs of test (instrument depreciation, maintenance and repair, reagents, calibration, quality controls, direct labor)

+

Indirect costs (general laboratory supplies), indirect labor (such as supervision, training), other indirects (such as research and development expenses)

=

Laboratory section cost

+

General laboratory overhead (specimen collection, report distribution, information systems, management, education, quality assurance, sales, marketing)

=

Laboratory test total cost

Laboratory Costing Examples

Tables 33.1 through 33.6 are examples of the types of information that need to be collected and some of the calculations involved in generating unit costs. Table 33.1 shows the key variables that are needed to generate unit cost, including staff costs that are both variable (tester) and fixed (nontester), plus indirect fixed divisional, overall laboratory, and overall hospital costs.

Table 33.2 is an example of the calculation involved in generating a per-unit cost for a test that is run in a batch with other tests. It is an example of a step-fixed cost. Should the threshold of 250 tests per run be exceeded, another run would need to be instituted, along with its concomitant expenses. The "step" is the period jump in costs with each new test run, whereas the cost per test progressively decreases within each test run as more samples are added. The most efficient position would be the inclusion of 250 tests in *every* run, the situation in which no further savings could be achieved without increasing the capacity of the run. In Table 33.2, the average number of tests per run is 228, a point that approaches the most economic efficiency possible.

Table 33.3 combines all the costing information thus far to calculate a unit cost for a given volume. After generating this cost information it is important to validate the model by running a check on the total cost captured by the model. This total is measured by multiplying the unit costs by the volume over a given period of time and comparing that to actual costs for the same time period, which were generated in Table 33.1.

Tables 33.4 through 33.6 are the same as the previous examples, except they show the effects of adding an additional 7,500 partial thromboplastin time tests to the mix.

Table 33.1 Key variables for a hematology laboratory with static volume

Position	Type	Average Salary	FTEs	Total Salary Exp	Fringe Expense	Total Salary & Fringe
Lab Specialist	Tester	$ 32,000	1.00	$ 32,000	$ 8,000	$ 40,000
Medical Technologist	Tester	$ 40,000	3.00	$ 120,000	$ 30,000	$ 150,000
Medical Lab Technician	Tester	$ 33,500	1.00	$ 33,500	$ 8,375	$ 41,875
Laboratory Supervisor	Non-Tester	$ 47,500	1.00	$ 47,500	$ 11,875	$ 59,375
Total			6.00	$ 233,000	$ 58,250	$ 291,250
Avg Tester Salary & Fringe Benefit Expense						**$ 46,375**
Total Non-Tester Salary & Fringe Benefit Expense						**$ 59,375**

Divisional Indirect Costs	Amount	Cost/Test
Non-Tester Salary & Fringe	$ 59,375	
Office Supplies	$ 10,000	
Books/Subs/Dues	$ 15,000	
Travel Meeting Dues	$ 15,000	
Total	$ 99,375	$ 0.76

Lab Indirect Costs	Amount
Management	$ 115,000
Central Receiving	$ 625,000
General Support	$ 100,000
Administrative Support	$ 75,000
Subtotal	$ 915,000
Hematology % of Total Lab Volume	15%
Hematology Allocation	$ 137,250 $ 1.04

Hospital Indirect Costs (Lab Portion)	Amount
Patient Financial Services	$ 500,000
Human Resources	$ 300,000
Management	$ 100,000
Finance	$ 100,000
Subtotal	$ 1,000,000
Hematology % of Total Lab Vol	15%
Hematology Allocation	$ 150,000 $ 1.14

Clearly, the additional tests make all the indirect fixed costs less expensive because the same fixed costs are now being divided over a larger number of tests. This relationship is important when generating pricing proposals for new business.

Comparing Table 33.5 with Table 33.2 shows the effects of adding additional tests to the cost of a test run. In Table 33.2 we were able to run the batch of tests five times a week and still be under the test run maximum of 250. With the addition of 7,500 tests, one can see in Table 33.5 that the batch now needs to be run six times a week, which adds more cost and increases the per-unit cost of the tests. Thus, the cost for these tests was fixed within a certain volume level (250 tests per batch), but when the volume went over that level, the costs shifted upward, an example of a step-fixed cost.

Break-Even Analysis

Contribution margin is the revenue per UOS less the marginal cost per UOS and is often written as contribution margin = price − variable costs. As long as the contribution margin is positive, the organization benefits. The margin can go to supporting fixed costs (or to supporting items or activities whose contribution margin is negative), and if fixed costs have been covered, it represents profit.

The break-even point is the volume of activity required for all fixed costs to be covered. Therefore, the break-even

Table 33.2 Test run calculation for a hematology laboratory with static volume

Division	Test Description	CPT Code	Total Volume	Test Run Volume	Current Runs/Week	Maximum Tests/Run	Avg Tests per Run	Test Run Minutes	Total Year Salary & Fringe Expense	Total Year Supplies & Reagent Expense	Salary & Fringe Expense per Test	Supplies & Reagents Expense per Test
	Partial Thromboplastin Time	85730	25,973									
	Prothrombin Time	85610	33,318									
HEMATOLOGY	HEMA001 Test Run			59,291	5	250	228	180	$ 17,391	$ 5,200	$ 0.29	$ 0.09

Table 33.3 Cost calculation for a hematology laboratory with static volume

						DIRECT COST					INDIRECT COST					
						Variable Cost			Step-Fixed Cost		Fixed Cost					
Division	Test Description	CPT Code	Total Volume	Additional Volume	Revised Volume	Test Minutes	Test Salary & Fringe	Test Supplies & Reagents	Test Run Sal & Frg	Test Run Supp & Reag	Divisional Cost	Lab Cost	Hospital Cost	Variable Cost	Fixed Cost	Total Cost
HEMATOLOGY	Fibrinogen	85384	2,057	-	2,057	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 2.86	$ 2.94	$ 5.80
HEMATOLOGY	Heinz Body Preparation	85441	10	-	10	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 2.86	$ 2.94	$ 5.80
HEMATOLOGY	Hematocrit, Spun	85013	107	-	107	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 2.86	$ 2.94	$ 5.80
HEMATOLOGY	Kleihauer Test	85460	342	-	342	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 1.61	$ 2.94	$ 4.56
HEMATOLOGY	Leukocyte Alkaline Phosphatase	85540	29	-	29	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 1.61	$ 2.94	$ 4.56
HEMATOLOGY	LA Confirm Test	85613	133	-	133	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 1.61	$ 2.94	$ 4.56
HEMATOLOGY	Hemogram	85027	63,600	-	63,600	5	$ 1.86	$ 0.50	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 2.36	$ 2.94	$ 5.30
HEMATOLOGY	Partial Thromboplastin Time	85730	25,973	-	25,973	-	$ -	$ -	$ 0.29	$ 0.09	$ 0.76	$ 1.04	$ 1.14	$ -	$ 3.32	$ 3.32
HEMATOLOGY	Platelet Aggregation	85576	17	-	17	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 5.72	$ 2.94	$ 8.66
HEMATOLOGY	Prothrombin Time	85610	33,318	-	33,318	-	$ -	$ -	$ 0.29	$ 0.09	$ 0.76	$ 1.04	$ 1.14	$ -	$ 3.32	$ 3.32
HEMATOLOGY	Protein C, Functional	85303	181	-	181	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 5.72	$ 2.94	$ 8.66
HEMATOLOGY	Protein S, Functional	85306	175	-	175	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 5.72	$ 2.94	$ 8.66
HEMATOLOGY	Sed. Rate, Westergren	85652	5,527	-	5,527	15	$ 5.57	$ 4.00	$ -	$ -	$ 0.76	$ 1.04	$ 1.14	$ 9.57	$ 2.94	$ 12.51
	Total		131,469	-	131,469											
	Cost Capture Check															
	Total Calculated Cost		$ 621,257													
	Total Actual Cost		$ 677,875													
	Cost Capture Percent		91.6%													

Table 33.4 Key variables for a hematology laboratory with additional volume

Position	Type	Average Salary	FTEs	Total Salary Exp	Fringe Expense	Total Salary & Fringe
Lab Specialist	Tester	$ 32,000	1.00	$ 32,000	$ 8,000	$ 40,000
Medical Technologist	Tester	$ 40,000	3.00	$ 120,000	$ 30,000	$ 150,000
Medical Lab Technician	Tester	$ 33,500	1.00	$ 33,500	$ 8,375	$ 41,875
Laboratory Supervisor	Non-Tester	$ 47,500	1.00	$ 47,500	$ 11,875	$ 59,375
Total			6.00	$ 233,000	$ 58,250	$ 291,250
Avg Tester Salary & Fringe Benefit Expense						**$ 46,375**
Total Non-Tester Salary & Fringe Benefit Expense						**$ 59,375**

Divisional Indirect Costs	Amount	Cost/Test
Non-Tester Salary & Fringe	$ 59,375	
Office Supplies	$ 10,000	
Books/Subs/Dues	$ 15,000	
Travel Meeting Dues	$ 15,000	
Total	$ 99,375	$ 0.72

Lab Indirect Costs	Amount
Management	$ 115,000
Central Receiving	$ 625,000
General Support	$ 100,000
Administrative Support	$ 75,000
Subtotal	$ 915,000
Hematology % of Total Lab Volume	15%
Hematology Allocation	$ 137,250

Hospital Indirect Costs (Lab Portion)	Amount	
Patient Financial Services	$ 500,000	
Human Resources	$ 300,000	
Management	$ 100,000	
Finance	$ 100,000	
Subtotal	$ 1,000,000	
Hematology % of Total Lab Vol	15%	
Hematology Allocation	$ 150,000	$ 1.08

point equals the total fixed cost divided by the contribution margin.

$$\text{Volume break-even point} = \frac{\text{total fixed costs}}{\text{contribution margin per unit}}$$

$$= \frac{\text{total fixed costs}}{\text{price} - \text{variable costs}}$$

This equation underscores the relationships among costs, volume, and profits. In the previous section, we discussed cost behavior and displayed the relationships of fixed and variable costs to volume. A given responsibility center incurs both fixed and variable costs, and its total costs are the sum of the two, as illustrated in Fig. 33.2. Adding the revenue line, which increases at a rate equal to the revenue per unit, yields Fig. 33.3.

If the revenue per unit is greater than the variable cost per unit, the revenue line and the total cost line must cross at some point, where revenues equal costs—the break-even point. Note that the graph illustrates not only the break-even volume, but also the unit revenue required to reach break-even. Figure 33.4 shows this calculation for a hypothetical hematology division.

Equipment Purchase

When considering expensive equipment purchases, it is critical to know the point at which the volume of procedures

Table 33.5 Test run calculation for a hematology laboratory with additional volume

Division	Test Description	CPT Code	Total Volume	Test Run Volume	Current Runs/Week	Maximum Tests/Run	Avg Tests per Run	Test Run Minutes	Total Year Salary & Fringe Expense	Total Year Supplies & Reagent Expense	Salary & Fringe Expense per Test	Supplies & Reagents Expense per Test
	Partial Thromboplastin Time	85730	33,473									
	Prothrombin Time	85610	33,318									
HEMATOLOGY	HEMA001 Test Run			66,791	6	250	214	180	$ 20,869	$ 6,240	$ 0.31	$ 0.09

Table 33.6 Cost calculation for a hematology laboratory with additional volume

						DIRECT COST					INDIRECT COST					
						Variable Cost			Step-Fixed Cost		Fixed Cost					
Division	Test Description	CPT Code	Total Volume	Additional Volume	Revised Volume	Test Minutes	Test Salary & Fringe	Test Supplies & Reagents	Test Run Sal & Frg	Test Run Supp & Reag	Divisional Cost	Lab Cost	Hospital Cost	Variable Cost	Fixed Cost	Total Cost
HEMATOLOGY	Fibrinogen	85384	2,057	-	2,057	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 2.86	$ 2.78	$ 5.64
HEMATOLOGY	Heinz Body Preparation	85441	10	-	10	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 2.86	$ 2.78	$ 5.64
HEMATOLOGY	Hematocrit, Spun	85013	107	-	107	5	$ 1.86	$ 1.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 2.86	$ 2.78	$ 5.64
HEMATOLOGY	Kleihauer Test	85460	342	-	342	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 1.61	$ 2.78	$ 4.40
HEMATOLOGY	Leukocyte Alkaline Phosphatase	85540	29	-	29	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 1.61	$ 2.78	$ 4.40
HEMATOLOGY	LA Confirm Test	85613	133	-	133	3	$ 1.11	$ 0.50	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 1.61	$ 2.78	$ 4.40
HEMATOLOGY	Hemogram	85027	63,600	-	63,600	5	$ 1.86	$ 0.50	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 2.36	$ 2.78	$ 5.14
HEMATOLOGY	Partial Thromboplastin Time	85730	25,973	7,500	33,473	-	$ -	$ -	$ 0.31	$ 0.09	$ 0.72	$ 0.99	$ 1.08	$ -	$ 3.19	$ 3.19
HEMATOLOGY	Platelet Aggregation	85576	17	-	17	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 5.72	$ 2.78	$ 8.50
HEMATOLOGY	Prothrombin Time	85610	33,318	-	33,318	-	$ -	$ -	$ 0.31	$ 0.09	$ 0.72	$ 0.99	$ 1.08	$ -	$ 3.19	$ 3.19
HEMATOLOGY	Protein C, Functional	85303	181	-	181	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 5.72	$ 2.78	$ 8.50
HEMATOLOGY	Protein S, Functional	85306	175	-	175	10	$ 3.72	$ 2.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 5.72	$ 2.78	$ 8.50
HEMATOLOGY	Sed. Rate, Westergren	85652	5,527	-	5,527	15	$ 5.57	$ 4.00	$ -	$ -	$ 0.72	$ 0.99	$ 1.08	$ 9.57	$ 2.78	$ 12.36
	Total		131,469	7,500	138,969											
	Cost Capture Check															
	Total Calculated Cost		$ 625,775													
	Total Actual Cost		$ 677,875													
	Cost Capture Percent		92.3%													

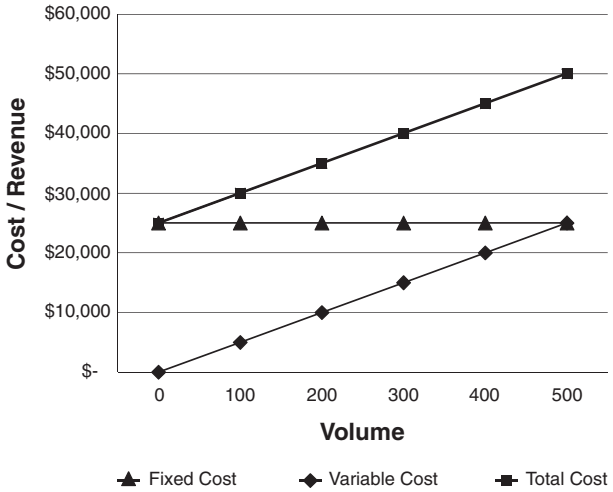


Figure 33.2 Fixed, variable, and total cost.
doi:10.1128/9781555817282.ch33.f2

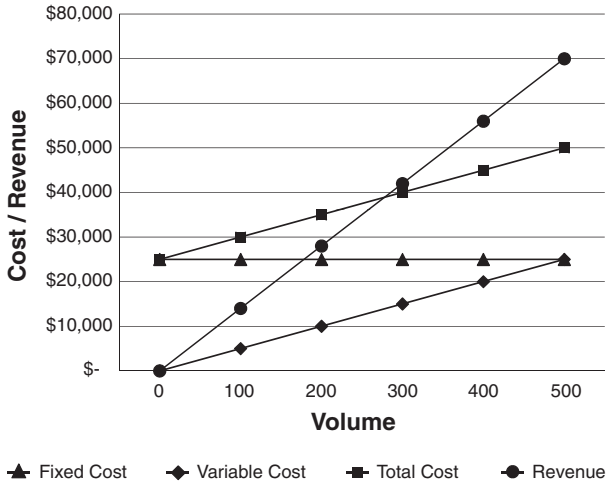


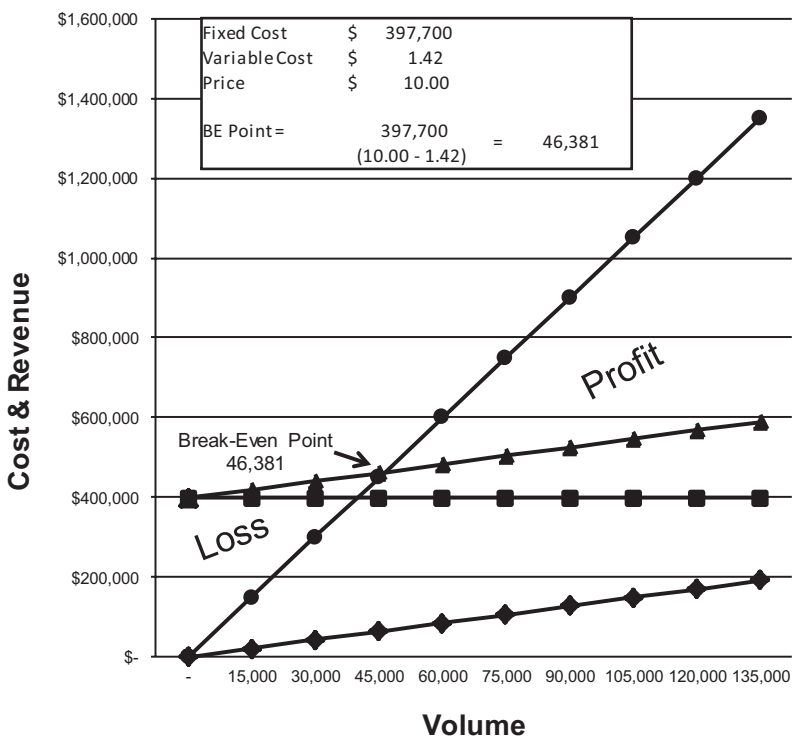
Figure 33.3 Fixed, variable, and total expense and revenue.
doi:10.1128/9781555817282.ch33.f3

performed on the equipment covers its annual depreciation and maintenance costs, compared to the projected demand for the procedures, as illustrated in Fig. 33.5.

Capitation Contract

Under "capitation," healthcare providers are paid a fixed amount per member per month (PMPM). Revenue varies, therefore, with member enrollment, not with the volume of procedures performed. To understand what the break-even point is in terms of the number of members, a provider must first understand the expected utilization by those members (see Fig. 33.6). The provider, not the health plan, is usually at risk for variations in utilization. This risk can be ameliorated by negotiating utilization

Figure 33.4 Graphical representation of the break-even point for a hematology division.
doi:10.1128/9781555817282.ch33.f4



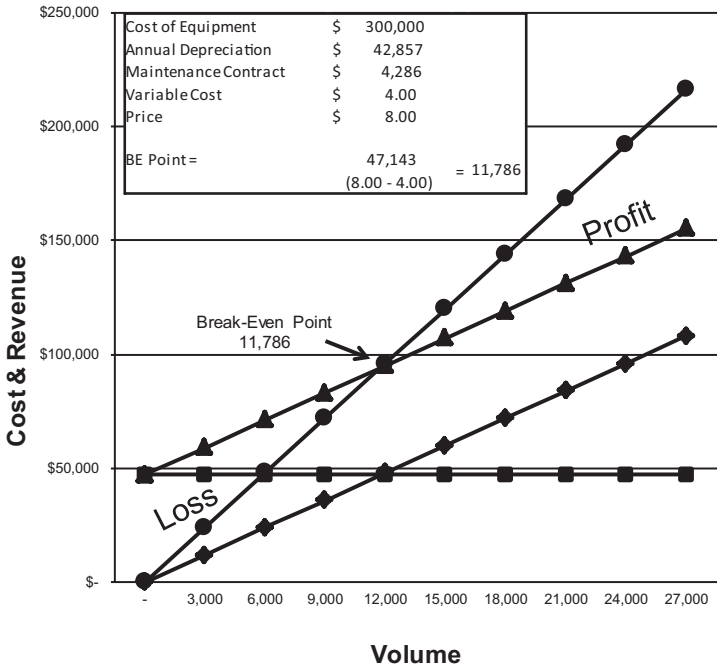


Figure 33.5 Break-even point for equipment purchase. doi:10.1128/9781555817282.ch33.f5

corridors into the contract, whereby the PMPM revenue is adjusted up or down if utilization is over or under budget by a certain amount. If not, the provider can incur significant losses if utilization is over budget.

Capital Acquisition Concepts

Time Value of Money

Before evaluating potential capital acquisitions, it is important to understand the concept of the time value of money. Most people prefer current consumption to future consumption. Similarly, investors expect to be rewarded for their patience by receiving a rate of return on an investment, which could be interest, dividends, or capital gains. Intrinsic in this is the notion that money received in the future is not as valuable as money received today. We can quantify this. The future value (FV) of an investment = its present value (PV) multiplied by (1 + interest rate, k) raised to the number of investment periods, n (usually expressed as years), or

$$\mathrm{FV} = \mathrm{PV} \times (1 + k)^n$$

The future value in 3 years of \$100 invested at 5% interest equals $\$100 \times (1 + 0.05)^3 = \$115.76$. This formula becomes useful in considering capital acquisitions when we rearrange the terms:

$$\mathrm{PV} = \frac{FV}{(1 + k)^n}$$

Here, the rate k is called the discount rate (not the interest rate), and the practice is called discounting (we are discounting the value of money, not to be confused with discounting, or reducing the price of, a test charge). This approach allows us to value different investments in today's dollars in relation to their future values. Which would you rather receive: \$115.76 in 3 years or \$120.34 in 4 years? At a 5% discount rate, we already know that the present value of \$115.76 after 3 years is \$100.00. For \$120.34 after 4 years,

$$\mathrm{PV} = \frac{\$120.34}{(1 + 0.05)^4} = \$99.00$$

Therefore, the first choice (3 years) has a higher value.

Investments are evaluated based on their cash flows (CF), where CF = cash revenues − cash expenses. The net present value (NPV) of a project equals the sum of the PV of the CF of the project.

$$\mathrm{NPV} = \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}$$

Here, the rate k is referred to as the required rate of return, the cost of capital, or the hurdle rate. If the NPV is > 0, the investment is warranted. If NPV < 0, it should not be pursued. If you are comparing two alternatives, pick the one with the higher NPV. A special case is when the NPV = 0. The rate k that induces this is called the internal rate of return (IRR). Instead of calculating the NPV for two competing investments, you can calculate their internal rates of return. Pick the investment with the higher IRR, as long as the IRR is greater than your cost of capital (if it is not, then your capital would be better invested elsewhere). For example, a new analyzer costs \$100,000 and will allow the

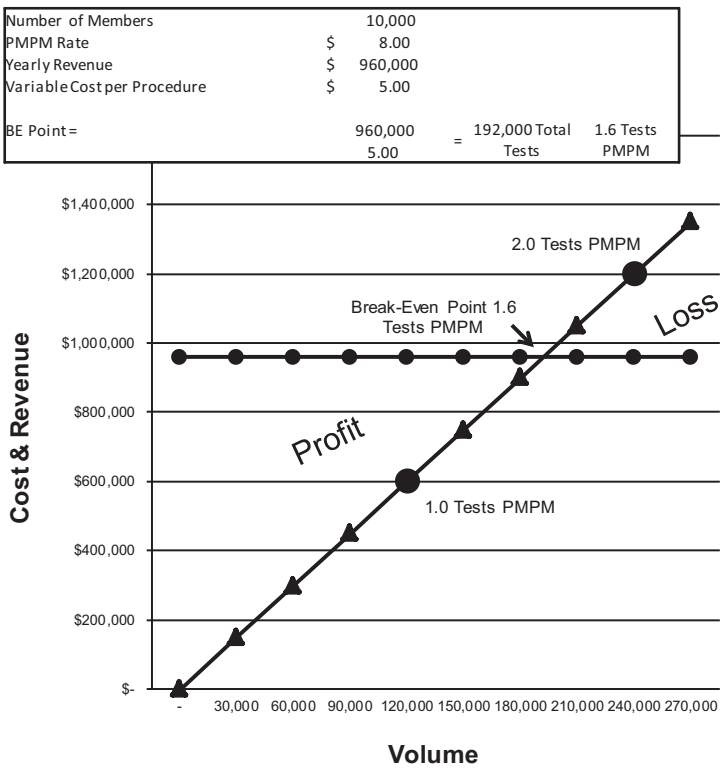


Figure 33.6 Break-even point for a capitated contract. doi:10.1128/9781555817282.ch33.f6

laboratory to perform testing it does not perform today, so it will generate $35,000 in net cash flow per year for the next 4 years. If our required rate of return is 10%, is this a worthwhile investment?

Time	Cash flow
0	−$100,000
1	$35,000
2	$35,000
3	$35,000
4	$35,000

$$NPV = \frac{-\$100{,}000}{(1+0.10)^0} + \frac{\$35{,}000}{(1+0.10)^1} + \frac{\$35{,}000}{(1+0.10)^2} + \frac{\$35{,}000}{(1+0.10)^3} + \frac{\$35{,}000}{(1+0.10)^4}$$

$$NPV = \$10{,}945$$

Solving for the internal rate of return (spreadsheet software and most financial calculators automate this):

$$0 = \frac{-\$100{,}000}{(1+IRR)^0} + \frac{\$35{,}000}{(1+IRR)^1} + \frac{\$35{,}000}{(1+IRR)^2} + \frac{\$35{,}000}{(1+IRR)^3} + \frac{\$35{,}000}{(1+IRR)^4}$$

IRR = 14.96%. This IRR would then be compared with the other possible returns the company might get with the money if it were invested in other projects.

Many laboratory investments do not create new revenues, but these same techniques can be applied to calculating net present *cost* and then choosing the option with the lowest cost.

Table 33.7 evaluates a direct purchase versus an installment purchase, where payments are made over time, as an example of a net present cost application. Assume the following: direct purchase price equals $200,000; installment purchase equals $40,000 per year with a useful life of 7 years; discount rate equals 10%. In this example it would be less expensive to purchase the equipment directly than make an installment purchase, $200,000 versus $213,397. Nonetheless, other factors may favor installments, such as available cash.

Table 33.8, the evaluation of two different pieces of laboratory equipment that serve the same function, is an example of calculating the NPVs. Equipment 1 costs $200,000 and generates $60,000 of net cash flow per year for the 7-year useful life of the equipment. Equipment 2 costs $300,000 and generates $90,000 per year for the 7-year useful life of the equipment. The cost of the equipment and depreciation is spread evenly over the 7 years

Table 33.7 NPV of direct purchase versus installment purchase

Project	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Discount Rate	10%							
Direct Purchase	$ 200,000							
Installment Purchase	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
NPV of Installment Purchase	$ 213,397							

Table 33.8 NPV of two different pieces of equipment

Project	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Discount Rate	10%							
Equipment #1								
Cost of Equipment	$ (200,000)							
Incremental Revenue		$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Incremental Expense		$ (68,571)	$ (68,571)	$ (68,571)	$ (68,571)	$ (68,571)	$ (68,571)	$ (68,571)
Depreciation		$ 28,571	$ 28,571	$ 28,571	$ 28,571	$ 28,571	$ 28,571	$ 28,571
Net Cash Flow	$ (200,000)	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000
Net Present Value of Cash Flows	$ 83,732							
Equipment #2								
Cost of Equipment	$ (300,000)							
Incremental Revenue		$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Incremental Expense		$ (102,857)	$ (102,857)	$ (102,857)	$ (102,857)	$ (102,857)	$ (102,857)	$ (102,857)
Depreciation		$ 42,857	$ 42,857	$ 42,857	$ 42,857	$ 42,857	$ 42,857	$ 42,857
Net Cash Flow	$ (300,000)	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Net Present Value of Cash Flows	$ 125,598							

of useful life. Based on these figures, equipment 2 would be chosen over equipment 1 because of its higher NPV—$125,598 versus $83,732.

Depreciation

Depreciation is associated with capital investments, so it is worth commenting on. Depreciation is the allocation of the cost to acquire an asset that has a useful life of greater than 1 year into each year of the asset's life. It is common to use a "straight line" method in healthcare, whereby the depreciation is evenly allocated across the item's useful life. For example, if a piece of equipment costs $100,000 and has a useful life of 10 years, after which it is worth nothing, an annual depreciation expense of $10,000 per year would be recorded for each of the 10 years. There are other methods of depreciation that are driven by tax laws and usually allow for a more accelerated treatment of this expense.

Investment decisions are based on cash flows, and depreciation is not a cash flow. The relevant cash flow is the purchase event. From an accounting standpoint, the organization is simply exchanging one asset, cash, for another, the asset. Depreciation serves to reduce the value of the asset over time on the organization's financial statements, but it should be *ignored* when evaluating capital acquisitions.

Budgeting

It is through budgeting that an organization turns its strategic plans into daily operations. A budget expresses planned revenues and expenses, as well as the volumes of services and amounts of resources required to realize them. Through the budget process the organization establishes priorities for its plans, allocates its resources, and controls its costs. It authorizes new programs and services and sets performance standards for existing ones. A budget thus serves as a tool and a benchmark for monitoring the performance of the organization throughout its fiscal year. In addition, it is a mechanism for imposing discipline on the organization.

Two key concepts are integral to healthcare budgeting: full-time equivalents (FTEs) and UOSs. An FTE is one or more employees paid for a total of 2,080 h per year (based on 8 h per day $\times$ 5 days per week $\times$ 52 weeks per year); this is the standard labor measure. An employee who is paid for two 8-h days per week represents 0.4 FTE, while an employee who is paid for two 12-h days per week represents 0.6 FTE. Together, they represent 1.0 FTE to the organization. Labor is divided into productive time, the time spent working on job-related activities, and nonproductive time, which includes vacation, holidays, and sick time. Depending on an organization's fringe benefit policies, it will need 1.1 or more FTEs to realize 1.0 FTE of productive time.

Each area of the organization needs a way of quantifying its productivity. As stated earlier, a UOS is the logical measure of work for a given area. In the laboratory, it is usually either the number of billed tests or the number of procedures performed. For the operating room, it may be the number of surgeries; for a physician office, it may be the number of patient visits. UOSs are useful for measuring and comparing resource consumption, such as total expenses per billed test or billed tests per FTE, as we saw in the cost accounting section.

Types of Budgets

Three separate budgets are developed during the budgeting process.

The first, and the one with which you are probably most familiar, is the *operating budget.* This is prepared at the level of the cost center, usually by those managers who have direct responsibility for managing the cost center and who can affect its operations. The operating budget can be broken down into three components:

- *Statistical budget*, or volume budget, which is the forecast of activity for the unit
- *Revenue budget*, which determines the gross charges that will be generated by the forecasted volume
- *Expense budget*, which projects the amounts of resources that will be required to produce the forecasted volumes

The *capital budget* is the second type of budget. Its development can occur simultaneously with the operating budget. It is usually prepared at the organization level and includes new or replacement property, physical plant, and equipment needs of the organization for the coming year. Most organizations have a system in place to collect information on these needs from departments across the organization and then arrange the priorities centrally with respect to acuity of need, organizational goals, and available funding. Capital budgeting is separated from the operating budget because the impact of capital purchases is predominantly on cash, with only the depreciation expense affecting the operating budget (see the previous section's discussion of depreciation).

With the operating and capital budgets prepared, an organization can develop the third type, the *cash budget.* This is usually prepared by the organization's finance department and predicts the cash flows in and out of the organization and the resultant cash availability. While obscure to most, it is the most critical of the three budgets. To remain solvent and thus stay in business, the organization must carefully plan its cash reserves, timing of cash disbursements, and any borrowing and investing activities.

The Budgeting Process

Creating a budget entails a fairly linear set of sequential steps, some of which occur at the organizational level and some that are done at the departmental or cost center levels.

Step 1. Establish organizational goals and objectives. Although the senior management usually sets these, it is not uncommon for departments to develop their own objectives in support of the broader organizational goals. For instance, a hospital may set a goal to expand market share in ABC County by 3%. This, in turn, might lead to a goal of establishing a satellite facility in that county. The laboratory might then establish objectives for equipping and running a laboratory or phlebotomy station at that satellite.

Step 2. Review key environmental factors, such as demographics, political and regulatory issues, competition, technology, and the economy. This function is usually performed at the organizational level, although the laboratory may have unique information about its particular niche, such as the marketing activities of a regional reference laboratory with which it is competing for outpatient testing.

Step 3. Determine starting assumptions about inflation, payment levels, admissions, and other key volumes. This function is usually performed at the organizational level.

Step 4. Develop the statistical budget for each UOS in the organization. This budget is completed at the department level using the information garnered in steps 1 to 3. The laboratory manager will need to consider projections of the number of admissions and the length of stay to forecast volumes of inpatient laboratory tests and will have to estimate the activity for various outpatient departments to forecast volumes of outpatient laboratory tests. If the laboratory is freestanding or has nonaffiliated clients, managers must develop forecasting methods for these markets as well.

Step 5. Develop the revenue budget, based on the statistical volumes forecasted in step 3 multiplied by the applicable charges per UOS, resulting in the gross revenue budget. In most organizations, consideration of contractual allowances, write-offs, and bad debt occurs at the organizational level, for purposes of estimating the net revenue budget.

Step 6. Prepare the expense budget on the basis of the data gathered in steps 1 to 4. Because labor often constitutes roughly 70% of a healthcare organization's budget, the expense budget is frequently broken down separately into a staffing budget and a nonpersonnel expense budget. The staffing budget takes into account the numbers and types of employees, pay rates, and FTEs required in each cost center. Nonpersonnel expenses include the various supplies consumed and services utilized to produce the UOS forecasted.

Step 7. Assuming the capital budget was produced in parallel with the previous steps, there is usually a process of negotiation and revision between department heads and senior managers once all of the departments' budgets are rolled into one organizational budget and the operating income is calculated.

Step 8. Develop the cash budget.

Step 9. Continue negotiations and revisions across the organization.

Step 10. Submit the budget to the organization's board of directors for approval. Usually, current year and prior year results form the basis on which the new budget is developed. This process is called incremental budgeting. An alternative used in some organizations is zero-based budgeting. Under this approach, every expenditure must be justified as if the service were starting from scratch, and it must be established that other ways to provide a service are not more cost-effective. While this can be time-consuming, it forces a regular reexamination of why things are done the way they are and whether they still fit with the organization's mission.

Another refinement to the budget process is the use of flexible budgets. The process that has been described so far results in a fixed budget, one in which an annual budget is developed and approved, after which this agreed-upon budget acts as the yardstick against which monthly performance is monitored. Recall, however, the earlier discussion about cost behavior (fixed, variable, etc.). It is relatively straightforward to divide an organization's expenses into those that vary with changes in UOS and those that do not. Subsequently, the variable portion of the budget may change with volume for purposes of monitoring performance. This approach is known as flexible budgeting.

Budget Examples

Table 33.9 is an example of a staffing worksheet that is prepared to calculate how many FTEs a laboratory division would need for the upcoming fiscal year and the costs associated with those FTEs. In practice, more detailed information is required than just FTEs and hourly rates to generate an accurate staffing budget. A manager also has to break down each employee's hours into the different shifts that he or she works, so that any differential rates can be applied. Examples of typical differential rates would be for weekends, evenings, nights, holidays, overtime, etc. In this example, the manager is requesting 19.36 FTEs, which equates to $998,247 in salary expense and $299,474 in fringe benefit expense (such as payroll taxes, health insurance premiums, etc.). Notice that the salary expense is broken down into productive and nonproductive components. This allocation is commonly done to track nonworked but paid hours versus the actual worked hours.

Table 33.10 is an example of a worksheet that is used to analyze a budget being requested by a manager. In this example, the starting point is a pro forma budget that was calculated by (i) projecting any changes in volume and (ii) using the revenue and expense per UOS from the previous year to adjust both revenues and costs.

This calculation allows for a comparison between what one would expect for revenue and expense, given a certain volume level, and what the manager is actually requesting. The manager will need to present a valid case for deviating

Table 33.9 Staffing worksheet

JOB			2012		
Code	Title	Employee Name	FTE	Hourly Rate	Total Pay
078J	Charge Technologist	Employee Name	1.01	$ 30.15	$ 63,341
078J	Charge Technologist	Employee Name	1.01	$ 30.08	$ 63,194
078J	Charge Technologist	Employee Name	1.00	$ 27.31	$ 56,800
078J Total			**3.02**		**$ 183,335**
078K	Medical Technologist	Employee Name	0.35	$ 23.59	$ 17,171
078K	Medical Technologist	Employee Name	0.76	$ 26.07	$ 41,208
078K	Medical Technologist	Employee Name	0.81	$ 23.68	$ 39,897
078K	Medical Technologist	Employee Name	0.97	$ 26.25	$ 52,972
078K	Medical Technologist	Employee Name	1.02	$ 18.39	$ 39,021
078K	Medical Technologist	Employee Name	0.65	$ 24.23	$ 32,760
078K	Medical Technologist	Employee Name	0.77	$ 26.57	$ 42,556
078K	Medical Technologist	Employee Name	0.75	$ 23.67	$ 36,924
078K	Medical Technologist	Employee Name	0.87	$ 26.51	$ 47,976
078K	Medical Technologist	Employee Name	0.96	$ 19.41	$ 38,758
078K	Medical Technologist	Employee Name	0.35	$ 23.52	$ 17,120
078K	Medical Technologist	Employee Name	0.53	$ 22.14	$ 24,403
078K	Medical Technologist	Employee Name	1.02	$ 21.54	$ 45,699
078K	Medical Technologist	Employee Name	1.01	$ 19.31	$ 40,556
078K	Medical Technologist	Employee Name	0.76	$ 18.88	$ 29,852
078K Total			**11.58**		**$ 546,873**
078L	Medical Lab Technician	Employee Name	0.08	$ 21.45	$ 3,569
078L Total			**0.08**		**$ 3,569**
900A	Sr Medical Technologist	Employee Name	0.27	$ 27.51	$ 15,448
900A	Sr Medical Technologist	Employee Name	0.78	$ 26.35	$ 42,748
900A	Sr Medical Technologist	Employee Name	0.63	$ 27.51	$ 36,045
900A Total			**1.68**		**$ 94,240**
B474	Lab Assistant II	Employee Name	1.00	$ 16.60	$ 34,533
B474 Total			**1.00**		**$ 34,533**
L314	Supervisor Laboratory	Employee Name	1.00	$ 27.33	$ 56,849
L314 Total			**1.00**		**$ 56,849**
L437	Chief Technologist - Lab	Employee Name	1.00	$ 37.91	$ 78,849
L437 Total			**1.00**		**$ 78,849**
			19.36		**$ 998,247**
				Non-Productive Salary	$ 109,807
				Productive Salary	$ 888,440
				Total Salary	$ 998,247
				Fringe @ 30%	$ 299,474

from the pro forma budget. Once the differences between the pro forma budget and the requested budget, i.e., the variance, have been resolved with senior management, the last step in the process is to apply inflation factors to the approved budget (if all the variances have been accepted) and generate the final budget for the upcoming fiscal year.

Variance Analysis

Management reporting is a process of communicating actual versus budget performance throughout the organization to identify necessary corrective actions and help make decisions. Distribution of reports usually follows the organizational structure. Detailed line item reports are analyzed at the cost center level. These reports roll up into more and more summaries as one moves up the chain of command. For example, a chemistry supervisor reviews more detail than does the laboratory manager, who looks at summary reports across the laboratory, while the vice president for ancillary services looks at summary reports for the laboratory, radiology, pharmacy, etc.

Variance analysis is critical to the control function of management. Having established a budget, the extent to which actual experience differs from the budget represents a variance. Controllable variances can be resolved by management action. Vendors may be substituted, contracts may be renegotiated, or alternative methodologies may be pursued. Other variances are not controllable, such as a flu epidemic that drives up demand for services above what was budgeted, but as a result may require management to make changes to more discretionary expenditures to offset the uncontrollable epidemic factor. Variance analysis commonly focuses on the company's actual results versus budgeted expectations on a line-by-line basis for each cost center. It is important that the line manager who has the understanding of the cost center and the ability to make any necessary changes actually perform this analysis. It is the job of the manager to explain the variances to superiors.

Table 33.10 Worksheet for constructing a budget

CATEGORY	FY11 PROJECTED	FY12 PRELIMINARY BUDGET	VOLUME ADJUSTMENT	FY12 ADJUSTED PROFORMA	INFLATION FEE INCREASE ADJUSTMENT	FY12 FINAL BUDGET
VOLUME						
Inpatient Volume	155,415	159,897	-	159,897	-	159,897
Outpatient Volume	133,572	130,887	1,000	131,887	-	131,887
Total Volume	288,987	290,784	1,000	291,784	-	291,784
REVENUE						
Inpatient Revenue	3,079,451	3,124,187	-	3,124,187	62,484	3,186,671
Outpatient Revenue	2,540,748	2,471,015	19,022	2,490,037	49,801	2,539,837
Gross Patient Revenue	5,620,199	5,595,202	19,022	5,614,224	112,284	5,726,508
Est Deductions from Revenue	(1,967,070)	(1,958,321)	(6,658)	(1,964,978)	(39,300)	(2,004,278)
Net Patient Revenue	3,653,130	3,636,881	12,364	3,649,245	72,985	3,722,230
EXPENSE						
Non-Productive Salary	95,979	84,823	332	85,155	1,703	86,859
Productive Salary	726,993	686,298	2,516	688,813	13,776	702,590
Overtime	10,016	16,011	35	16,046	321	16,367
Salaries	832,988	787,132	2,882	790,014	15,800	805,815
Fringe	215,411	203,584	745	204,329	4,087	208,416
Payroll Tax & Fringe	215,411	203,584	745	204,329	4,087	208,416
Salaries & Fringe Benefits	1,048,399	990,716	3,628	994,344	19,887	1,014,231
Medical Surgical Supplies	2,633	3,594	9	3,603	72	3,675
Lab Supplies	256,982	328,640	889	329,529	6,591	336,120
Pharmacuetical Supplies	350	312	1	313	6	319
Office Supplies	2,382	3,054	-	3,054	61	3,115
Books/Subscriptions/Dues	-	250	-	250	5	255
Travel/Meetings	3,043	3,349	-	3,349	67	3,416
Maintenance Contracts	34,808	44,000	-	44,000	880	44,880
Celebration/Food	180	350	-	350	7	357
Small Equipment	2,174	2,647	-	2,647	53	2,700
Total Non-Salary Expense	302,552	386,196	900	387,096	7,742	394,837
Total Expense	1,350,951	1,376,912	4,527	1,381,439	27,629	1,409,068
Contribution Margin	2,302,179	2,259,969	7,837	2,267,806	45,356	2,313,162
STATISTICS						
Contribution Margin Percent	63.0%	62.1%	63.4%	62.1%	0.0%	62.1%
Total FTEs	18.30	17.29	0.06	17.35	-	17.35
Hours per UOS	0.13	0.12	0.12	0.12	-	0.12
Revenue per UOS	12.64	12.51	12.36	12.51	-	12.76
Expense per UOS	4.67	4.74	4.53	4.73	-	4.83
Contribution per UOS	7.97	7.77	7.84	7.77	-	7.93

Table 33.11 is an example of a typical variance report for a laboratory division.

Cost variances can have several causes. Volume variances result from a change in the volume of services performed, either up or down. A flexible budget, described in the previous section, takes account of these variances. At the top of Table 33.11, you can see that volume is under budget by $1,797, or a little less than 1%. Price variances are due to a change in the price of a supply or service versus what was anticipated in the budget. In Table 33.11, laboratory supplies are budgeted at $1.13/UOS, but the actual cost is $0.89, a $0.24 favorable price variance. Quantity, or efficiency, variances represent differences in the amount of inputs (labor and/or supplies) used to produce each UOS. The budget in Table 33.11 considers 16,818 tests per FTE (290,784 tests divided by 17.29 FTEs), and the actual is only 15,792/FTE, so more employee hours are required than was budgeted, an unfavorable quantity variance that helps explain the unfavorable salary dollar variance.

Any variance can be broken down into one of three main causes: volume, price, or quantity. If the cause of the variance is understood, a manager can tailor the response rationally and appropriately. Analysis and reporting of variances are ongoing processes and should be conducted monthly in order to respond quickly. As with cost accounting, however, the effort should be justified by the information gained in the process. Normal random fluctuations will cause small variances, so it is useful to establish triggers to indicate when further investigation is warranted. Control charts, as illustrated in Fig. 33.7, are useful tools for this purpose. In this chart the budget monthly test volume serves as the median line. The upper and lower limits represent arbitrary figures that are 5% above and below the budgeted volume.

Table 33.11 Variance report

CATEGORY	FY12 ACTUAL	FY12 BUDGET	DOLLAR VARIANCE	PERCENT VARIANCE
VOLUME				
Inpatient Volume	155,415	159,897	(4,482)	-2.80%
Outpatient Volume	133,572	130,887	2,685	2.05%
Total Volume	288,987	290,784	(1,797)	-0.62%
REVENUE				
Inpatient Revenue	3,079,451	3,124,187	(44,736)	-1.43%
Outpatient Revenue	2,540,748	2,471,015	69,733	2.82%
Gross Patient Revenue	5,620,199	5,595,202	24,997	0.45%
Est Deductions from Revenue	(1,967,070)	(1,958,321)	(8,749)	0.45%
Net Patient Revenue	3,653,130	3,636,881	16,248	0.45%
EXPENSE				
Non-Productive Salary	95,979	84,823	11,156	13.15%
Productive Salary	726,993	686,298	40,695	5.93%
Overtime	10,016	16,011	(5,995)	-37.44%
Salaries	832,988	787,132	45,856	5.83%
Fringe	215,411	203,584	11,827	5.81%
Payroll Tax & Fringe	215,411	203,584	11,827	5.81%
Salaries & Fringe Benefits	1,048,399	990,716	57,683	5.82%
Medical Surgical Supplies	2,633	3,594	(961)	-26.74%
Lab Supplies	256,982	328,640	(71,658)	-21.80%
Pharmaceutical Supplies	350	312	38	12.26%
Office Supplies	2,382	3,054	(672)	-21.99%
Books/Subscriptions/Dues	-	250	(250)	-100.00%
Travel/Meetings	3,043	3,349	(306)	-9.14%
Maintenance Contracts	34,808	44,000	(9,192)	-20.89%
Celebration/Food	180	350	(170)	-48.57%
Small Equipment	2,174	2,647	(473)	-17.88%
Total Non-Salary Expense	302,552	386,196	(83,644)	-21.66%
Total Expense	1,350,951	1,376,912	(25,961)	-1.89%
Contribution Margin	2,302,179	2,259,969	42,209	1.87%
STATISTICS				
Contribution Margin Percent	63.0%	62.1%	0.9%	1.41%
Total FTEs	18.30	17.29	1.01	5.86%
Hours per UOS	0.13	0.12	0.01	6.51%
Revenue per UOS	12.64	12.51	0.13	1.07%
Expense per UOS	4.67	4.74	(0.06)	-1.28%
Contribution per UOS	7.97	7.77	0.19	2.50%

Variations in labor, which can be further analyzed, are important because labor costs constitute such a large portion of expenses. Both labor costs and hours can be divided into worked and paid categories. The duties of workers who are vacationing, attending conferences, sick, or injured must be assumed by others; the proportion of costs due to a reduction in worked versus paid time may be important for the organization. Worked time can be further subdivided into productive and nonproductive. The variance due to assuming the duties of staff who are attending a conference is considered nonproductive worked time. Only if such expenses are adequately identified and characterized can a rational decision be made as to whether they are justified by sufficient benefit to the organization. At the bottom of Table 33.11, one can see that in this example FTEs are over budget by 1.01, or 5.86%.

Laboratory productivity, defined as the UOSs produced divided by the laboratory inputs required to produce them (in either hours or cost), should be benchmarked against regional and national peers to gauge the laboratory efficiency of the organization. At the bottom of Table 33.11, you can see that for this example hours per UOS are over budget by 0.01, or 6.51%. This variance is caused by a combination of volume being slightly under budget and FTEs being over budget.

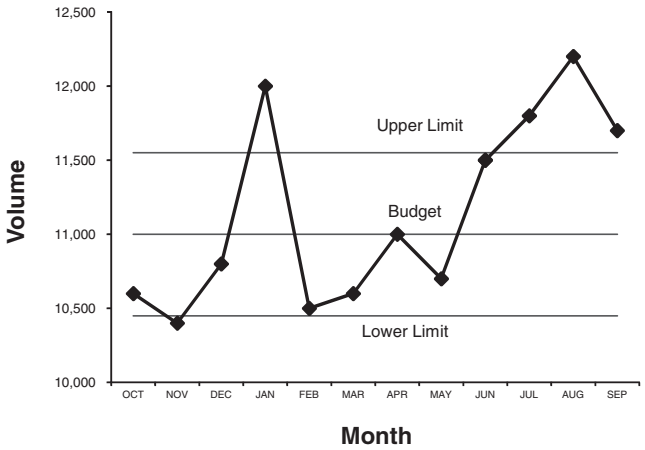


Figure 33.7 Volume control chart.
doi:10.1128/9781555817282.ch33.f7

Financial Statements

In the previous section, we discussed internal reporting and variance analysis, which management uses to control expenses and help make decisions. In this section, we turn to external reporting of an organization's finances. The various groups of people interested in the financial health of an organization include stockholders who have invested in the company (or potential stockholders), creditors who might loan the company money, and government agencies that regulate the company. Management itself also uses financial statements to help monitor the activities of the firm.

The three primary financial statements are the balance sheet, the income statement, and the cash flow statement. The balance sheet (Table 33.12) is a snapshot of a firm's financial position at a particular point. It has two sections: assets and equities. Assets are economic resources that are expected to benefit the company's activities. Equities are claims against or interests in the assets. Equities are divided into liabilities and owners' equity. Liabilities are economic obligations of the organization. Owners' equity (usually called stockholders' equity) is the ownership

Table 33.12 Balance sheet for an organization as of September 2012

Assets / Liabilities & Stockholder Equity	Sept 30 2011		Sept 30 2012	
ASSETS				
Current Assets				
Cash	15,000,000		13,200,000	
Short-Term Investments	50,000,000		42,000,000	
Accounts Receivable	140,000,000		145,000,000	
Contractual Allowance Reserve	(60,000,000)		(62,000,000)	
Inventories	5,000,000		5,500,000	
Prepaid Expenses	2,000,000	152,000,000	1,500,000	145,200,000
Fixed Assets				
Equipment	300,000,000		320,000,000	
Furniture & Fixtures	150,000,000		160,000,000	
Leasehold Improvements	200,000,000		205,000,000	
Accumulated Depreciation	(400,000,000)	250,000,000	(419,000,000)	266,000,000
Other Assets		7,000,000		7,500,000
Total Assets		409,000,000		418,700,000
LIABILITIES & STOCKHOLDER EQUITY				
Current Liabilities				
Accounts Payable	8,000,000		7,000,000	
Accrued Expenses	20,000,000		19,000,000	
Short-Term Portion of Notes Payable	5,000,000	33,000,000	4,500,000	30,500,000
Long-Term Liabilities				
Capital Lease Obligations	1,000,000		750,000	
Long-Term Portion of Notes Payable	90,000,000	91,000,000	85,000,000	85,750,000
Stockholder Equity				
Common Stock	185,000,000		185,000,000	
Retained Earnings	100,000,000	285,000,000	117,450,000	302,450,000
Total Liabilities & Stockholder Equity		409,000,000		418,700,000

claim against the total assets. Balance sheet account balances carry over from year to year, whereas income statement account balances start from zero at the beginning of each new fiscal year.

The income statement in Table 33.13 reports the results of a firm's operations over a period of time by matching its revenues to its expenses, while the cash flow (CF) statement in Table 33.14, also called the statement of changes in financial position, reports the impact of operating, investing, and financing activities over a period of time. Its purpose is to present the results of financial management, as opposed to the operating management reflected in the income statement.

Financial Ratios

Several key indicators, expressed as ratios, can help us understand the financial health of an organization as represented in its statements. There are four categories of financial ratios:

- Liquidity ratios measure the ability of a firm to meet its immediate obligations, i.e., the relationship

Table 33.13 Income and expense statement for an organization, year-to-date September 2012

Revenue & Expenses	YTD Actual	YTD Budget	YTD Variance	Percent Variance
REVENUES				
Patient Service Revenue				
Inpatient Revenue	250,000,000	260,000,000	(10,000,000)	-3.85%
Outpatient Revenue	120,000,000	105,000,000	15,000,000	14.29%
Physician Revenue	170,000,000	160,000,000	10,000,000	6.25%
Total Patient Service Revenue	540,000,000	525,000,000	15,000,000	2.86%
Deductions From Revenue				
Blue Cross	26,000,000	25,000,000	1,000,000	4.00%
Medicare	58,000,000	57,000,000	1,000,000	1.75%
Medicaid	16,000,000	16,000,000	-	0.00%
Commercial	26,000,000	25,000,000	1,000,000	4.00%
Managed Care	25,000,000	25,000,000	-	0.00%
Contractual Allowance Reserve	9,500,000	9,500,000	-	0.00%
Total Deductions From Revenue	160,500,000	157,500,000	3,000,000	1.90%
Net Patient Service Revenue	379,500,000	367,500,000	12,000,000	3.27%
Other Revenue	10,000,000	9,500,000	500,000	5.26%
Total Revenue	389,500,000	377,000,000	12,500,000	3.32%
EXPENSES				
Salary & Fringe				
Physician Salary	60,000,000	59,500,000	500,000	0.84%
Staff Salary	125,000,000	124,000,000	1,000,000	0.81%
Physician Fringe	18,000,000	17,850,000	150,000	0.84%
Staff Fringe	31,250,000	31,000,000	250,000	0.81%
Total Salary & Fringe	234,250,000	232,350,000	1,900,000	0.82%
Medical Supplies	30,000,000	28,500,000	1,500,000	5.26%
Pharmaceuticals	15,000,000	14,000,000	1,000,000	7.14%
Utilities	8,000,000	7,500,000	500,000	6.67%
Insurance	7,000,000	6,500,000	500,000	7.69%
Purchased Service	14,000,000	14,000,000	-	0.00%
Other Expenses	28,000,000	27,500,000	500,000	1.82%
Depreciation	19,000,000	19,000,000	-	0.00%
Interest Expense	5,000,000	5,500,000	(500,000)	-9.09%
Provision for Bad Debt	16,000,000	15,750,000	250,000	1.59%
Total Expense	376,250,000	370,600,000	5,650,000	1.52%
Income From Operations	13,250,000	6,400,000	6,850,000	107.03%
NON-OPERATING GAINS				
Non-Operating Gains				
Unrestricted Gifts	400,000	500,000	(100,000)	-20.00%
Investment Income	12,000,000	13,000,000	(1,000,000)	-7.69%
Income from Affiliates	(200,000)	100,000	(300,000)	-300.00%
Unrealized Gain/Loss	(8,000,000)	(5,000,000)	(3,000,000)	60.00%
Total Non-Operating Gains	4,200,000	8,600,000	(4,400,000)	-51.16%
Revenue & Gains in Excess of Expenses	17,450,000	15,000,000	2,450,000	16.33%

Table 33.14 Cash flow statement for an organization, September 2012

CASH FLOWS FROM OPERATING ACTIVITIES & GAINS	
Revenue & Gains in Excess of Expenses	17,450,000
Depreciation & Amortization	19,000,000
Unrealized Gain/Loss	8,000,000
Decrease (Increase) in Accounts Receivable	(5,000,000)
Decrease (Increase) in Inventories	(500,000)
Increase (Decrease) in Contractual Allowance Reserve	2,000,000
Increase (Decrease) in Accounts Payable	(1,000,000)
Increase (Decrease) in Accrued Expenses	(1,000,000)
Net Cash Flow Provided by Operating Activities & Gains	38,950,000
CASH FLOWS FROM INVESTING ACTIVITIES	
Purchase of Fixed Assets	(35,000,000)
Increase (Decrease) in Notes Payable	(5,500,000)
Increase (Decrease) in Capital Lease Obligations	(250,000)
Increase (Decrease) in Common Stock	-
Net Cash Provided by Investing Activities	(40,750,000)
Cash at Beginning of Reporting Period - 09/30/2011	15,000,000
Cash at End of Reporting Period - 09/30/2012	13,200,000

between a firm's cash and other current assets to its current liabilities.

- Asset management, or activity, ratios measure how effective a firm is at managing its assets.
- Debt management, or leverage, ratios measure both the extent to which the firm is financed with borrowing and its likelihood of defaulting on its debt obligations.
- Profitability ratios measure the combined effects of liquidity, asset management, and debt management policies on operating results.

Although the financial ratio values themselves, or their trends over time, provide useful information, their greater value comes from comparing them to industry averages. As an example, the automotive industry, with its well-established firms, will have a very different financial structure than firms in the Internet industry. A negative profitability ratio in the automotive industry would be viewed as a sign of poor financial health, but in the Internet industry it may not be viewed this way (or, at least, so it was once thought). Table 33.15 shows the financial ratios for the financial statements shown in Tables 33.12 through 33.14.

Summary

In this chapter, we began with cost accounting and discussed the types and behaviors of costs. Direct costs are clearly associated with the item being costed, while all other costs are indirect. The behavior of costs relative to changes in volume can be variable (in direct proportion to volume) or fixed (constant regardless of volume) or some combination thereof. We reviewed how to measure full cost and how it differs from marginal cost, which is the change in total cost relative to a change in volume. An extensive costing example showed what data are needed to generate a cost analysis and how to cost a basic laboratory test.

Understanding the relationships among cost, volume, and profits allowed us to calculate contribution margin—the revenue per UOS less its marginal cost—and break-even point, which is total fixed cost divided by the contribution margin per UOS. These concepts were applied to an equipment purchase and to evaluating a capitation contract. The equipment purchase decision was then augmented by applying time value of money concepts to capital acquisition plans using the NPV and IRR calculations. These techniques allow for acquisitions with different future cash flow patterns to be compared in today's dollars. We looked at purchasing versus leasing and compared two pieces of equipment using these techniques.

We then turned to the budget process and reviewed the three common types of budgets: the operating budget (which consists of a statistical, or volume, budget; a revenue budget; and an expense budget), the capital budget, and the cash budget. We learned the concepts of FTE and UOS, two key building blocks in budget development. We walked through the 10 steps of the budgeting process and illustrations of staffing and budget worksheets. With the budget as the baseline, we looked at management reporting and how to analyze the causes of differences in actual financial performance from budgeted amounts. We broke variances down into one of three causes: volume, price, or quantity variances. Finally, we discussed the importance of understanding which factor is responsible in order to direct the manager's response.

Table 33.15 Ratio analysis for an organization, September 2012

Financial Ratios	Equation	September 30, 2011			September 30, 2012			Industry Average
LIQUIDITY RATIOS								
Current Ratio	Current Assets / Current Liabilities	152,000,000 / 33,000,000	=	4.6	145,200,000 / 30,500,000	=	4.8	4.0
Quick Ratio	Cash + Accts Receivable / Current Liabilities	95,000,000 / 33,000,000	=	2.9	96,200,000 / 30,500,000	=	3.2	3.0
ACTIVITY RATIOS								
Days in A/R	Accts Receivable X 365 / Sales	51,100,000,000 / 370,000,000	=	138	52,925,000,000 / 389,500,000	=	136	140
Days Cash on Hand	Cash + ST Investments / (Expense - Deprec) / 365	65,000,000 / 957,397	=	68	55,200,000 / 978,767	=	56	52
DEBT MANAGEMENT RATIOS								
Debt Ratio	Total Liabilities / Total Assets	124,000,000 / 409,000,000	=	30.32%	116,250,000 / 418,700,000	=	27.76%	35.00%
Times Interest Earned	Net Profit Before Interest / Interest Expense	10,150,000 / 5,000,000	=	2.0	12,450,000 / 5,000,000	=	2.5	1.5
PROFITABILITY RATIOS								
Return on Total Assets	Net Profit / Total Assets	15,150,000 / 409,000,000	=	3.70%	17,450,000 / 418,700,000	=	4.17%	3.50%
Return on Stockholder Equity	Net Profit / Stockholder Equity	15,150,000 / 285,000,000	=	5.32%	17,450,000 / 302,450,000	=	5.77%	7.00%
Return on Permanent Capital	Net Profit / Equity + LT Liabilities	15,150,000 / 376,000,000	=	4.03%	17,450,000 / 388,200,000	=	4.50%	4.00%
Profit Margin	Net Profit / Sales Revenue	15,150,000 / 370,000,000	=	4.09%	17,450,000 / 389,500,000	=	4.48%	6.00%

We learned about the three primary financial statements: The balance sheet is a snapshot of the company's financial condition at a given point in time and is a cumulative statement; the income statement reports the results of the company's operations over a period of time; the cash flow statement presents the results of financial, as opposed to operating, management of the company. We used four types of financial ratios to reveal information about an organization's financial health from its financial statements: liquidity ratios, asset management ratios, debt management ratios, and profitability ratios. Ratios are best used in comparison to other companies in the same industry.

KEY POINTS

- Cost accounting is an important tool for controlling expenses and making good resource allocation decisions.
- Marginal costs and the break-even point are relevant when considering taking on additional work.
- Capital investments, such as equipment purchases, require an NPV approach to decision making.
- Budget creation and monitoring should be vested in the managers responsible for implementing the changes that affect the budget.
- Regular variance analysis, especially in regard to labor, is critical to managing within a budget.
- Financial statements and their corollary financial ratios are useful for benchmarking against other organizations in the same industry.

GLOSSARY

Accounts receivable Money that is owed to the firm by outsiders.

Accrual accounting System that records revenue and expenses as they occur.

Asset (and asset accounts) The resources owned or used by the firm.

Asset management ratios Measure of how effective the firm is at managing its assets.

Average cost Full cost divided by the unit of service.

Bad debt Recorded as an expense for gross charges that are deemed uncollectable from self-payors.

Balance sheet Shows assets on the left side and liabilities or claims against assets on the right side. The balance sheet shows a firm's financial position at a particular point in time.

Break-even point The level of activity at which revenue and total costs are exactly equal.

Capital The cash required to purchase the firm's property, plant, and equipment.

Capital budget The financial plan for the acquisition of capital assets.

Capital lease A lease in which the firm retains ownership of the asset at the end of the lease period.

Capitation A reimbursement mechanism in which the service provider receives a fixed payment based on the number of covered lives. The payment does not fluctuate with the level of activity.

Cash accounting Records revenue and expenses when the cash has either been paid out or collected.

Cash budget The cash management plan for how the operational and capital budgets will be supported.

Cash flow (CF) Cash revenues less cash expenses; excludes noncash expenses such as depreciation.

Cash flow statement Reports the impact on cash flow of a firm's operating, investing, and financing activities over a period of time.

Contractual allowances Discounts on gross charges given to third-party payors who have a negotiated contract with the billing provider.

Contribution margin The excess of revenue over variable costs.

Cost accounting A system of measuring and reporting information about cost.

Debt management ratios Measure of both the extent to which the firm is financed with borrowing and its likelihood of defaulting on its debt obligations.

Depreciation An annual charge of an asset's cost into each year of the asset's useful life, for assets that have a useful life of greater than 1 year.

Direct allocation Allocates costs of each service department directly and only to revenue-producing responsibility centers.

Direct cost A cost that can be traced to, or caused by, a particular service, product, segment, or activity of the department.

Discount rate The rate used to calculate the present value of future cash flows.

Equity Claims against, or interests in, the assets of a company; divided into liabilities and owners' equity.

Expense budget The amount of resources that will be required to produce the forecasted activity.

Fiscal year The year on which the general ledger is based. It can be different from the calendar year. The fiscal year used by a firm is usually based on the norm of the industry to which it belongs.

Fixed budget A budget in which the budgeted amounts do not fluctuate with the volume.

Fixed costs Costs whose total remains constant regardless of changes in level of activity.

Flexible budget A budget in which the variable portion of the budget fluctuates with the level of volume.

Full-time equivalent (FTE) The proportion of an employee's paid hours per year to the standard labor measure, which is typically 2,080 h (5 days $\times$ 8 h $\times$ 52 weeks per year).

Fund accounting A form of accounting in which revenues and expenses must always be equal and expenses are stopped when revenue is exhausted.

Future value (FV) The amount to which a given amount of cash will grow at the end of a given period of time when compounded at a given rate of interest.

General ledger The system that records all accounting activity.

Income statement Reports the financial results of a firm's operations over a period of time.

Incremental budgeting Uses prior year results as a basis for building the current year budget.

Indirect cost A cost that cannot be traced to a particular service, product, segment, or activity.

Interest rate The amount charged by lending institutions for the use of the money borrowed by a firm.

Internal rate of return (IRR) The rate that equates the present value of a project's expected cash inflows to the present value of the project's costs.

Liabilities (and liability accounts) The debts or obligations owed to outsiders.

Liquidity ratios Measure of the firm's ability to meet its immediate obligations; thus, the relationship between a firm's current assets and its current liabilities.

Long-term debt The firm's obligations that are due after more than a year.

Management reporting A process of communicating actual versus budgeted performance throughout the organization to identify necessary corrective actions and help make decisions.

Marginal cost The change in total cost relative to the change in volume, i.e., the cost of producing one more unit of service; incremental cost.

Net present value (NPV) The present value of future net cash flows, discounted at the cost of capital.

Nonproductive time Paid time for non-job-related activities such as vacation, holidays, and sick time.

Operating budget The financial plan for managers with direct responsibility for managing the operations of a responsibility center(s). The operating budget is made up of a statistical budget, a revenue budget, and an expense budget.

Overhead costs Costs that are from non-revenue-generating departments.

Owners' equity The ownership claim against the total assets of a company (also called stockholders' equity).

Present value (PV) The value today of a future cash flow.

Price variance The difference between the price of a supply or service versus the price that was budgeted.

Productive time Paid time for job-related activities.

Profitability ratios Measure of the combined effects of liquidity, asset management, and debt management policies on operating results.

Quantity variance The difference between the amount of inputs (labor and/or supplies) used to produce each unit of service versus the quantity that was budgeted.

Required rate of return Known as the hurdle rate or cost of capital, it represents the minimum return on investment a firm requires on capital expenditures.

Revenue budget The revenue that will be generated by the forecasted activity for a responsibility center.

Semi-variable costs Costs that include both variable and fixed-cost elements.

Standard cost A measure of how much an item should cost, rather than a record of how much it actually did.

Statistical budget The forecast of activity for a responsibility center.

Step-down allocation Distributes the costs of the service departments providing the most services to all departments. All remaining service departments' costs are then allocated in descending order determined by the amount of service they render.

Step-fixed costs Costs that are fixed over a range of activity and are then increased when activity levels go up.

Stockholder equity accounts The difference between a firm's assets and liabilities (claims against assets). The accounts are reported on the balance sheet and have natural credit balances.

Time value of money A concept that recognizes that a dollar of cash today is worth more than a dollar of cash to be received at some time in the future.

Unit of service (UOS) The logical measure of work for a given area. In the laboratory, it is usually the number of billed tests or procedures performed.

Variable costs Items of cost that vary, in total, directly, and proportionately with volume or level of activity changes.

Variance analysis The process of analyzing differences in actual versus budgeted performance to identify necessary corrective actions and help make decisions.

Volume variance The difference between the volume of services performed versus the volume that was budgeted.

Write-offs Recorded reductions in revenue for gross charges that are deemed uncollectable from third-party payors.

Zero-based budgeting A budgeting methodology in which every expenditure must be justified regardless of the prior year's results.

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