Budgeting and Decision Making

Larry M. Walther; Christopher J. Skousen

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Budgeting and Decision Making

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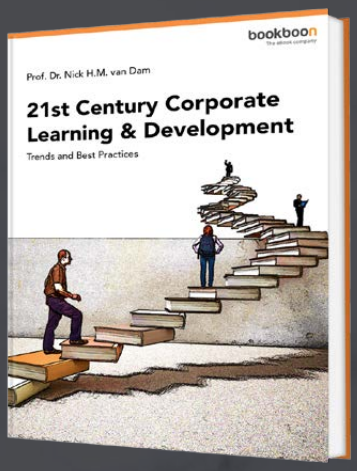

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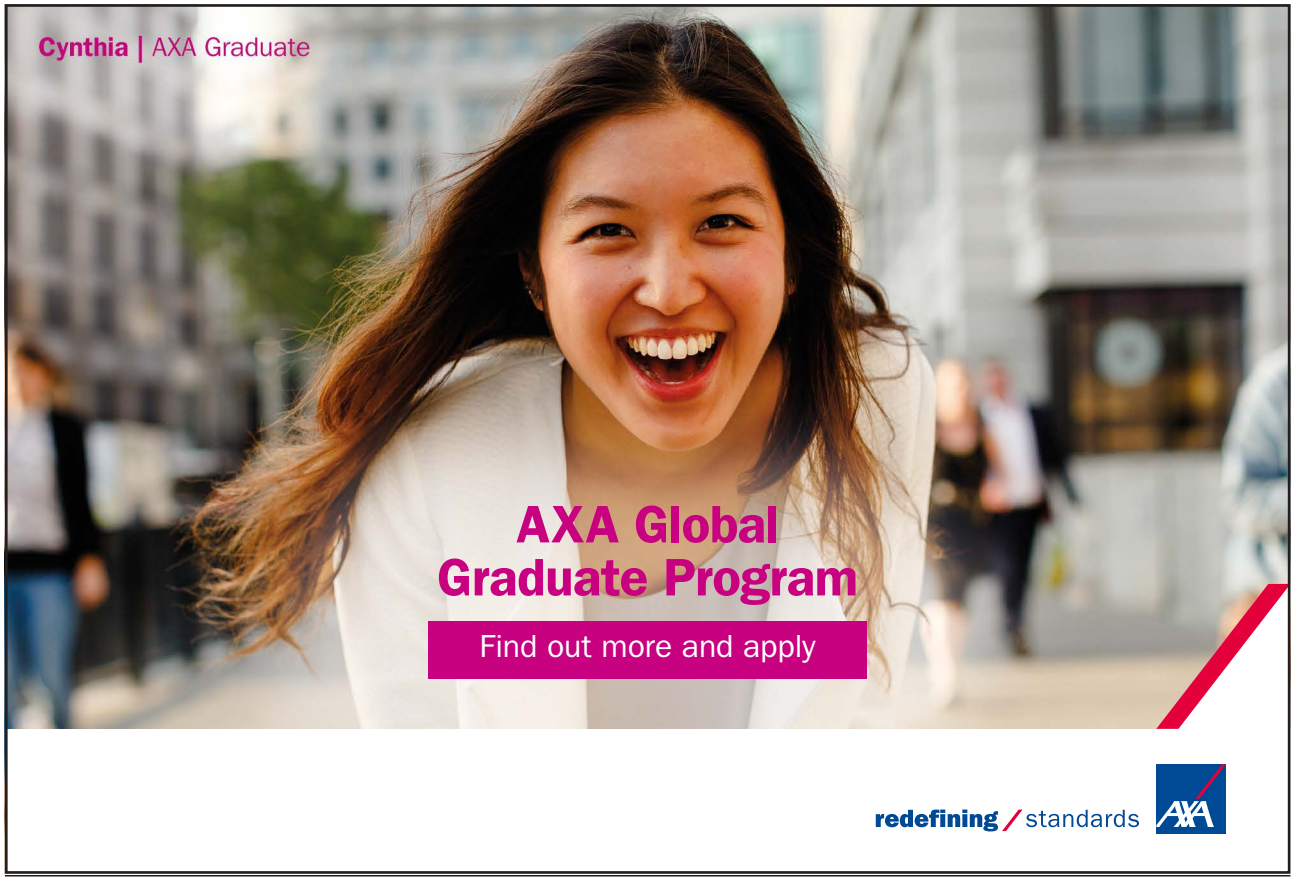

Budgeting: Planning for Success

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Part.1 Budgeting: Planning for Success

Your goals for this "budgeting" chapter are to learn about:

- The importance and use of budgets within an organization.
- The budget process and the impact of human behavior.
- The various components of a master budget.
- Budget periods and budget adjustments.

1. Importance of Budgets

In beginning to write this chapter, I tried to find words to "sugar coat" the title. Perhaps the word "budget" could be avoided altogether. Words like "financial map" or "operational guide" might be suitable alternatives. After all, for those of you already in the workforce, you probably associate the word "budget" with "dread" or "drudgery" or some other less than flattering term. No doubt, some employees will question the need for a budget. The process of budget preparation is sometimes seen as painful, and it is not always clear how the effort that is required leads to any productive output. Furthermore, budgets can be seen as imposing constraints that are hard to live with, and establishing goals that are hard to meet!

Despite the rather dismal introductory remarks, it is imperative that organizations carefully plan their financial affairs to achieve financial success. These plans are generally expressed as "budgets." A budget is a detailed financial plan that quantifies future expectations and actions relative to acquiring and using resources. Budgets don't guarantee success, but they certainly help to avoid failure.

1.1 Forms and Functions

Budgets can take many forms and serve many functions. Budgets can provide the basis for detailed sales targets, staffing plans, inventory production, cash investment/borrowing, capital expenditures (for plant assets, etc.), and on and on. Budgets provide benchmarks against which to compare actual results and develop corrective measures. Budgets give managers "preapproval" for execution of spending plans. Budgets allow managers to provide forward looking guidance to investors and creditors. Budgets are necessary to convince banks and other lenders to extend credit

Medium and larger organizations invariably rely on budgets. This is equally true in businesses, government, and not-for-profit organizations. The budget provides a formal quantitative expression of expectations. It is an essential facet of the planning and control process. Without a budget, an organization will be highly inefficient and ineffective. Let's consider a "case study" into the importance of budgeting.

1.3 An Electrifying Case in Budgeting

Imagine that you have just been appointed as general manager of a newly constructed power plant. Further imagine that you have considerable flexibility in running all facets of the plant. But, your compensation and ultimately your job will depend on the financial success of the venture. What is one of the first tasks you will undertake? Think about this question for a few minutes . . . .

You have probably concluded that you need to quickly get a handle on the finances of the business. Your mind likely raced over a number of daunting challenges. How many customers will be served? What are the peak load electricity needs for these customers? What rate can be charged and will it be enough to cover expenses? How much fuel will be necessary to produce the electricity? How many employees must be available? Will the cash supply always be sufficient to meet cash outflow requirements? Furthermore, once the answers to these questions are in hand, how will actions be executed and controlled? In other words, once you decide how much fuel is needed, how will you make sure it is actually purchased (and no more!)? Once you conclude on the staffing plan, how do you put it in place? What will you do about expected periods of cash shortages?

Perhaps the above is simply too much to deal with. Let's assume you decide instead to spend all your time on marketing and personnel management. You join every possible community organization to get the word out about your company. You engage in countless publicity efforts. You attend every employee event, and you get to know most every employee on a personal level. In short, you do a marvelous job of selling electricity and motivating the employees to pull together as a cohesive caring team. Let's assume your efforts sold lots and lots of electricity! Unfortunately, the sales growth was such that the local natural gas pipeline could not deliver enough fuel to your plant to meet your demand. This caused you to truck in more expensive fuel oils to produce the electricity. In addition, the Transmission Department ordered a huge supply of replacement transformers just in case there was a bad electrical storm. Unfortunately, there was an ice storm and the Transmission Department did not have funds to acquire replacement wires that were destroyed. Your suppliers became concerned, as they sensed that your revenues might be inadequate to cover the added fuel cost and down-time due to the ice storm. As a result, vendors began to insist on shortened payment terms, thereby crunching the company's cash supply. To solve this problem, it was necessary to reduce the workforce, which generated ill will among all employees who now

2. Budget Processes and Human Behavior

A comprehensive budget usually involves all segments of a business. As a result, representatives from each unit are typically included throughout the process. The process is likely to be spearheaded by a budget committee consisting of senior level personnel. Such individuals bring valuable insights about all aspects of sales, production, and other phases of operations. Not only are these individuals ideally positioned to provide the best possible information relative to their respective units, they also need to be present to effectively advocate for the opportunities and resource needs within their unit.

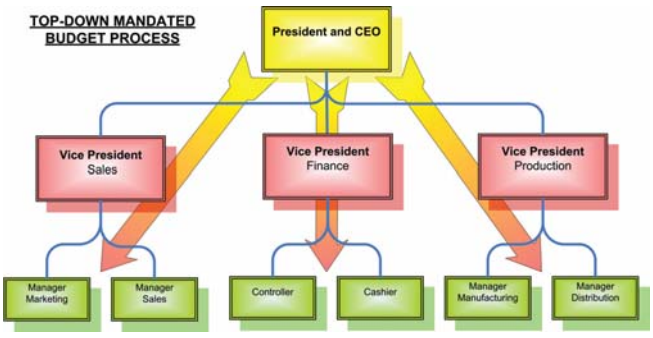
The budget committee's work is not necessarily complete once the budget document is prepared and approved. A remaining responsibility for many committees is to continually monitor progress against the budget, and potentially recommend mid-course corrections. The budget committee's decisions can greatly impact the fate of specific business units, in terms of resources made available as well as setting the benchmarks that will be used to assess performance. As a result, members of the budget committee will generally take their task very seriously.

2.1 Budget Construction

The budget construction process will normally follow the organizational chart. Each component of the entity will be involved in preparing budget information relative to its unit. This information is successively compiled together as it is passed up through the organization until an overall budget plan is achieved. But, beyond the data compilation, there is critical difference in how budgets are actually developed among different organizations. Some entities follow a top-down, or mandated approach. Others utilize a bottom-up, or participative philosophy.

2.2 Mandated Budgets

Some entities will follow a top-down mandated approach to budgeting. These budgets will begin with upper level management establishing parameters under which the budget is to be prepared. These parameters can be general or specific. They can cover sales goals, expenditure levels, guidelines for compensation, and more. Lower-level personnel have very little input in setting the overall goals of the organization. The upper-level executives call the shots, and lower-level units are essentially reduced to doing the basic budget calculations consistent with directives. Mid-level executives may color the budget process by refining the leadership directives as the budget information is passed down through the organization.



Operations and responsibilities are normally divided among different segments and managers. This introduces the concept of "responsibility accounting." Under this concept, units and their managers are held accountable for transactions and events under their direct influence and control. Budgets should provide sufficient detail to reflect anticipated revenues and costs for each unit. This philosophy pushes the budget down to a personal level, and mitigates attempts to pass blame to others. Without the harsh reality of an enforced system of responsibility, an organization will quickly become less efficient. Now, deviations do not always suggest the need for imposition of penalties. Poor management and bad execution are not the only reasons things don't always go according to plan. But, deviations should be examined and unit managers need to explain/justify them.

Money is a scarce resource. Within most organizations it becomes very common for managers to argue and compete for allocations of limited resources. Each business unit likely has employees deserving of compensation adjustments, projects needing to be funded, equipment needing to be replaced, and so forth. This naturally creates strain within an organization, as the sum of the individual resource requests will usually be greater than the available pool of funds. Successful managers will learn to make a strong case for the resources needed by their unit. But, successful managers also understand that their individual needs are subservient to the larger organizational goals. Once the plan for resource allocation is determined, a good manager will close ranks behind the overall plan and move ahead to maximize results for the overall entity. Personal managerial ethics demands loyalty to an ethical organization, and success requires team work. Here, the budget process is the device by which the greater goals are mutually agreed upon, and the budget reflects

The bottom-up participative approach is driven by involving lower-level employees in the budget development process. Top management may initiate the budget process with general budget guidelines, but it is the lower-level units that drive the development of budgets for their units. These individual budgets are then grouped and regrouped to form a divisional budget with mid-level executives adding their input along the way. Eventually top management and the budget committee will receive the overall plan. As you might suspect, the budget committee must then review the budget components for consistency and coordination. This may require several iterations of passing the budget back down the ladder for revision by lower units. Ultimately, a final budget is reached.

The participative budget approach is viewed as self-imposed. As a result, it is argued that it improves employee morale and job satisfaction. It fosters the "team-based" management philosophy that has proven to be very effective for modern organizations. Furthermore, the budget is prepared by those who have the best knowledge of their own specific areas of operation. This should allow for a more accurate budget; in any event, it certainly removes one of the primary excuses that is used to explain why a particular budget was not met!

On the negative side of the equation, a bottom-up approach is generally more time consuming and expensive to develop and administer. This occurs because of the iterative process needed for its development and coordination. Another potential shortcoming has to do with the fact that some managers may try to "pad" their budget, giving them more room for mistakes and inefficiency. More will be said about this problem shortly, but it is particularly problematic with a highly participative approach.

2.4 Blended Approach

Theoretically the budget process can be portrayed as top-down or bottom-up. But, the reality is that most budgets are prepared with a blended approach where information is passed both ways.

2.5 Organizational Structure Considerations

It is very important for managers at all levels to understand how information is transformed as it passes through an organization. Review the preceding graphics, this time noting how the top-down arrows change from yellow to pink as they pass through the middle-level leadership. Conversely, the arrows in the bottom-up approach morph from green to pink as they pass through the middle level managers. As budget information is transferred up and down an organization, the "message" will inevitably be influenced by the beliefs and preferences of the communicators. There is always a chance that information can be so transformed as to lose its original intent. Top management can lose touch with information originating on the front line, and front-line employees may not always get a clear picture of the goals and objectives originating with senior management.

2.6 Flattening the Organization Chart

There are staggering differences in the organization charts of different entities. Business growth is a natural incubator for expansion of the number of levels within an organization; as a result, great care must be taken to preserve the efficiency and effectiveness of growing entities. Sometimes the very attributes that contribute to growth can be undone by the growth itself. The charts of some entities

consume many pages and involve potentially dozens of "levels." Other companies may have worked to "flatten" their organizational chart to minimize the number of links in the chain of command. While these endeavors are often seen as attempts to reduce the cost of middle-level management, the overriding issue is to allow top management more clear and direct access to vital information originating with front-line employees (and vice versa). In addition to focusing on revenues and costs, the budget process should also be taken as an opportunity for continuous monitoring of the organizational structure of an entity.

2.7 Budget Estimation

One thing is sure, no one can see the future. And, budgets clearly involve a good deal of forward looking prognostication. As a result, a certain amount of error is inevitable. Accordingly, it is easy to slip into a trap of becoming cavalier about the estimates that form the basis for a budget. This should be avoided. Budget estimates should be given careful consideration. They should have a basis in reason and logically be expected to occur. Haphazardness should be replaced by study and statistical evaluation of historical information, as this provides a good starting point for predictions. Changing economic conditions and trends need to be carefully evaluated.

2.8 Slack and Padding

Because budgets frequently form an important part of performance evaluation, human behavior suggests that participants in the budget process are going to try to create "breathing room" for themselves by overestimating expenses and underestimating sales. This deliberate effort to affect the budget is known as creating "budget slack" or "padding the budget." This is done in an attempt to create an environment where budgeted goals are met or exceeded. However, this does little to advance the goals of the organization.

When slack is introduced into a budget, employees may fail to maximize sales and minimize costs. For example, once it is clear that budgeted sales goals will be met, there may be a reduction in incentive to push ahead. In fact, there may be some concern about beating sales goals within a period for fear that a new higher benchmark will be established that must be exceeded in a subsequent period. This can result in a natural desire to push pending transactions to future periods. Likewise, padding the planned level of expenses can actually provide incentive to overspend, as managers fear losing money in subsequent budgets if they don't spend all of the currently budgeted funds. This has the undesirable consequence of encouraging waste.

2.9 Zero-Based Budgeting

The problem of budgetary slack is particularly acute when the prior year's budget is used as the starting point for preparing the current budget. This is called "incremental" budgeting. It is presumed that established levels from previous budgets are an acceptable baseline, and changes are made based on new information. This usually means that budgeted amounts are incrementally increased. The alternative to incremental budgeting is called "zero-based budgeting."

With zero-based budgeting, each expenditure item must be justified for the new budget period. No expenditure is presumed to be acceptable simply because it is reflective of the status quo. This

approach may have its genesis in governmental units that struggle to control costs. Governmental units usually do not face a market test; they rarely fail to exist if they do not perform with optimum efficiency. Instead, governmental entities tend to sustain their existence by passing along costs in the form of mandatory taxes and fees. This gives rise to considerable frustration in trying to control spending. Some governmental leaders push for zero-based budgeting concepts in an attempt to filter necessary services from those that simply evolve under the incremental budgeting process.

Business entities may also utilize zero-based budgeting concepts to reexamine each expenditure each budget cycle. While this is good in theory, zero-based budgeting can become very time consuming and expensive to implement. In business, the opportunity for gross inefficiency is kept in check by market forces, and there may not be sufficient savings to offset the cost of a serious zero-based budgeting exercise. Nevertheless, business managers should be familiar with zero-based budgeting concepts as one tool to identify and weed out budgetary slack. There is nothing to suggest that every unit must engage in zero-based budgeting every year. Instead, a rolling schedule that thoroughly reexamines each unit once every few years may provide a cost effective alternative.

2.10 The Impossible Budget and Employee Capitulation

At the opposite end of budgetary slack is the phenomena of unattainable budget standards. If employees feel that budgets are not possibly achievable, they may become frustrated or disenchanted. Such a condition may actually reduce employee performance and morale. Good managers should be as alert to this problem as they are to budgetary slack. Suffice it to say that preparing a budget involves more than just number crunching; there is a fair amount of organizational psychology that a good manager must take into account in the process.

2.11 Ethical Challenges in Budgeting

You also need to know that many financial reporting frauds have their genesis in overly optimistic budgets that subsequently lead to an environment of "cooking the books" to reach unrealistic goals. These events usually start small, with the expectation that time will make up for a temporary problem. The initial seemingly harmless act is frequently followed by an ever escalating pattern of deception that ultimately leads to collapse.

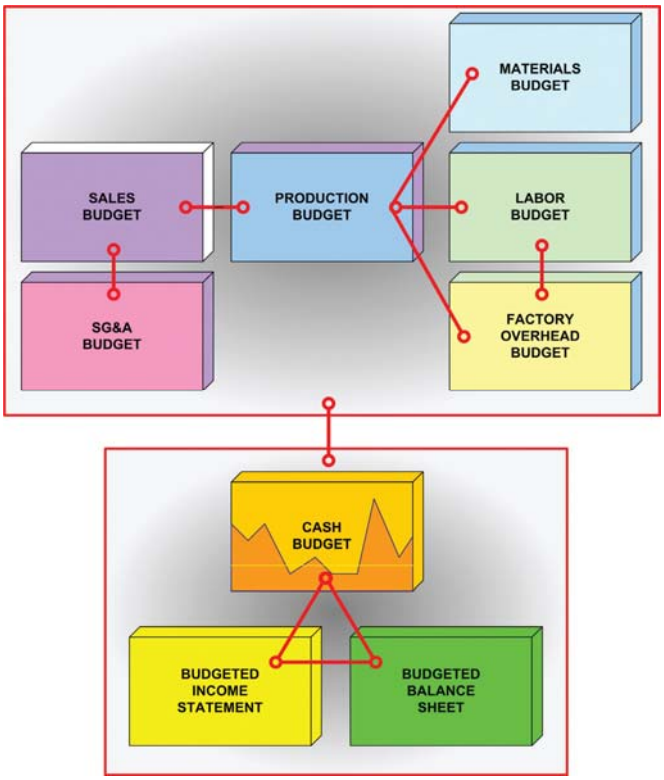
To maintain organizational integrity, senior-level managers need to be careful to provide realistic budget directives. Lower-level managers need to be truthful in reporting "bad news" relative to performance against a budget, even it they find fault with the budget guidelines. All too often, the carnage that follows a business collapse will be marked by management claims that they were misled by lower-level employees who hid the truth. And, lower-level employees will claim that they were pressured by management to hide the truth. Undoubtedly, someone reading these words today will find themselves facing this very challenge during their career. Be wise, and resolve that you will avoid the snare of this all too common destructive trap!

3. Components of the Budget

Business processes are highly complex and require considerable effort to coordinate. Managers frequently cite coordination as one of the greatest leadership challenges. The comprehensive or "master" budget is an essential part of the coordinating effort. Such budgets consist of many individual building blocks that are tied together in logical harmony, and reflect the financial plan for the entire organization. Careful articulation is essential.

The starting point for the master budget is an assessment of anticipated sales via the sales budget. The expected sales level drives both the production plans and the selling, general, and administrative budget. Production drives the need for materials and labor. Factory overhead may be applied based on labor, but it is ultimately driven by overall production. The upper portion of the following graphic is a simplified illustration of these budget building blocks. Notice that the background colors of each block reflect dependency on another budget (i.e., the production and SG&A budget blocks each have a purple background because they are derivatives of the purple sales budget).

The lower portion of the graphic illustrates that the planned business activities must be considered in terms of their cash flow and financial statement impacts. It is quite easy to plan production that can outstrip the resources of a company. In addition, a business should develop plans that have a successful outcome; the budgeted financial statements are key measures of that objective.



It would be very easy to expand the illustration to reflect additional interactions and budgets (e.g., the coordination of a long-term capital spending budget). However, the graphic would start to resemble the organization chart that was steam rolled earlier in this chapter. Little educational value would be derived by such a complex illustration. Instead, the point is to make it clear that comprehensive budgeting entails coordination and interconnection of various components. Next is a detailed illustration showing how these budget concepts are put into operation.

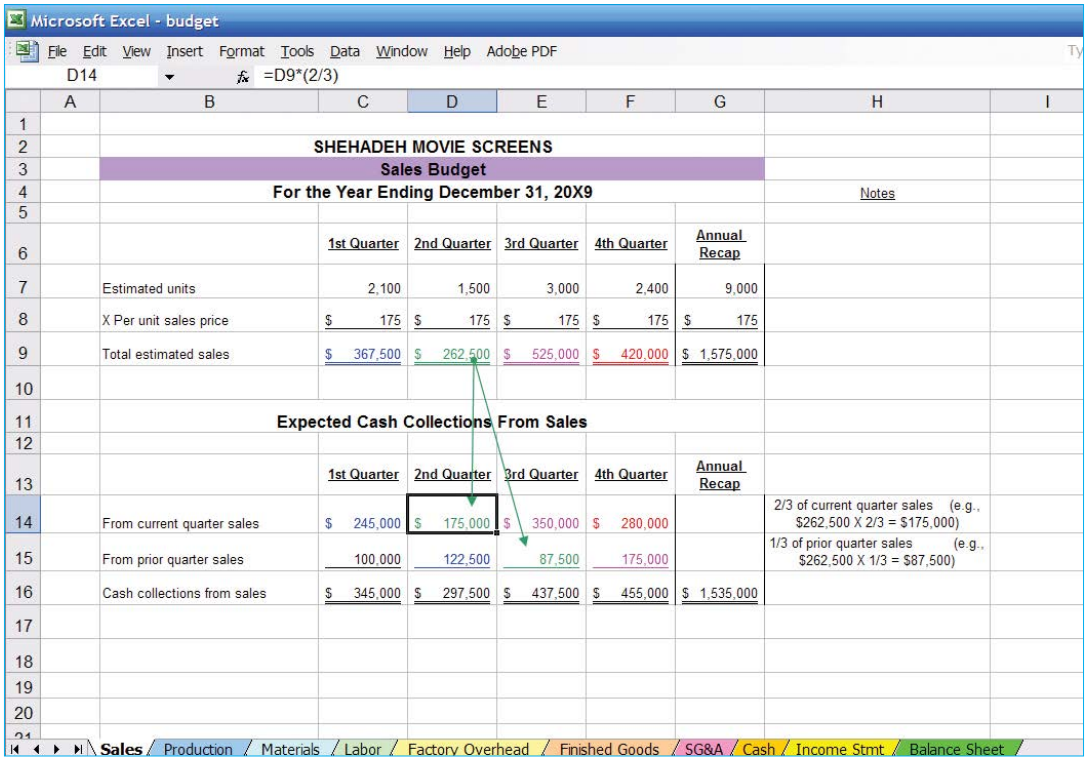
3.1 Sales Budget

The budgeting process usually begins with a sales budget. The sales budget reflects forecasted sales volume and is influenced by previous sales patterns, current and expected economic conditions, activities of competitors, and so forth. The sales budget is complimented by an analysis of the resulting expected cash collections. Sales often occur on account, so there can be a delay between the time of a sale and the actual conversion of the transaction to cash. For the budget to be useful, careful consideration must also be given to the timing and pattern of cash collections.

Mezan Shehadeh recently perfected a low-cost vinyl product that was very durable and could be used outdoors in conjunction with rear screen projection equipment. This product enables movie theaters to replace the usual lettered signs with actual videos to promote the "now showing" movies. Mezan's company, Shehadeh Movie Screens, is rapidly growing. The sales budget for 20X9 follows. Review the sales budget closely, noting the expected pattern of sales. The fall and winter seasons are typically the best for the release of new movies, and the anticipated pattern of screen sales aligns with this industry-wide business cycle. The screens are sold through a network of dealers/installers at a very low price point of $175 per unit.

The lower portion of the sales budget converts the expected sales to expected collections. Dealers are normally given credit terms of 30 days, and the result is that roughly two-thirds of sales are collected in the same quarter as the sale itself. The other third is collected in the following quarter. Shehadeh started 20X9 with $100,000 in receivables, and they are assumed to be collected in the first quarter of 20X9. Shehadeh's dealer network has been carefully screened and the company has very few problems with uncollectible accounts. Shehadeh will end the year with $140,000 in receivables, determined as one-third of the final quarter's expected sales ($420,000 X 1/3 = $140,000).

Mezan uses an electronic spreadsheet to compile the budget. This tool is extremely useful in budgeting applications. If care is used in constructing the embedded formulas, it becomes very easy to amend the budget to examine the impact of different assumptions about sales, sales price, etc. If you look closely at the very bottom of this illustration, you will note that a unique sheet is created for each budget building block; here, the Sales sheet is the active sheet:



3.2 Production Budget

Sales drive the level of production. Production is also a function of the beginning finished goods inventory and the desired ending finished goods inventory. The budgeted units of production can be calculated as the number of units sold, plus the desired ending finished goods inventory, minus the beginning finished goods inventory. In planning production, one must give careful consideration to the productive capacity, availability of raw materials, and similar considerations.

Following is the production budget of Shehadeh Movie Screens. Shehadeh plans to end each quarter with sufficient inventory to cover 25% of the following quarter's planned sales. Shehadeh started the New Year with 525 units in stock, and planned to end the year with 700 units in stock. Below is a quarter-by-quarter determination of the necessary production. Carefully examine this information, paying very close attention to how each quarter's desired ending finished goods can be tied to the following quarter's planned sales. In case it is not obvious, the estimated units sold information was taken from the sales budget; utilizing the power of the spreadsheet, the values in the cells on row 7 of this "production" sheet were simply taken from the corresponding values in row 7 of the "Sales" sheet ("=Sales!C7", "=Sales!C8", etc.).

Microsoft Excel - budget

File Edit View Insert Format Tools Data Window Help Adobe PDF

C8 =D7*0.25

	A	B	C	D	E	F	G	H
1								
2		SHEHADEH MOVIE SCREENS						
3		Production Budget						
4		For the Year Ending December 31, 20X9						Notes
5								
6			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
7		Estimated units sold	2,100	1,500	3,000	2,400	9,000	from "sales" sheet
8		Desired ending finished goods	375	750	600	700	700	25% of following quarter's sales (e.g., 1,500 X 25% = 375)
9		Total units needed	2,475	2,250	3,600	3,100		
10		Less: Beginning finished goods	(525)	(375)	(750)	(600)	(525)	prior quarter ending amount
11		Scheduled production	1,950	1,875	2,850	2,500	9,175	
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								

Sales | Production | Materials | Labor | Factory Overhead | Finished Goods | SG&A | Cash | Income Stmt | Balance Sheet

3.3 Direct Material Purchases Budget

Each movie screen requires 35 square feet of raw material. For example, the scheduled production of 1,875 units for the second quarter will require 65,625 square feet of raw material. Shehadeh maintains raw material inventory equal to 20% of the following quarter's production needs. Thus, Shehadeh plans to start the second quarter with 13,125 square feet (65,625 X 20%) and end the quarter with 19,950 square feet (99,750 X 20%). Budgeted purchases can be calculated as direct materials needed in planned production, plus the desired ending direct material inventory, minus the beginning direct materials inventory (65,625 + 19,950 - 13,125 = 72,450). This fundamental calculation is repeated for each quarter. The upper portion of the following "Materials" spreadsheet illustrates these calculations. Once again, the electronic spreadsheet draws data from preceeding sheets via embedded links.

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Note: LIGS University is not accredited by any nationally recognized accrediting agency listed by the US Secretary of Education.
More info here.

Microsoft Excel - budget

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A1

	A	B	C	D	E	F	G	H
1		SHEHADEH MOVIE SCREENS						
2		Direct Materials Budget						
3		For the Year Ending December 31, 20X9						Notes
5			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
6		Scheduled production	1,950	1,875	2,850	2,500	9,175	from "production" sheet
7		X Raw materials per unit (sq.ft.)	35	35	35	35	35	35 square feet per screen
8		Total raw material needs (sq.ft.)	68,250	65,625	99,750	87,500	321,125	
9		Plus: Target ending raw material	13,125	19,950	17,500	19,600	19,600	20% of following quarter's needs (e.g., 65,625 X 20% = 13,125)
10		Total units needed (sq. ft.)	81,375	85,575	117,250	107,100	340,725	
11		Less: Target beg. raw material	(13,650)	(13,125)	(19,950)	(17,500)	(13,650)	
12		Raw material purchases (sq. ft.)	67,725	72,450	97,300	89,600	327,075	
13		X Estimated cost per square foot	$ 1.40	$ 1.40	$ 1.40	$ 1.40	n/a	
14		Cost of raw material purchases	$ 94,815	$ 101,430	$ 136,220	$ 125,440	$ 457,905	
16		Expected Cash Payments For Materials Purchases						
18			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
19		For current quarter purchases	$ 75,852	$ 81,144	$ 108,976	$ 100,352		80% of current quarter purchases (e.g., $101,430 X 80% = $81,144)
20		For prior quarter purchases	15,000	18,963	20,286	27,244		20% of prior quarter purchases (e.g., $101,430 X 20% = $20,286)
21		Cash payments for materials	$ 90,852	$ 100,107	$ 129,262	$ 127,596	$ 447,817	

Sales / Production / **Materials** / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

The direct material purchases budget provides the necessary framework to plan cash payments for materials. The lower portion of the above spreadsheet shows that the raw material is slated to cost $1.40 per square foot. Shehadeh pays for 80% of each quarter's purchases in the quarter of purchase. The remaining 20% is paid in the following period.

The direct materials budget also reveals a planned end of year inventory of 19,600 square feet, which has a cost of $27,440 (19,600 X $1.40). As you will later see, this value will be needed to prepare the budgeted ending balance sheet.

3.4 Direct Labor Budget

The direct labor budget provides the framework for planning staffing needs and costs. Each of Shehadeh's screens requires three direct labor hours to produce. As revealed by the "labor" sheet, the scheduled production is multiplied by the number of hours necessary to produce each unit. The resulting total direct labor hours are multiplied by the expected hourly cost of labor to produce the total direct labor cost. As is usually the case, there is very little lag time between incurring and paying labor costs. Thus, Shehadeh assumes that the cost of direct labor will be funded in the quarter incurred.

Microsoft Excel - budget

C7 =Production!C11

	A	B	C	D	E	F	G	H
1								
2		SHEHADEH MOVIE SCREENS						
3		Direct Labor Budget						
4		For the Year Ending December 31, 20X9						Notes
6			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
7		Scheduled production	1,950	1,875	2,850	2,500	9,175	from "production" sheet
8		X Direct labor hours per unit	3	3	3	3	3	3 hours per screen
9		Total direct labor hours	5,850	5,625	8,550	7,500	27,525	
10		X Cost per direct labor hour	$ 14.00	$ 14.00	$ 14.00	$ 14.00	$ 14.00	
11		Cost of direct labor	$ 81,900	$ 78,750	$ 119,700	$ 105,000	$ 385,350	

Sales / Production / Materials / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

3.5 Factory Overhead Budget

Like many companies, Shehadeh applies overhead based on direct labor hours. Based on extensive analysis, the annual factory overhead is anticipated to include a fixed amount of $220,200, plus $5 per direct labor hour. The fixed portion includes depreciation of $3,000 per quarter for the first half of the year and $7,000 per quarter for the last half of the year (the increase is due to a planned purchase of factory equipment occurring at the end of the second quarter). Following is the factory overhead budget. Notice that the bottom portion of the budget reconciles the total factory overhead with the cash paid for overhead (depreciation is subtracted because it is a noncash expense). Both of these amounts will be needed to complete subsequent budget calculations.

Be mindful that the variable factory overhead rate shown in the spreadsheet is arrived at by very careful analysis. The budget process entails an assessment of variable overhead costs to determine this expected rate. As such, budgeting requires a great deal of study into the actual production process. There is much more to budgeting than just cranking numbers through a spreadsheet.

Microsoft Excel - budget

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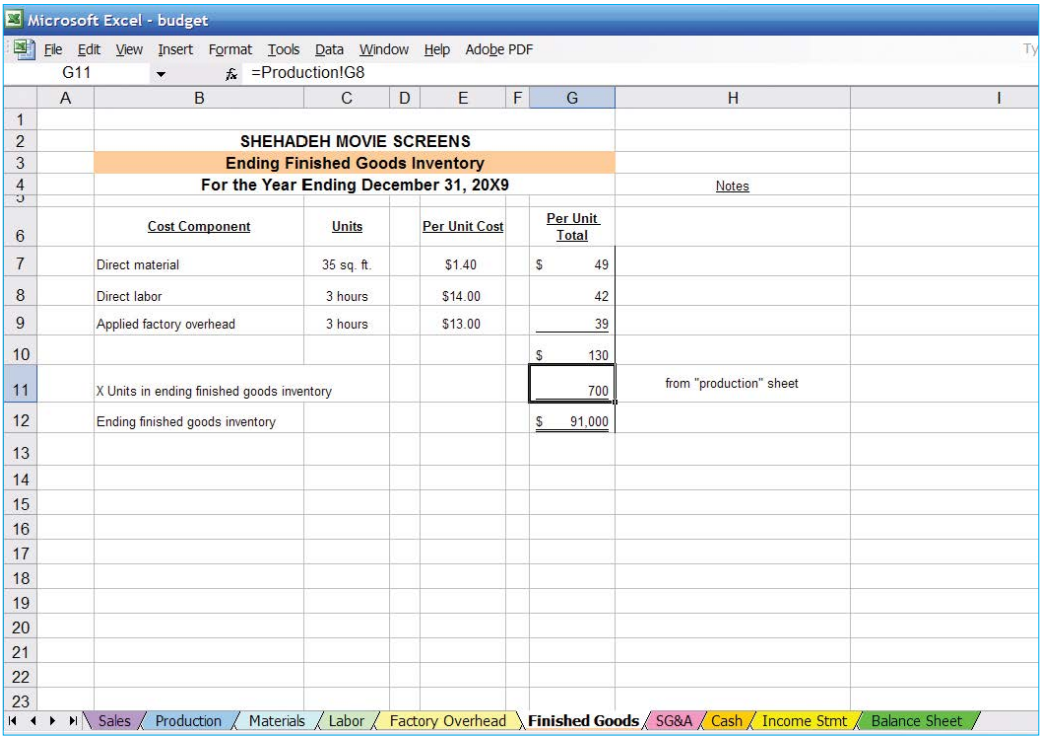
C7 =Labor!C9

	A	B	C	D	E	F	G	H
2		SHEHADEH MOVIE SCREENS						
3		Factory Overhead Budget						
4		For the Year Ending December 31, 20X9						Notes
5								
6			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
7		Driect labor hours	5,850	5,625	8,550	7,500	27,525	from "labor" sheet
8		X Variable factory overhead rate	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	
9		Total variable factory overhead	$ 29,250	$ 28,125	$ 42,750	$ 37,500	$ 137,625	
10		Fixed factory overhead	53,050	53,050	57,050	57,050	220,200	
11		Total factory overhead	$ 82,300	$ 81,175	$ 99,800	$ 94,550	$ 357,825	applied factory overhead rate = $13 per hour ($357,825/27,525)
12		Less: Depreciation	(3,000)	(3,000)	(7,000)	(7,000)	(20,000)	
13		Cash paid for factory overhead	$ 79,300	$ 78,175	$ 92,800	$ 87,550	$ 337,825	
14								
15								
16								
17								
18								
19								
20								
21								
22								

Sales / Production / Materials / Labor / **Factory Overhead** / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

The direct labor hours used in the Factory Overhead sheet are drawn from the Direct Labor budget. Further, the sidebar notes also indicate that the average overhead rate (fixed and variable together, applied to the total labor hours for the year) is $13 per hour. This information is useful in assigning costs to ending inventory. Assuming an average-cost method, ending finished goods inventory can be valued as follows:



Microsoft Excel - budget

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G11 =Production!G8

	A	B	C	D	E	F	G	H	I
1									
2		SHEHADEH MOVIE SCREENS							
3		Ending Finished Goods Inventory							
4		For the Year Ending December 31, 20X9						Notes	
6		Cost Component	Units		Per Unit Cost		Per Unit Total		
7		Direct material	35 sq. ft.		$1.40		$ 49		
8		Direct labor	3 hours		$14.00		42		
9		Applied factory overhead	3 hours		$13.00		39		
10							$ 130		
11		X Units in ending finished goods inventory					700	from "production" sheet	
12		Ending finished goods inventory					$ 91,000		
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									

Sales | Production | Materials | Labor | Factory Overhead | Finished Goods | SG&A | Cash | Income Stmt | Balance Sheet

3.6 Selling and Administrative Expense Budget

Companies must also plan for selling, general, and administrative costs. These costs also consist of variable and fixed components. The expected quarterly sales are multiplied by the variable cost per unit. Total variable expenses are added to the fixed items. Some fixed items (e.g., rent) may be the same each quarter. Other fixed costs can change over time. Below, Shehadeh is assuming a small advertising campaign in the first quarter, to be followed by an advertising blitz in the second quarter, and then a return to a more normal level during the final two quarters. The bottom line of the SG&A budget is the planned level of expenditures. Most of these items are funded at about the same time as they are incurred. Therefore, one may assume that the expense amount is met with a similar amount of cash outflow.

Microsoft Excel - budget

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G16 =G9+G15

	A	B	C	D	E	F	G	H
1								
2		SHEHADEH MOVIE SCREENS						
3		Selling, General, and Administrative Budget						
4		For the Year Ending December 31, 20X9						Notes
6			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
7		Estimated units sold	2,100	1,500	3,000	2,400	9,000	from "sales" sheet
8		X Per unit variable SG&A	$ 10	$ 10	$ 10	$ 10	$ 10	
9		Total variable SG&A	$ 21,000	$ 15,000	$ 30,000	$ 24,000	$ 90,000	
10		Fixed SG&A						
11		Salaries	$ 12,000	$ 12,000	$ 12,000	$ 12,000	$ 48,000	
12		Office	4,000	4,000	4,000	4,000	16,000	
13		Advertising	5,000	15,000	10,000	10,000	40,000	
14		Other	3,000	3,000	3,000	3,000	12,000	
15		Total fixed SG&A	$ 24,000	$ 34,000	$ 29,000	$ 29,000	$ 116,000	
16		Total budgeted SG&A	$ 45,000	$ 49,000	$ 59,000	$ 53,000	$ 206,000	
17								
18								
19								
20								
21								

Sales / Production / Materials / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

Each of the budgets/worksheets presented thus far are important in their own right. They will guide numerous operating decisions about raw materials acquisition, staffing, and so forth. But, at this point, it is very difficult to assess the success or failure of Shehadeh's plans! It is essential that all of these individual budgets be drawn together into a set of reports that provides for outcome assessments. This part of the budgeting process will result in the development of a cash budget and budgeted financial statements.

3.7 Cash Budget

Cash is an essential resource. Without an adequate supply of cash to meet obligations as they come due, a business will quickly crash. Even the most successful businesses can get caught by cash crunches attributable to delays in collecting receivables, capital expenditures, and so on. These types of cash crises can usually be avoided with a little planning. The cash budget provides the necessary tool to anticipate cash receipts and disbursements, along with planned borrowings and repayments.

Shehadeh's cash budget follows. In reviewing this document, you will begin to see that the data in most rows are drawn from earlier budget components (the beginning of year cash is assumed to be $50,000). The cash received from customers is taken from the "Sales" sheet, the cash paid for materials is taken from the "Materials" sheet, and so on. The tax information is assumed; usually a tax accountant would perform some extensive analysis of the overall plan and provide this anticipated data. As mentioned earlier, it is also assumed that Shehadeh is planning to purchase new production equipment at the end of the second quarter, as shown on row 15 following.

Microsoft Excel - budget

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F7 =Sales!F16

	A	B	C	D	E	F	G	H
1		SHEHADEH MOVIE SCREENS						
2		Cash Budget						
3		For the Year Ending December 31, 20X9						Notes
5			1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Recap	
6		Beginning cash balance	$ 50,000	$ 82,948	$ 64,416	$ 4,654	$ 50,000	
7		Plus: Customer receipts	345,000	297,500	437,500	455,000	1,535,000	from "sales" sheet
8		Available cash	$ 395,000	$ 380,448	$ 501,916	$ 459,654	$ 1,585,000	
9		Less: Disbursements						
10		Direct materials	$ 90,852	$ 100,107	$ 129,262	$ 127,596	$ 447,817	from "materials" sheet
11		Direct labor	81,900	78,750	119,700	105,000	385,350	from "labor" sheet
12		Factory overhead	79,300	78,175	92,800	87,550	337,825	from "factory overhead" sheet
13		SG&A	45,000	49,000	59,000	53,000	206,000	from "SG&A" sheet
14		Taxes	15,000	10,000	20,000	15,000	60,000	
15		Equipment purchase	-	150,000	-	-	150,000	
16		Total disbursements	$ 312,052	$ 466,032	$ 420,762	$ 388,146	$ 1,586,992	
17		Cash surplus/(deficit)	$ 82,948	$ (85,584)	$ 81,154	$ 71,508	$ (1,992)	
18		Financing:						
19		Planned Borrowing	-	150,000	-	-	150,000	
20		Planned repayment	-	-	(75,000)	(50,000)	(125,000)	
21		Interest on repayment	-	-	(1,500)	(2,000)	(3,500)	
22		Ending cash balance	$ 82,948	$ 64,416	$ 4,654	$ 19,508	$ 19,508	

Sales / Production / Materials / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

Look carefully at the Cash budget, and you will notice that the company is on track to end the second quarter with a cash deficit of $85,584 (before financing activities). To offset this problem, Shehadeh must plan to reduce expenditures or obtain added funding. The cash plan reveals a planned borrowing of $150,000 during the second quarter.

Much of this borrowing will be repaid from the positive cash flow that is anticipated during the third and fourth quarters, but the company will still end the year with a $25,000 debt ($150,000 - $75,000 - $50,000). Interest on the borrowing is calculated at 8% per year, with the interest payment coinciding with the repayment of principal (i.e., $75,000 X 8% X 3/12 = $1,500; $50,000 X 8% X 6/12 = $2,000). Take note that accrued interest at the end of the year will relate to the unpaid debt of $25,000 ($25,000 X 8% X 9/12 = $1,500); this will be included in the subsequent income statement and balance sheet, but does not consume cash during 20X9.

3.8 Budgeted Income Statement and Balance Sheet

Shehadeh can also utilize the individual budget components to develop budgeted or “pro forma” financial statements. Almost every item in the budgeted income statement is drawn directly from another element of the master budget, as identified in the “notes” column.

The following budgeted balance sheet includes columns for 20X9 and 20X8. The 20X8 data are assumed. The 20X9 amounts are logically deduced by reference to the beginning balances and information found in the details of the master budget. The notes in column H are intended to help you trace the resulting 20X9 balance for each account. For example, ending accounts receivable of $140,000 would relate to the uncollected sales during the fourth quarter ($420,000 sales - $280,000 collected = $140,000), found on the “Sales” sheet.

3.9 External Use Documents

Caution - Caution - Caution! Projected financial statements are often requested by external financial statement users. Lenders, potential investors, and others have a keen interest in such information. While these documents are very common and heavily used for internal planning purposes, great care must be taken in allowing them to be viewed by persons outside of the entity.

The accountant who is involved with external use reports has a duty to utilize appropriate care in preparing them; there must be a reasonable basis for the underlying assumptions. In addition, professional standards dictate the reporting that must accompany such reports if they are to be released for external use. Those reporting standards become fairly complex, and the specifics will

Microsoft Excel - budget

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E8 =Production!G11*'Finished Goods'!G10

	A	B	E	F	G	H	I
1		SHEHADEH MOVIE SCREENS					
2		Budgeted Income Statement					
3		For the Year Ending December 31, 20X9				Notes	
4							
5		Sales			$ 1,575,000	from "sales" sheet	
6		Cost of goods sold					
7		Beginning finished goods	$ 68,250			from "balance sheet"	
8		Cost of goods manufactured	1,192,750			from "production" sheet (9,175 units) X from "finished goods" sheet ($130 per unit)	
9		Goods available for sale	$ 1,261,000				
10		Less: Ending finished goods inventory	$ 91,000			from "finished goods" sheet	
11		Cost of goods sold			1,170,000		
12		Gross profit			$ 405,000		
13		SG&A			206,000	from "SG&A" sheet	
14		Income before interest and taxes			$ 199,000		
15		Interest			5,000	from "cash" sheet plus accrued interest on balance sheet	
16		Income before taxes			$ 194,000		
17		Income taxes			60,000	from "cash" sheet	
18		Net income			$ 134,000		
19							

Sales / Production / Materials / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

Microsoft Excel - budget

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C22 =F22+'Income Stmt'!G18

	A	B	C	D	E	F	G	H
1		SHEHADEH MOVIE SCREENS						
2		Budgeted Balance Sheet						
3		December 31, 20X8 and 20X9						Notes
4			20X9			20X8		
5		ASSETS						
6		Current Assets						
7		Cash	$ 19,508			$ 50,000		from "cash" sheet
8		Accounts receivable	140,000			100,000		from "sales" sheet ($420,000 - $280,000)
9		Raw materials inventory	27,440			19,110		from "materials" sheet (X $1.40 per sq. ft.)
10		Finished goods inventory	91,000	$ 277,948		68,250	$ 237,360	from "income statement" sheet
11		Property, Plant, & Equipment						
12		Plant and equipment	$275,000			$ 125,000		increase from "cash" sheet
13		Less: Accumulated depreciation	(80,000)	195,000		(60,000)	65,000	increase from "factory overhead" sheet
14		Total Assets		$ 472,948			$ 302,360	
15		Liabilities						
16		Current liabilities						
17		Accounts payable	$ 25,088			$ 15,000		from "materials" sheet ($125,440 - $100,352 = $25,088)
18		Interest payable	1,500			-		unpaid interest
19		Notes payable	25,000	$ 51,588		-	$ 15,000	increase from "cash" sheet
20		Stockholders' equity						
21		Common stock	$ 200,000			$ 200,000		
22		Retained earnings	221,360	421,360		87,360	287,360	beginning balance plus income from "income statement" sheet
23		Total liabilities and equity		$ 472,948			$ 302,360	

Sales / Production / Materials / Labor / Factory Overhead / Finished Goods / SG&A / Cash / Income Stmt / Balance Sheet

depend on the nature of external use. But, those reports will necessarily include language that makes it very clear that the participating accountant is not vouching for their achievability.

Managers must also be careful in external communications of forward looking information. USA securities laws can hold managers accountable if they fail to include appropriate cautionary language to accompany forward looking comments, and the comments are later shown to be faulty. In addition, other regulations (Reg FD) may require "full disclosure" to everyone when such information is made available to anyone. As a result, many managers are reticent to make any forward looking statements. It is no wonder that many budgetary documents are emblazoned "internal use only."

3.10 Performance Appraisal

This chapter has made several references to the fact that budgets will be used for performance evaluations. Actual results will be compared to budgeted results. These comparisons will help identify strengths and weaknesses, areas for improvements, and potential staffing changes. But, the process for performance appraisal is far more complex than simply comparing budget to actual results – so much so that the next chapter is devoted exclusively to this subject.

4. Budget Periods and Adjustments

Budgets usually relate to specific future periods of time, such as an annual reporting year or a natural business cycle. For example, a car producer may release the 20X8 models in the middle of 20X7. In such a case, the budget cycle may be more logically geared to match the model year of the cars rather than the actual calendar year.

There is nothing to suggest that budgets are only for one year intervals. For purposes of monitoring performance, annual budgets are frequently divided into monthly and quarterly components. This is helpful in monitoring performance on a timely basis. Sometimes, specific amounts within a monthly/quarterly budget are merely proportional amounts of the annual total. For instance, monthly rent might be 1/12 of annual rent. But, other costs do not behave as uniformly. For instance, utilities costs can vary considerably with changes in the weather, and businesses need sufficiently detailed budgets to plan accordingly. Major capital expenditure budgets may transcend many years. A manufacturer may have 10 facilities in need of major overhauls. It is unlikely they could all be upgraded in just one or two years; capital expenditure budgets may cover as much as a five to ten-year horizon.

4.1 Continuous Budgets

Computer technology permits companies to employ continuous or perpetual budgets. These budgets may be constantly updated to relate to the next 12 months or next 4 quarters, etc. As one period is completed, another is added to the forward looking budgetary information. This approach provides for continuous monitoring and planning and allows managers more insight and reaction time to adapt to changing conditions. An analogy might be made to driving. A bad driver might focus only on getting from one intersection to the next. A good driver will constantly monitor conditions well beyond the upcoming intersection, anticipating the need to change lanes as soon as distant events first come into view.

4.2 Flexible Budgets

The discussion in this chapter has largely presumed a “static budget.” A static budget is not designed to change with changes in activity level. Once sales and expenses are estimated, they become the relevant benchmarks. An alternative that has some compelling advantages is the flexible budget. Flexible budgets relate anticipated expenses to observed revenue. To illustrate, if a business greatly exceeded the sales goal, it is reasonable to expect costs to also exceed planned levels. After all, some items like cost of sales, sales commissions, and shipping costs are directly related to volume. How ridiculous would it be to fault the manager of the business for having cost overruns? Conversely, failing to meet sales goals should be accompanied by a reduction in variable costs. Certainly it would make no sense to congratulate a manager for holding costs down in this case! A flexible budget is one that reflects expected costs as a function of business volume; when sales rise so do certain budgeted costs, and vice versa. The next chapter will illustrate flexible budgets in much detail.

4.3 Encumbrances

In working with budgets, especially budgets of governmental units, you may encounter an "encumbrance." An encumbrance is a budgetary restriction occurring in advance of a related expenditure. The purpose of an encumbrance is to earmark funds for a designated future purpose. For instance, a department may have $100,000 budgeted for office supplies for the upcoming year. However, the department may have already entered into a $500 per month contract for copy machine repair services. Although $100,000 is budgeted, the remaining free balance is only $94,000 because $6,000 has already been committed for the repair service. At any point in time, the total budget, minus actual expenditures, minus remaining encumbrances, would result in the residual free budget balance for the period.

Tools for Enterprise Performance Evaluation

Part 2

Your goals for this “performance evaluation” chapter are to learn about:

- Concepts in responsibility accounting and management by exception.
- Using flexible budgets to adapt outcome assessments to variable scenarios.
- Developing and using standard costs.
- Traditional variance calculations for monitoring cost and efficiency.
- The balanced scorecard approach to measuring business performance.

5.4 Profit Center

Some business units have control over both costs and revenues and are therefore evaluated on their profit outcomes. For such profit centers, "cost overruns" are expected if they are coupled with commensurate gains in revenue and profitability.

A restaurant chain may evaluate each store as a separate profit center. The store manager is responsible for the store's revenues and expenses. A store with more revenue would obviously generate more food costs; an assessment of food cost alone would be foolhardy without giving consideration to the store's revenues. For such profit centers, the flexible budgets discussed in this chapter are particularly useful evaluative tools. Other metrics include unit-by-unit profitability analysis using ratio tools introduced in the financial analysis chapter.

5.5 Investment Center

At higher levels within an organization, unit managers will be held accountable not only for cost control and profit outcomes, but also for the amount of investment capital that is deployed to achieve those outcomes. In other words, the manager is responsible for adopting strategies that generate solid returns on the capital they are entrusted to deploy. Evaluation models for investment centers become more complex and diverse. They usually revolve around various calculated rates of return.

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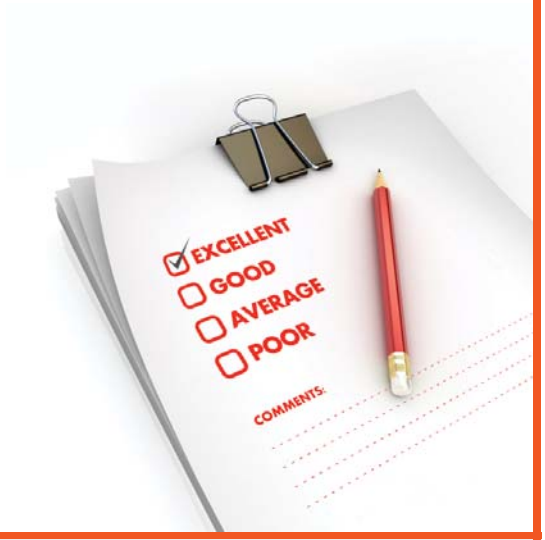

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Many contemporary business successes have occurred in highly decentralized organizations. Top management concentrates on strategy, and leaves the day-to-day operation and decision-making tasks to lower-level personnel. This facilitates rapid "front-line" response to customer issues and provides for identifying and training emerging managers. It can also improve morale by providing each employee with a clear sense of importance that is often lacking in a highly centralized environment. Decentralization can prove a fertile ground for cultivating new and improved products and business processes.

5.2 Responsibility Centers

A decentralized environment results in highly dispersed decision making. As a result, it is imperative to monitor and judge the effectiveness of each manager. This is easier said than done. Not all units are capable of being evaluated on the same basis. Some units do not generate any revenue; they only incur costs in support of some necessary function. Other units that deliver goods and services have the potential to be assessed on the basis of profit generation.

As a generalization, the part of an organization under the control of a manager is termed a "responsibility center." To aid performance evaluation it is first necessary to consider the specific character of each responsibility center. Some responsibility centers are cost centers and others are profit centers. On a broader scale, some are considered to be investment centers. The logical method of assessment will differ based on the core nature of the responsibility center.

5.3 Cost Center

Obviously most business units incur costs, so this alone does not define a cost center. A cost center is perhaps better defined by what is lacking; the absence of revenue, or at least the absence of control over revenue generation.

Human resources, accounting, legal, and other administrative departments are expensive to support and do not directly contribute to revenue generation. Cost centers are also present on the factory floor. Maintenance and engineering fall into this category. Many businesses also consider the actual manufacturing process to be a cost center even though a saleable product is produced (the sales "responsibility" is shouldered by other units).

It stands to reason that assessments of cost control are key in evaluating the performance of cost centers. This chapter will show how standard costs and variance analysis can be used to pinpoint areas where performance is above or below expectation. Cost control should not be confused with cost minimization. It is easy to reduce costs to the point of destroying enterprise effectiveness. The goal is to control costs while maintaining enterprise effectiveness.

Nonfinancial metrics are also useful in monitoring cost centers: documents processed, error rates, customer satisfaction surveys, and other similar measures can be used. The concept of a balanced scorecard is discussed later in this chapter, and it can be very relevant to evaluating the performance of a cost center.

5.4 Profit Center

Some business units have control over both costs and revenues and are therefore evaluated on their profit outcomes. For such profit centers, “cost overruns” are expected if they are coupled with commensurate gains in revenue and profitability.

A restaurant chain may evaluate each store as a separate profit center. The store manager is responsible for the store’s revenues and expenses. A store with more revenue would obviously generate more food costs; an assessment of food cost alone would be foolhardy without giving consideration to the store’s revenues. For such profit centers, the flexible budgets discussed in this chapter are particularly useful evaluative tools. Other metrics include unit-by-unit profitability analysis using ratio tools introduced in the financial analysis chapter.

5.5 Investment Center

At higher levels within an organization, unit managers will be held accountable not only for cost control and profit outcomes, but also for the amount of investment capital that is deployed to achieve those outcomes. In other words, the manager is responsible for adopting strategies that generate solid returns on the capital they are entrusted to deploy. Evaluation models for investment centers become more complex and diverse. They usually revolve around various calculated rates of return.

One popular method was pioneered by E. I. du Pont de Nemours and Company. It is commonly known as the DuPont return on investment (ROI) model, and is pictured at right. This model consists of a margin subcomponent (Operating Income/Sales) and a turnover subcomponent (Sales/Average Assets). These two subcomponents can be multiplied to arrive at the ROI. Thus, ROI = (Operating Income/ Sales) X (Sales/Average Assets). A bit of algebra reveals that ROI reduces to a much simpler formula: Operating Income/ Average Assets.

But, a prudent manager who is to be evaluated under the ROI model will quickly realize that the subcomponents are important. Notice that ROI can be increased by any of the following actions: increasing sales, reducing expenses, and/or decreasing the deployed assets. The DuPont approach encourages managers to focus on increasing sales, while controlling costs and being mindful of the amount invested in productive assets. A disadvantage of the ROI approach is that some "profitable" opportunities may be passed by managers because they fear potential dilution of existing successful endeavors. The consulting firm of Stern, Stewart & Co. has trademarked and popularized the Economic Value Added model as an alternative comprehensive evaluative tool for assessing investment returns. Presumably, it compensates for the deficiencies of simpler models. Advanced managerial accounting courses typically devote considerable coverage to the various approaches to evaluating investment centers.

5.6 Affixing Responsibility

Lower-level managers may only be responsible/accountable for a small subset of business activities. As one moves up the organizational chart, mid and upper-level managers assume ever greater degrees of responsibility. The reporting system should mimic the expanded scope, and develop information which reveals the performance for all units within the control of a particular manager. At successively higher steps, individual performance reports are combined to reveal the success or failure of all activities beneath a particular manager. This can result in one manager being held accountable for a combination of cost, profit, and investment centers. A keen manager must be familiar with the specific techniques for managing and gauging the success of each!

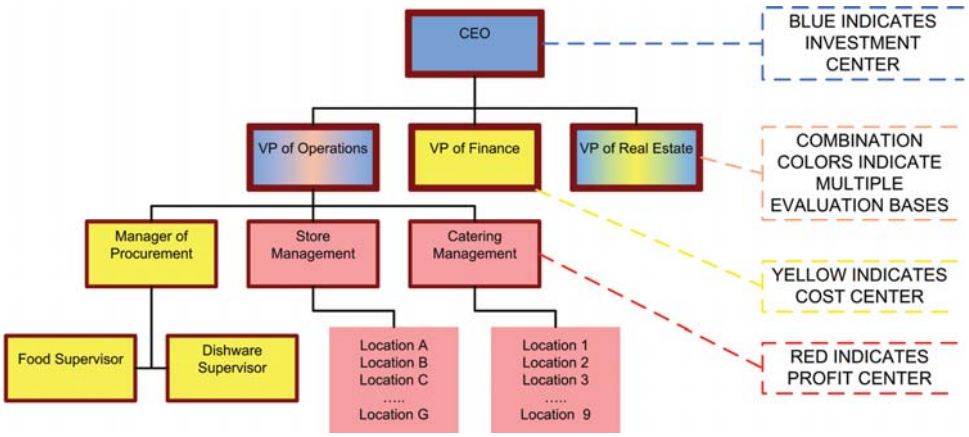
Following is an organization chart for Out To Lunch Hamburgers. Out to Lunch is a rapidly growing fast-food restaurant chain. Their business model revolves around a uniquely flavored hamburger, and a very simple menu consisting of a hamburger, fries, and drinks. They provide simple "round number" pricing, few products, and rapid service. Out to Lunch also has a catering service for sporting events, corporate outings, and similar occasions.

The block colors in the organization chart indicate the character of performance/responsibility evaluation that is germane to each position. The Chief Executive Officer reports to the owners, and the owners are primarily interested in their return on investment. Three vice presidents report to the CEO:

The VP of operations is responsible • for the overall investment in operations, which is driven heavily by the combined profits of each store. The VP of Operations oversees procurement, store management, and catering management.

- The Procurement Manager oversees purchasing of food and dishware.
    - The Procurement activities are evaluated as cost centers, relying on budgets and standard costs to control activities.
- The Store and Catering managers oversee supervisors from each location.
    - The Store and Catering Managers are responsible for producing profits, and are evaluated accordingly.

- The VP of Finance is viewed and evaluated as a cost center.
- The VP of Real Estate is responsible for site acquisition and construction. Although the activities are largely viewed in the context of a cost center, there is an expected rate of return for each new real estate investment. Therefore, the VP of Real Estate is evaluated for cost control and return on investments.

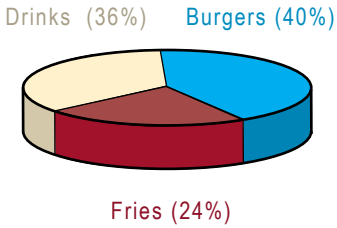


5.7 Responsibility Center Reports

A company's accounting system should support preparation of an accounting report for each responsibility center. This information is essential to monitor, control, and direct each business unit. The exact form and detail of a performance report depends on the particular organization and the nature of the responsibility center. Oftentimes, the reports will provide a comparison between budgeted and actual data, with the difference being reported as a variance from budget. These performance reports should be consistent with the organizational structure of the firm. At successively higher levels within an organization, the reports tend to include less transaction specific detail and more combinations of business units. For Out to Lunch Hamburgers, each store will likely have a customized performance report:

PERFORMANCE REPORT -- STORE LOCATION A
FOR THE YEAR ENDING DECEMBER 31, 20X5

	ACTUAL RESULTS		BUDGETED RESULTS		VARIANCE
	Percent of Sales	Totals	Percent of Sales	Totals	
Sales:					
Burgers	40%	$1,000,000	43%	$1,100,000	$ (100,000)
Fries	24%	600,000	22%	550,000	50,000
Drinks	36%	900,000	35%	875,000	25,000
Total Sales	100%	$2,500,000	100%	$2,525,000	$ (25,000)
Less: Variable Expenses					
Food Cost	19%	$ 475,000	20%	$ 505,000	$ (30,000)
Other Variable Expenses	7%	175,000	8%	200,000	(25,000)
Total Variable Expenses	26%	$ 650,000	28%	$ 705,000	$ (55,000)
Contribution Margin		$1,850,000		$1,820,000	$ 30,000
Less: Traceable Fixed Costs		1,100,000		1,100,000	-
Location A Margin		$ 750,000		$ 720,000	$ 30,000



The next step in the corporate ladder is the CEO. This individual would most likely be evaluated on the overall financial statement outcomes. Although the CEO would have access to any and all of the reports from within the organization, they would mostly focus on the reports emanating from each vice president's unit.

5.8 The Power of a Data Base System

The static reports illustrated above are quite useful, but do suffer from an important limitation.

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5.10 Management by Expansion

"Underperforming stores are identified, problems are studied, and corrective measures are taken. Very little time is spent on locations that are meeting or exceeding corporate profit goals." These sentences are taken directly from the preceding discussion about how the senior manager of store operations uses the performance reports. This is an excellent illustration of what is meant by the concept of management by exception. The objective of management by exception is to focus attention on areas where corrective measures appear necessary. Performance evaluation tools that do not satisfy this objective are of little value. Importantly, not every exception requires a remedy. One characteristic of a strong manager is the ability to study problems, and differentiate between those requiring a solution and those that simply happened because of bad luck.

PERFORMANCE REPORT -- ALL STORES
FOR THE YEAR ENDING DECEMBER 31, 20X5

	Combined	Location A	Location B	Location C	Location D	Location E	Location F	Location G
Sales:								
Burgers	$ 7,050,000	$1,000,000	$ 875,000	$1,200,000	$1,400,000	$ 600,000	$ 875,000	$1,100,000
Fries	3,675,000	600,000	400,000	750,000	800,000	200,000	300,000	625,000
Drinks	5,685,000	900,000	910,000	975,000	1,000,000	450,000	550,000	900,000
Total Sales	$16,410,000	$2,500,000	$2,185,000	$2,925,000	$3,200,000	$1,250,000	$1,725,000	$2,625,000
Less: Variable Exp.								
Food Cost	$ 3,334,850	$ 475,000	$ 458,850	$ 526,500	$ 640,000	$ 337,500	$ 293,250	$ 603,750
Other Variable Exp.	1,241,100	175,000	131,100	234,000	224,000	112,500	207,000	157,500
Total Variable Exp.	$ 4,575,950	$ 650,000	$ 589,950	$ 760,500	$ 864,000	$ 450,000	$ 500,250	$ 761,250
Contribution Margin	$11,834,050	$1,850,000	$1,595,050	$2,164,500	$2,336,000	$ 800,000	$1,224,750	$1,863,750
Traceable Fixed Costs	8,000,000	1,100,000	1,000,000	900,000	1,200,000	1,300,000	1,100,000	1,400,000
Location Margin	$ 3,834,050	$ 750,000	$ 595,050	$1,264,500	$1,136,000	$ (500,000)	$ 124,750	$ 463,750
Common Fixed Costs	1,500,000							
Stores Margin	$ 2,334,050							

PERFORMANCE REPORT -- OPERATIONS FOR THE YEAR ENDING DECEMBER 31, 20X5				
	Combined	Stores	Catering	Procurement
Total Sales	$28,866,000	$16,410,000	$12,456,000	$ -
Total Variable Expenses	$ 6,942,590	$ 4,575,950	$ 2,366,640	$ -
Contribution Margin	$21,923,410	$11,834,050	$10,089,360	$ -
Less: Traceable Fixed Costs	17,700,000	9,500,000	7,000,000	1,200,000
Unit Margin	$ 4,223,410	$ 2,334,050	$ 3,089,360	$(1,200,000)
Less: Common Fixed Costs	1,300,000			
Operations Margin	$ 2,923,410			

The next step in the corporate ladder is the CEO. This individual would most likely be evaluated on the overall financial statement outcomes. Although the CEO would have access to any and all of the reports from within the organization, they would mostly focus on the reports emanating from each vice president's unit.

5.8 The Power of a Data Base System

The static reports illustrated above are quite useful, but do suffer from an important limitation. Specifically, what you see is what you get. It is very difficult to "mine data" pertinent to a specific inquiry. For example, if the VP of Operations wanted to know the overall corporate sales mix proportions (hamburgers, fries, drinks) a specific request would be initiated to the store and catering managers. They would gather the individual reports from each location and develop a report to channel back up to the VP. The VP of Operations would then need to combine the two reports before having an answer to the inquiry. This is very inefficient and may have the undesirable outcome of forcing management to make decisions based on incomplete information. Increasingly, companies are developing customized electronic data base systems that capture data and store it in such a way as to enable accurate and real time retrieval of information relevant to an almost endless number of potential questions.

5.9 Traceable Versus Common Fixed Costs

You likely noticed that the above reports separated out variable and fixed expenses. The fixed expenses were further divided between those that were traceable to a specific business unit and common fixed costs. Traceable fixed costs would not exist if the unit under evaluation ceased to exist. Common fixed costs support the operations of more than one unit. Great care must be taken in distinguishing between traceable and common fixed costs. Remember that effective performance evaluations require a clear alignment of responsibility and accountability. To the extent a unit manager is burdened with allocations of common costs, poor signaling of performance can result. This is why such costs are usually segregated out in performance based reporting methods. This topic will be further explored in the next chapter's discussion of segment reporting.

5.10 Management by Expansion

"Underperforming stores are identified, problems are studied, and corrective measures are taken. Very little time is spent on locations that are meeting or exceeding corporate profit goals." These sentences are taken directly from the preceding discussion about how the senior manager of store operations uses the performance reports. This is an excellent illustration of what is meant by the concept of management by exception. The objective of management by exception is to focus attention on areas where corrective measures appear necessary. Performance evaluation tools that do not satisfy this objective are of little value. Importantly, not every exception requires a remedy. One characteristic of a strong manager is the ability to study problems, and differentiate between those requiring a solution and those that simply happened because of bad luck.

6. Flexible Budgets

The previous chapter provided a comprehensive budget illustration using a static budget. The static budget is one which is developed for a single level of activity. It is very useful for planning and control purposes. However, you were also cautioned about the potential shortcomings of using static budgets for performance evaluation. Specifically, when the actual output varies from the anticipated level, variances are likely to arise. These variances can be quite misleading. The genesis of the problem is that variable costs will tend to track volume. If the company produces and sells more products than anticipated, one would expect to see more variable costs (and vice versa). Presumably, it is a good thing to produce and sell more than planned, but the variances resulting from the higher costs can appear as a bad thing! The opposite occurs when volume is less than anticipated.

To illustrate, assume that Mooster's Dairy produces a premium brand of ice cream. Mooster's Dairy uses a static budget based on anticipated production of 100,000 gallons per month. Cost behavior analysis revealed that direct materials are variable and anticipated to be $1 per gallon ($100,000 in total), direct labor is variable and anticipated to be $.50 per gallon ($50,000 in total), and variable factory overhead is expected to be $1.50 per gallon ($150,000 in total). Fixed factory overhead is planned at $205,000 per month. The monthly budget for total manufacturing costs is $505,000, as shown in the budget column below.

MOOSTER'S DAIRY - Static Budget/Expense Analysis
For the Month Ending July 31, 20X9

	Actual (105,000 units)	Budget (100,000 units)	Variance
Variable Expenses			
Direct materials	$ 105,000	$ 100,000	$ (5,000)
Direct labor	53,000	50,000	(3,000)
Variable factory overhead	155,000	150,000	(5,000)
Total Variable Expenses	$ 313,000	$ 300,000	$ (13,000)
Fixed Factory Overhead	$ 200,000	$ 205,000	$ 5,000
Total Manufacturing Costs	$ 513,000	$ 505,000	$ (8,000)

July of 20X9 was hotter than usual, and Mooster found them selves actually producing 105,000 gallons. Total factory costs were $513,000.

Mooster's July's budget versus actual expense analysis reveals unfavorable variances for materials, labor, and variable factory overhead. Does this mean the production manager has done a poor job in controlling costs? Remember that actual production volume exceeded plan. At a glance, it is challenging to reach any conclusion. What is needed is a performance report where the budget is "flexed" based on the actual volume.

The flexible budget reveals a much different picture. Rather than incurring $8,000 of cost overruns as portrayed by the variances associated with the static budget, you can see below that total production costs were $7,000 below what would be expected at 105,000 units of output. On balance, it appears that the production manager has done a good job.

MOOSTER'S DAIRY - Flexible Budget/Expense Analysis For the Month Ending July 31, 20X9			
	Actual (105,000 units)	Budget (105,000 units)	Variance
Variable Expenses			
Direct materials	$ 105,000	$ 105,000	$ -
Direct labor	53,000	52,500	(500)
Variable factory overhead	155,000	157,500	2,500
Total Variable Expenses	$ 313,000	$ 315,000	$ 2,000
Fixed Factory Overhead	$ 200,000	$ 205,000	$ 5,000
Total Manufacturing Costs	$ 513,000	$ 520,000	$ 7,000

Specifically, direct materials cost exactly $1.00 per gallon of output. Direct labor totaled $500 in excess of the plan amount of $52,500 (105,000 units X $0.50 = $52,500), resulting in an unfavorable labor variance. This could be due to using more labor hours or paying a higher labor rate per hour -- or some combination thereof. Later in this chapter, you will learn how to perform analysis to better identify the root contributing cause of such variances. The variable factory overhead was expected at $157,500 (105,000 units X $1.50 per unit = $157,500), but actually only cost $155,000. Fixed factory overhead was $5,000 less than anticipated.

6.1 Flexible Budget for Performance Evaluations

The flexible budget responds to changes in activity, and may provide a better tool for performance evaluation. It is driven by the expected cost behavior. Fixed factory overhead is the same no matter the activity level, and variable costs are a direct function of observed activity. When performance evaluation is based on a static budget, there is little incentive to drive sales and production above anticipated levels because increases in volume tend to produce more costs and unfavorable variances. The flexible budget-based performance evaluation provides a remedy for this phenomenon.

6.2 Flexible Budgets for Planning

The flexible budget illustration for Mooster's Dairy was prepared after actual production was known. While this tool is useful for performance evaluation, it does little to aid advance planning. But, flexible budgets can also be useful planning tools if prepared in advance. For instance, Mooster's Dairy might anticipate alternative volumes based on temperature-related fluctuations in customer demand for ice cream. These fluctuations will be very important to production management as they plan daily staffing and purchases of milk and cream that will be needed to support the manufacturing operation. As a result, Mooster's Dairy might prepare an advance flexible budget based on many different scenarios:

MOOSTER'S DAIRY - Static Budget/Expense Analysis
For the Month Ending July 31, 20X9

	Budget (80,000 units)	Budget (90,000 units)	Budget (100,000 units)	Budget (110,000 units)	Budget (120,000 units)	Notes
Variable Expenses						
Direct materials	$ 80,000	$ 90,000	$ 100,000	$ 110,000	$ 120,000	$1.00 per unit
Direct labor	40,000	45,000	50,000	55,000	60,000	$0.50 per unit
Variable factory overhead	120,000	135,000	150,000	165,000	180,000	$1.50 per unit
Total Variable Expenses	$ 240,000	$ 270,000	$ 300,000	$ 330,000	$ 360,000	
Fixed Factory Overhead	$ 205,000	$ 205,000	$ 205,000	$ 205,000	$ 205,000	
Total Manufacturing Costs	$ 445,000	$ 475,000	$ 505,000	$ 535,000	$ 565,000	

The above flexible budget reveals only the aggregate expense levels expected to be generated. In reality, supporting flexible budget documents would resemble the comprehensive budget documents portrayed in the prior chapter. Such comprehensive documents would provide the information necessary to manage the smallest of operating details that must be adjusted as production volumes fluctuate.

6.3 Flexible Budgets and Efficiency of Operation

It perhaps goes without saying that computers are most helpful in preparing budget information that is easily flexed for changes in volume. Indeed, even the preparation of the very simple illustrative information for Mooster's Dairy was aided by an electronic spreadsheet. Businesses save millions upon millions of dollars in accounting time by relying on computers to aid budget preparation.

But, this savings is inconsequential when compared to the real savings that results from using computerized flexible budgeting tools. As production volumes ramp up and down to meet customer demand, computerized flexible budgets are adjusted on a real-time basis to send signals throughout the modern organization (including electronic data interchange with suppliers). The net result is that the supply chain is immediately adjusted to match raw material orders to real production levels, thereby eliminating billions and billions of dollars of raw material waste and scrap.

7. Standard Costs

Budgets deal with total expected costs. But, as you saw for Mooster's Dairy, these overall estimates are based upon fundamental assumptions about standard quantity and cost of inputs required in producing a single unit of output. Recall for Mooster: ". . . direct materials are variable and anticipated to be $1 per gallon ($100,000 in total), direct labor is variable and anticipated to be $.50 per gallon ($50,000 in total), and variable factory overhead is expected to be $1.50 per gallon ($150,000 in total)." Standards are the predetermined expectation of the inputs necessary to achieve a unit of output. Standard costs provide an assessment of what those inputs should cost.

Standards are important ingredients in planning and controlling a business. You have just seen how they influence the budget preparation process. They are also integral to the assumptions needed for proper cost-volume-profit analysis discussed in an earlier chapter. Standards can also be used in pricing goods and services. Perhaps you have had your car repaired; the bill is likely based on an hourly rate applied to a standard number of hours for the job (your specific repair might have actually taken more or less time).

This chapter will look at how standards are used for performance evaluation via measures of efficiency and cost incurrence. You have perhaps worked in a restaurant. Each cashier may have a standard for how much business they must "ring." Managers have standards for how many tables must be "turned." The bus staff is allowed only so much "breakage." Virtually every business has a similar set of standards. In a traditional manufacturing environment, a unit of finished goods is decomposed into its components to determine how much raw material, labor, and overhead is necessary to produce the item. These component quantities are then considered in terms of what they should cost.

7.1 Setting Standards

The decision about the quantity and cost of productive components is more complex than it may seem. If you were building a new home, how much sheetrock (wall board) would you need for the job? In calculating the quantity you would begin with the overall wall dimensions and back out the area for windows and doors. But, you would also realize that some of the cutouts for windows would result in useless scrap material. In addition, it is inevitable that some material will be damaged or cut in error. In estimating the quantity of material, you will want to provide for such elements, but you also realize that excess material may not be easily returned without cost. Determining the right quantity of sheetrock is much like setting standards in a business environment.

Standard setters need to understand waste, spoilage, evaporation, and other characteristics that consume raw materials. Standard setters need to be mindful of how much time it takes to perform certain tasks, remembering that humans will make mistakes and need time to correct them. Humans must also have periods of rest. Standards are applicable to manufacturing and nonmanufacturing tasks. Even the accountants who are seen as the monitors of standards are themselves subject to standards. An auditor may be allowed a certain number of hours to audit payroll, verify a bank reconciliation, and so forth. Without standards, the tasks may expand in scope and time, beyond what is prudent or necessary.

Although performance reports may be prepared by managerial accountants, the standards themselves should originate with personnel who best understand the productive process. These personnel should develop standards that are based on realistic information derived from careful study of business processes. For example, an industrial engineer may engage in time and motion studies to determine the appropriate amount of time to complete a given task. Past data may be used to provide realistic measures of the raw material quantity that is needed to complete a finished unit. Some standards are based on averages; total estimated costs are divided by total estimated output or activity. For example, standard variable overhead can be determined by dividing estimated variable overhead by the estimated activity level for the upcoming period. Likewise, fixed standard per-unit overhead would be determined by dividing estimated fixed overhead by the estimated activity level.

7.2 Philosophy of Standards

It has probably already occurred to you that standards can be set very tight, allowing almost no room for waste or rest. Or, management may adopt a more realistic set of standards that are within reach. After all, standards are somewhat like goals. In playing a round of golf, most players will see "par" as a benchmark against which to compare a score; realistically, few players expect to achieve "par" on a consistent basis. Nevertheless, it constitutes a standard. At other times, golfers will calculate their "handicap" to determine a target score they plan to shoot on a given round of golf. This is also a standard, but one that is expected to be achieved. In setting standards within a business environment, management needs to consciously consider the level of standards to adopt:

- Achievable standards are realistically within reach. Such standards take into account normal spoilage and inefficiency. Such standards are intended to allow workers to reach the established benchmarks. This level of standard provides a clear set of metrics against which job performance can be gleaned. The interpretation is generally unambiguous; when goals are not met, improvement is needed. It is also thought to reduce the opportunity for frustration and discouragement that can be associated with less attainable goals.

- Ideal standards may never be reached. They represent what will result in a state of perfection -- no spoiled goods, no worker fatigue, no errors, etc. The idea behind such standards is that employees will never rest on their laurels. Instead, they will achieve their full potential by striving to hit the lofty goal. Many businesses avoid ideal standards because they fear that employees will see ideal standards as meaningless since they cannot hope to achieve them. In other words, the employees cease to strive for a goal they cannot hope to reach. Further, such goals may not help in performance evaluations; what is the feedback value of telling employees they failed to meet such standards (after all, isn't that what was expected)?

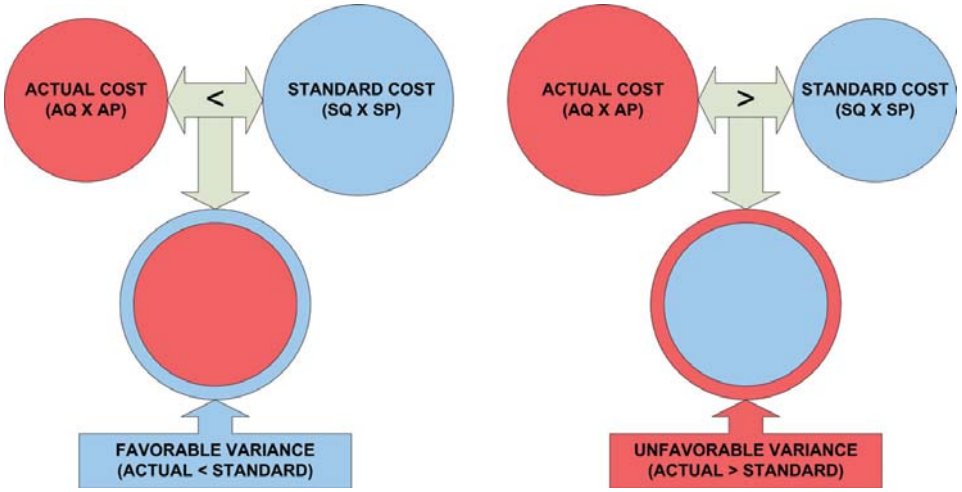
7.3 The Downside of the Standards

A manager also needs to consider the downside of standards and develop compensating balances. For instance, if employees are encouraged to work fast, quality can suffer. Standards need to be in place to make sure that quality of output is not adversely affected. On the other hand, some seasoned employees may have become so skilled that they can easily meet their output goals and find themselves able to coast through the work day. Usually skilled workers receive a higher pay scale; it is not unfair to expect them to produce more output. Therefore, one standard may not fit all. A good manager is particularly adept at helping to establish fair standards, and use them to plan and control the operations within their area of responsibility.

8. Variance Analysis

As already mentioned, standard costs provide information that is useful in performance evaluation. Standard costs are compared to actual costs, and mathematical deviations between the two are termed variances. Favorable variances result when actual costs are less than standard costs, and vice versa.

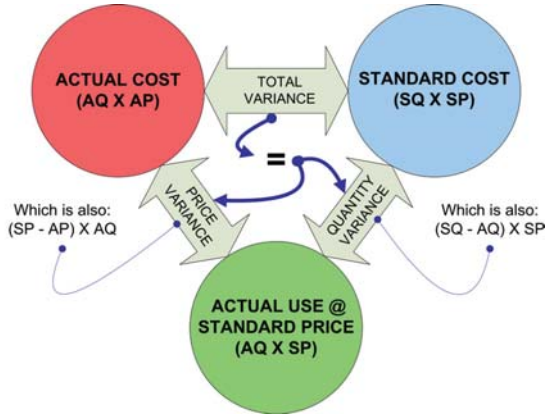
The following illustration is intended to demonstrate the very basic relationship between actual cost and standard cost. AQ means the "actual quantity" of input used to produce the output. AP means the "actual price" of the input used to produce the output. SQ and SP refer to the "standard" quantity and price that was anticipated. As you will soon see, variance analysis can be conducted for each factor of productive input: material, labor, and overhead. For the moment, just focus on the major concept -- variances are simply the differences between actual cost incurred and the standard cost that was appropriate for the achieved production:



Variance analysis is the logical examination of the deviations in an attempt to identify areas for improvement. Management is responsible for careful evaluation of variances. This task is an important part of effective control of an organization. While comparing total actual costs to total standard costs is interesting, it provides little useful information for pinpointing specific problem areas. Instead, management must perform a more penetrating analysis into the detailed variances relating to each factor of production.

8.1 Variances Relating to Direct Materials

The total variance for direct materials is found by comparing actual direct material cost to standard direct material cost. The top portion of the illustration at right demonstrates this point. However, the overall materials variance could result from any combination of having procured goods at prices equal to, above, or below standard cost, and using more or less direct materials than anticipated. Proper variance analysis requires that the Total Direct Materials Variance be separated into the:



- Materials Price Variance: A variance that reveals the difference between the standard price for materials purchased and the amount actually paid for those materials [(standard price - actual price) X actual quantity].

- Materials Quantity Variance: A variance that compares the standard quantity of materials that should have been used to the actual quantity of materials used. The quantity variation is measured at the standard price per unit [(standard quantity - actual quantity) X standard price].

If you carefully study the illustration, you will see there are several ways to perform the intrinsic variance calculations. You can very simply compute the values for the red, blue, and green balls; noting the differences. Or, you can perform the noted algebraic calculations for the price and quantity variances; adding them together gives you the total variance. In performing the math operations, be very careful to note that unfavorable variances (negative numbers) offset favorable (positive numbers) variances. But, don't get lost in the math and forget the importance of the analysis. Management's goal is to pinpoint problem areas. A total variance could be zero, resulting from the purchasing department having negotiated favorable pricing that was wiped out by waste in material usage. A good manager would want to take corrective action, but would be unaware of the problem based on an overall budget versus actual comparison. The moral of the story is to always look into the details for improvement opportunities.

8.2 An Illustration of Direct Material Variance Calculations

Blue Rail Manufacturing produces high quality handrails, gates, banisters, corral systems, and similar welded steel products. The primary raw material is 40 foot long pieces of heavy gauge steel pipe. This pipe is custom cut and welded into rails like that shown in the accompanying picture. In addition, the final stages of production require some grinding and sanding operations, along with a final spray coating of paint (welding rods, grinding disks, and paint are relatively inexpensive and are classified as indirect material components within factory overhead).

Blue Rail measures their output in "sections." Each section consists of one post and four rails. The sections are 10' in length and the posts average 4' each. Some overage and waste is expected due to the need for an extra post at the end of a set of sections, taller than normal posts, faulty welds, bad

pipe cuts, and defective pipe. The company has adopted an achievable standard of 1.25 pieces of raw pipe (50') per section of rail.

During August, Blue Rail produced 3,400 sections of railing. It was anticipated that pipe would cost $80 per 40' piece. Standard material cost for this level of output is computed as follows:

Output -- Number of rail sections	3,400
Standard quantity of input per rail section -- 40' long pieces of pipe	X 1.25
Standard quantity of input (pipes) to achieve output (rail sections)	4,250
Standard price per unit of input (pipe)	X $80
Standard cost of direct materials	$ 340,000

The production manager was very disappointed to receive the monthly performance report that revealed actual material cost of $369,000. A closer examination of the actual cost of materials revealed the following:

Actual quantity of input (pipes) to achieve output (rail sections)	4,100
Actual price per unit of input (pipe)	X $90
Actual cost of direct materials	$ 369,000

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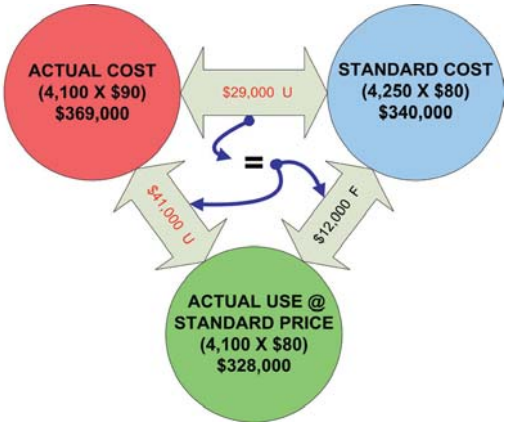
The total direct material variance was unfavorable $29,000 ($340,000 vs. $369,000). However, this unfavorable outcome was driven by higher prices for raw material, not waste. It seems that steel prices escalated rapidly. The unfavorable materials price variance is calculated as follows:

MATERIALS PRICE VARIANCE = (SP - AP) X AQ = ($80 - $90) X 4,100 = <$41,000>

Materials usage was favorable since less material was used (4,100 pieces of pipe) than was standard (4,250 pieces of pipe). This resulted in a favorable materials quantity variance:

MATERIALS QUANTITY VARIANCE = (SQ - AQ) X SP = (4,250 - 4,100) X $80 =$12,000

These two variances net (<$41,000> + $12,000) to produce the total $29,000 unfavorable outcome:



8.3 Journal Entries for Direct Material Variances

A company may desire to adapt their general ledger accounting system to capture and report variances. Let's see how this might occur for Blue Rail. First, do not ever lose sight of the very simple fact that the amount of money to account for is still the money that was actually spent ($369,000). To the extent the price paid for materials differs from standard, the variance is debited (unfavorable) or credited (favorable) to a Materials Price Variance account. This results in the Raw Materials Inventory account carrying only the standard price of materials, no matter the price paid:

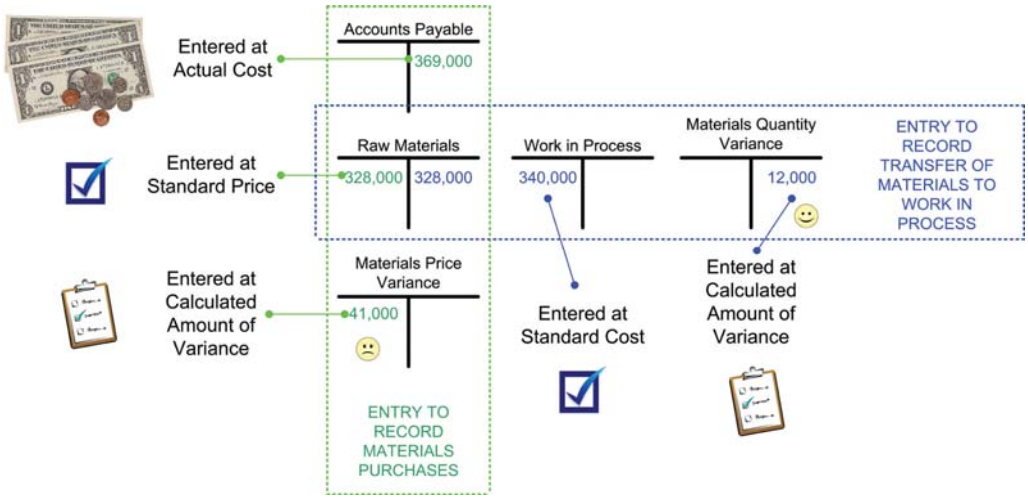
8-31-XX	Raw Materials Inventory		328,000	
	Materials Price Variance		41,000	
	Accounts Payable			369,000
	To record purchase of raw materials at standard price and related unfavorable variance			

Work in Process is debited for the standard cost of the standard quantity that should be used for the productive output achieved, no matter how much is actually used. Any difference between standard and actual raw material usage is debited (unfavorable) or credited (favorable) to the Materials Quantity Variance account:

8-31-XX	Work in Process Inventory	340,000	
	Raw Materials Inventory		328,000
	Materials Quantity Variance		12,000
	To transfer raw materials to production at standard usage rates and related favorable quantity variance		

The Materials Price Variances and Materials Quantity Variances are generally reported by decreasing income (if unfavorable debits) or increasing income (if favorable credits), although other outcomes are possible (alternative dispositions are discussed in more advanced managerial accounting courses).

Examine the following diagram to be sure you understand how these entries play out in the ledger -- the first entry is in green and the second is in blue. As you examine this diagram, notice that the $369,000 of cost is ultimately attributed to work in process inventory ($340,000 debit at standard cost/quantity), materials price variance ($41,000 debit), and materials quantity variance ($12,000 credit):



8.4 When Purchases Differ From Usage

The discussion and illustration for direct material variances presumed that all of the raw material purchases were put into production. If this were not a valid assumption, then the preceding illustration would need to be modified to reflect price variances based on the amount purchased and quantity variances based on output. Be aware that the ripple effect of this modification would potentially upset the relationships between the “red, green, and blue balls” used in this chapter to illustrate the basic principles of variance calculations. Further discussion of this topic issue is deferred to more advanced managerial accounting courses.

8.5 Variances Relating to Direct Labor

The intrinsic logic for direct labor variances is very similar to that of direct material. The total variance for direct labor is found by comparing actual direct labor cost to standard direct labor cost. The overall labor variance could result from any combination of having paid laborers at rates equal to, above, or below standard rates, and using more or less direct labor hours than anticipated. In this illustration, AH is the actual hours worked, AR is the actual labor rate per hour, SR is the standard labor rate per hour, and SH is the standard hours for the output achieved.

The Total Direct Labor Variance can be separated into the:

- Labor Rate Variance: A variance that reveals the difference between the standard rate and actual rate for the actual labor hours worked [(standard rate - actual rate) X actual hours].

- Labor Efficiency Variance: A variance that compares the standard hours of direct labor that should have been used to the actual hours worked. The efficiency variance is measured at the standard rate per hour [(standard hours - actual hours) X standard rate].

If you carefully study the illustration, you will see there are several ways to perform the intrinsic labor variance calculations. You can very simply compute the values for the red, blue, and green balls; noting the differences. Or, you can perform the noted algebraic calculations for the rate and efficiency variances; adding them together gives you the total variance. In performing the math operations, be very careful to note that unfavorable variances (negative numbers) offset favorable (positive numbers) variances.

8.6 An Illustration of Direct Labor Variance Calculations

Let's continue with our illustration for Blue Rail Manufacturing. Recall that each section of railing requires that individual pieces of pipe be custom cut, welded, sanded, and painted. Welding is a slow and labor intensive process, and the company has adopted a standard of 3 labor hours for each section of rail. Skilled labor is anticipated to cost $18 per hour. During August, remember that Blue Rail produced 3,400 sections of railing. Therefore, the standard labor cost for August is calculated as:

Output -- Number of rail sections	3,400
Standard hours per rail section	X 3.00
Standard hours to achieve output	10,200
Standard rate per hour of labor	X $18
Standard cost of direct labor	$ 183,600

The monthly performance report revealed actual labor cost of $175,000. A closer examination of the actual cost of labor revealed the following:

Actual hours of labor	12,500
Actual rate per hour	X $14
Actual cost of direct labor	$ 175,000

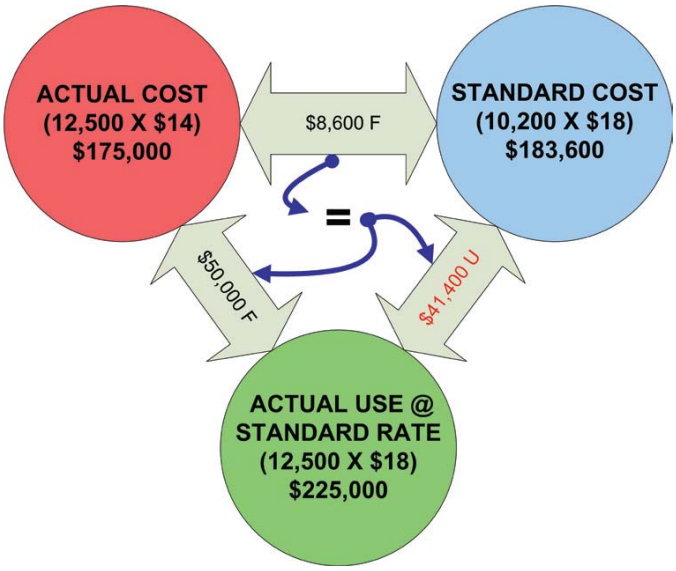
The total direct labor variance was favorable $8,600 ($183,600 vs. $175,000). This variance was driven by favorable wage rates:

LABOR RATE VARIANCE = (SR - AR) X AH = ($18 - $14) X 12,500 = $50,000

The hourly wage rate was lower because of a shortage of highly skilled welders. The less experienced welders were paid less per hour but they also worked slower. This inefficiency shows up in the unfavorable labor efficiency variance:

LABOR EFFICIENCY VARIANCE = (SH - AH) X SR = (10,200 - 12,500) X $18 =<$41,400>

These two variances net ($50,000 + <$41,400>) to produce the total $8,600 favorable outcome:

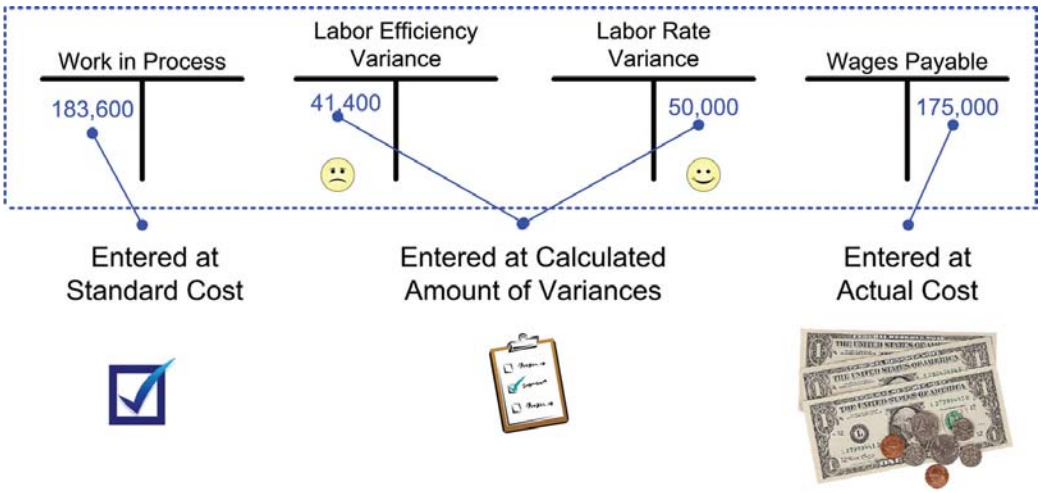


8.7 Journal Entries for Direct Labor Variances

If Blue Rail desires to capture labor variances in their general ledger accounting system, the entry might look something like this:

8-31-XX	Work in Process Inventory		183,600	
	Labor Efficiency Variance		41,400	
	Labor Rate Variance			50,000
	Wages Payable			175,000
	To increase work in process for the standard direct labor costs, and record the related efficiency and rate variances			

Once again, debits reflect unfavorable variances, and vice versa. Such variance amounts are generally reported as decreases (unfavorable) or increases (favorable) in income, with the standard cost going to the Work in Process Inventory account. The following diagram shows the impact within the general ledger accounts.



Before looking closer at these variances, it is first necessary to recall that overhead is usually applied based on a predetermined rate, such as $X per direct labor hour (you may find it helpful to review this concept from Part 3 of the Managerial and Cost Accounting book. This means that the amount debited to work in process is driven by the overhead application approach. This will become clearer with the following illustration.

8.12 An Illustration of Variable Overhead Variances

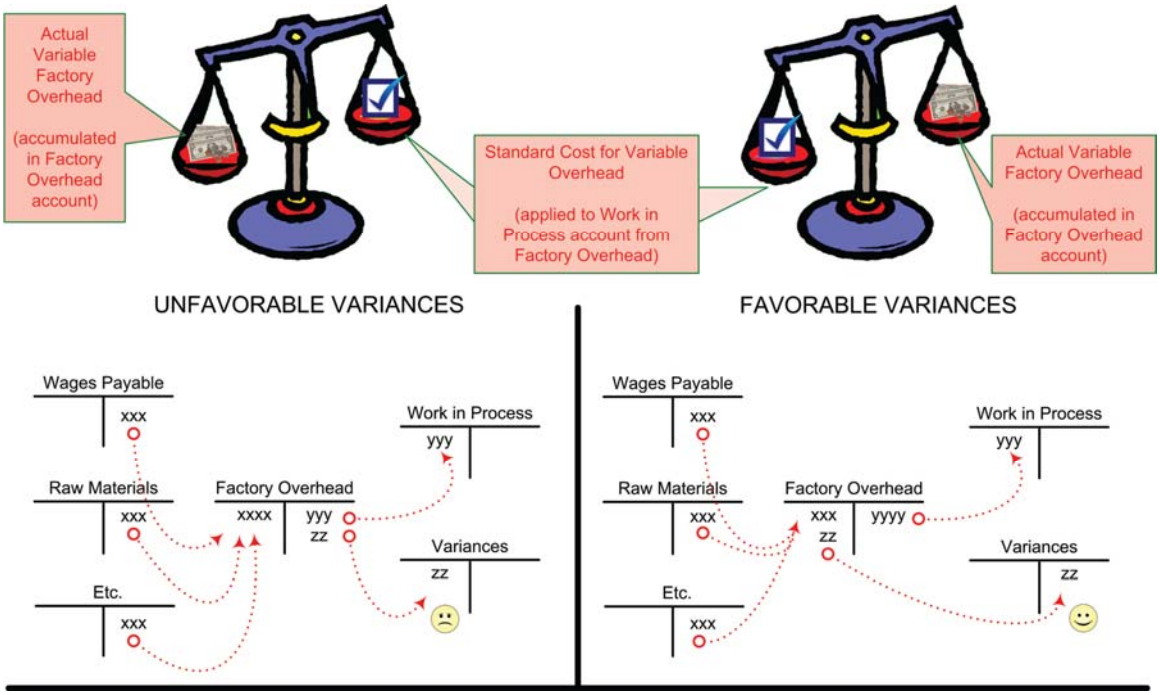
Let's return to the illustration for Blue Rail. Variable factory overhead for August consisted primarily of indirect materials (welding rods, grinding disks, paint, etc.), indirect labor (inspector time, shop foreman, etc.), and other items. Extensive budgeting and analysis had been performed, and it was estimated that variable factory overhead should be applied at $10 per direct labor hour. During August, $105,000 was actually spent on variable factory overhead items. The standard cost for August's production was as follows:

*

8.10 Variances Relating to Variable Factory Overhead

The cost behavior for variable factory overhead is not unlike direct material and direct labor, and the variance analysis is quite similar. The goal will be to account for the total "actual" variable overhead by applying: (1) the "standard" amount to work in process, and (2) the "difference" to appropriate variance accounts. This accounting objective is no different than observed for direct material and direct labor!

On the left-hand side of the following graphic, notice that more is spent on actual variable factory overhead than is applied based on standard rates. This scenario produces unfavorable variances (also known as "under applied overhead" since not all that is spent is applied to production). The right-hand side is the opposite scenario (favorable/over applied overhead). Beneath the graphics are T-accounts intending to illustrate the cost flow. As monies are spent on overhead (wages, utilization of indirect materials, etc.), the cost (xxx) is transferred to the Factory Overhead account. As production occurs, overhead is applied/transferred to Work in Process (yyy). When more is spent than applied (as on the left scale), the balance (zz) is transferred to variance accounts representing the unfavorable outcome. When less is spent than applied (as on the right scale), the balance (zz) represents the favorable overall variances.



8.11 Exploring Variable Overhead Variances

A good manager will want to explore the nature of variances relating to variable overhead. It is not sufficient to simply conclude that more or less was spent than intended. As with direct material and direct labor, it is possible that the prices paid for underlying components deviated from expectations (a variable overhead spending variance). On the other hand, it is possible that the company's productive efficiency drove the variances (a variable overhead efficiency variance). Thus, the Total Variable Overhead Variance can be divided into a Variable Overhead Spending Variance and a Variable Overhead Efficiency Variance.

Before looking closer at these variances, it is first necessary to recall that overhead is usually applied based on a predetermined rate, such as $X per direct labor hour (you may find it helpful to review this concept from Part 3 of the Managerial and Cost Accounting book. This means that the amount debited to work in process is driven by the overhead application approach. This will become clearer with the following illustration.

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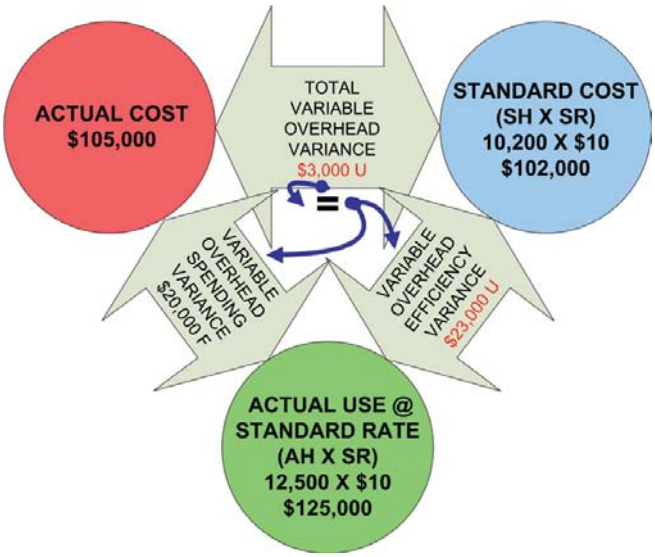
Output -- Number of rail sections	3,400
Standard hours per rail section	X 3
Standard hours to achieve output	10,200
Standard variable overhead rate per hour of direct labor	X $10
Standard cost of variable overhead	$ 102,000

The total variable overhead variance is unfavorable $3,000 ($102,000 - $105,000). This may lead to the conclusion that performance is about on track. But, a closer look reveals that overhead spending was quite favorable, while overhead efficiency was not so good. Remember that 12,500 hours were actually worked. Since variable overhead is consumed at the presumed rate of $10 per hour, this means that $125,000 of variable overhead (actual hours X standard rate) was attributable to the output achieved. Comparing this figure ($125,000) to the standard cost ($102,000) reveals an unfavorable variable overhead efficiency variance of $23,000. However, this inefficiency was significantly offset by the $20,000 favorable variable overhead spending variance ($105,000 vs. $125,000). The following diagram may prove useful in helping you sort out the variable overhead variances:



8.13 Journal Entry for Variable Overhead Variances

The following journal entry can be used to apply variable factory overhead to production and record the related variances:

8-31-XX	Work in Process Inventory	102,000	
	Variable Overhead Efficiency Variance	23,000	
	Variable OH Spending Variance		20,000
	Factory Overhead		105,000
	To increase work in process for the standard variable overhead, and record the related efficiency and spending variances		

8.14 Careful Interpretation of Variable Overhead Variances

Material and labor variances are more easily interpreted than variable overhead variances. The variable overhead efficiency variance can be somewhat confusing because it may reflect efficiencies or inefficiencies experienced with the base used to apply overhead, rather than overhead itself. For Blue Rail, remember that the total number of hours was "run up" beyond plan because of inexperienced labor. A good manager will want to keenly evaluate the cause and meaning of variable overhead variances. In fact, the variances are likely only the point of beginning for a proper evaluation. Remember that variable overhead is made up of many components. For Blue Rail, it is conceivable that the inexperienced welders used more welding rods, and the welds were likely sloppier requiring more grinding to smooth out the joints. Further, it is likely that inspectors had to spend more time checking work to make sure that the welds were strong. While the overall variance calculations would provide signals about these issues, a manager would actually need to drill down into each individual cost component (perhaps calculating variances for each budgeted line item rather than just on an overall basis) to truly find areas for business improvement.

How important is control of overhead? A study of self-made 50-year old millionaires revealed very little correlation between wealth and income, and a strong correlation between wealth and life-long savings patterns. Although the study is related to individuals, the message rings equally true for business. Careful control of spending is essential to long-term value building. Businesses vary considerably in their attitudes and discipline as it relates to control of overhead. Some businesses are rather cavalier about controlling things like light/electricity usage, control over low cost parts, efficiency in shipping methods, etc. Others are rather fanatical about maintaining absolute and stringent controls. For instance, one controller of a manufacturing plant was frustrated with the number of screws that were dropped and left to be swept away at the end of each business day. These were seemingly insignificant to the employees. In frustration, the controller scattered a box of nickels onto the factory floor -- by the end of the day none remained for the janitorial staff to sweep away. A subsequent memo was issued reminding everyone that screws cost 5¢ each. The rather obvious point was to draw a comparison between the nickels that everyone was eager to recover and the screws for which there was little concern. To build a successful business, a good manager will keep a keen eye on all overhead items, and control them with vigor. The variable overhead variances are macro indicators of success in accomplishing this goal.

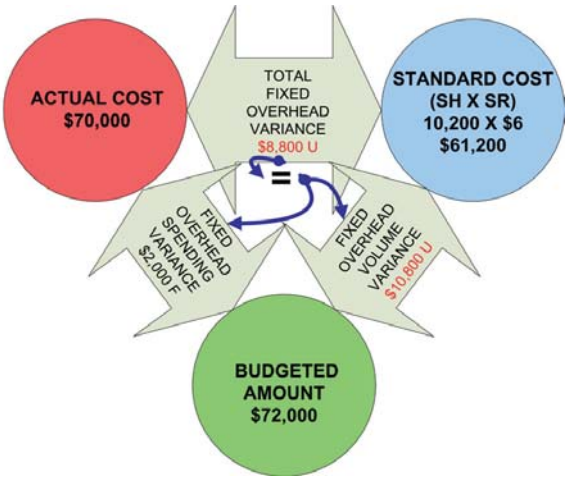
8.15 Variances Relating to Fixed Factory Overhead

Frequently (but not always), actual fixed factory overhead will show little variation from budget. This results because of the intrinsic nature of a fixed cost. For instance, rent is usually subject to a lease agreement that is relatively certain. Depreciation on factory equipment can be calculated in advance. The costs of insurance policies are negotiated and tied to a contract. Even though budget and actual numbers may differ little in the aggregate, the underlying fixed overhead variances are nevertheless worthy of close inspection.

8.16 An Illustration of Foxed Overhead Variances

Let's take one final look at Blue Rail. Assume that the company budgeted total fixed overhead at $72,000; only $70,000 was actually spent (seemingly a good outcome). Here our accounting objective will be to allocate the $70,000 actually spent between work in process and variance accounts. The temptation would be to book $72,000 into work in process and reflect a $2,000 offsetting favorable variance -- but that would be the wrong approach!

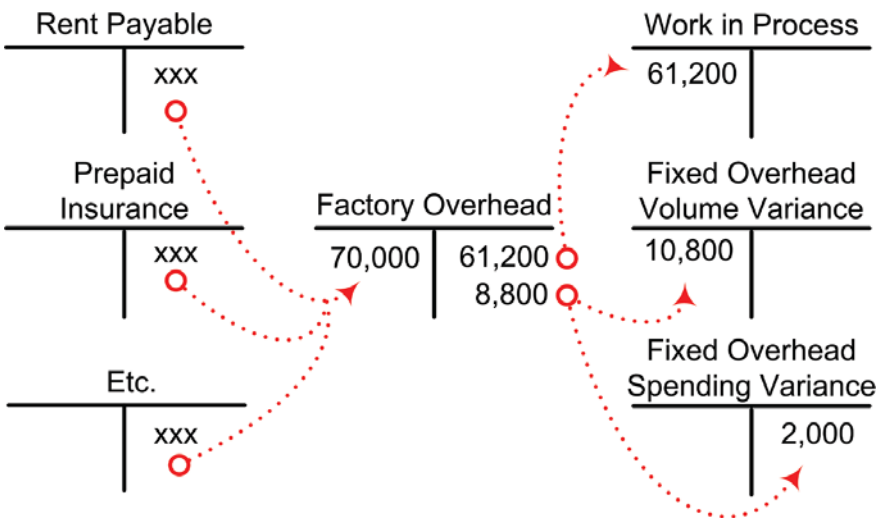
Instead, the Work in Process account should reflect the standard fixed overhead cost for the output actually produced. We get to this calculated value by reconsidering the company's original assumptions about production. Assume that Blue Rail had planned on producing 4,000 rail systems during the month; remember that only 3,400 systems were actually produced -- output was disappointing, perhaps due to the inexperienced labor pool. This means that the planned fixed overhead was $18 per rail ($72,000/4,000 = $18). Because three labor hours are needed per rail, the fixed overhead allocation rate is $6 per direct labor hour ($18/3). Use this new information to consider the following illustration for fixed factory overhead (remember from the earlier discussion that the standard labor hours for the actual output were 10,200):



By reviewing this familiar looking illustration, you can see that $61,200 should be allocated to work in process. This reflects the standard cost allocation of fixed overhead that would be attributable to the production of 3,400 units (i.e., 10,200 hours should be used to produce 3,400 units). Notice that this differs from the budgeted amount of fixed overhead by $10,800, representing an unfavorable Fixed Overhead Volume Variance. In other words, since production did not rise to the anticipated level of 4,000 units, much of the fixed cost (that was in place to support 4,000 units of output) was "wasted" or "under-utilized." Thus, the measured volume variance is highly unfavorable. If more units had been produced than originally anticipated, the fixed overhead volume variance would be favorable (this would reflect total budgeted fixed overhead being spread over more units than originally anticipated). For Blue Rail, the volume variance is offset by the more easily understood favorable Fixed Overhead Spending Variance of $2,000; $70,000 was spent versus the budgeted $72,000. Together, the two variances combine to reveal a net $8,800 unfavorable Total Fixed Overhead Variance.

8.17 Journal Entry for Fixed Overhead Variances

The diagram below illustrates the flow of fixed costs into the Factory Overhead account, and on to Work in Process and the related variances.



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Following is a compound journal entry to apply fixed factory overhead to production and record the related variances:

8-31-XX	Work in Process Inventory	61,200	
	Fixed Overhead Volume Variance	10,800	
	Fixed OH Spending Variance		2,000
	Factory Overhead		70,000
	To increase work in process for the standard fixed overhead, and record the related volume and spending variances		

8.18 Recapping Standards and Variances

The foregoing provided a painstakingly detailed account of the variances for Blue Rail. Before moving on, it is best to put the entire subject in perspective. The goal is to compare standard costs to actual costs. Blue Rail's work in process is recorded at the standard costs found in the Blue circles (hint – the work in process inventory of blue rails is recorded at the amounts found in blue circles), while actual costs are found in the red circles. These amounts are recapped in the table below:

	Actual Cost to Account For	Standard Cost Assigned to Work in Process	Overall Variances	Specific Variances
Direct Materials	$369,000	$340,000	$ (29,000)	
Price Variance				$ (41,000)
Quantity Variance				$ 12,000
Direct Labor	$175,000	$183,600	$ 8,600	
Rate Variance*				$ 50 000
Efficiency Variance				$ (41,400)
Variable Factory Overhead	$105,000	$102,000	$ (3,000)	
Spending Variance				$ 20,000
Efficiency Variance				$ (23,000)
Fixed Factory Overhead	$ 70,000	$ 61,200	$ (8,800)	
Spending Variance				$ 2,000
Volume Variance				$ (10,800)
AGGREGATE	$719,000	$686,800	$ (32,200)	

You will notice that the standard cost of $686,800 corresponds to the amounts assigned to work in process inventory via the various journal entries, while the total variances of $32,200 were charged/ credited to specific variance accounts. By so doing, the full $719,000 actually spent is fully accounted for in the records of the Blue Rail.

8.19 Examining Variances

Not all variances need to be analyzed. One must consider the circumstances under which the variances resulted and the materiality of amounts involved. One should also understand that not all unfavorable variances are bad. For example, buying raw materials of superior quality (at higher than anticipated prices) may be offset by reduction in waste and spoilage. Likewise, favorable variances are not always good. Blue Rail's very favorable labor rate variance resulted from using inexperienced, less expensive labor. Was this the reason for the unfavorable outcomes in efficiency and volume? Perhaps! The challenge for a good manager is to take the variance information, examine the root causes, and take necessary corrective measures to fine tune business operations.

In closing this discussion of standards and variances, be mindful that care should be taken in examining variances. If the original standards are not accurate and fair, the resulting variance signals will themselves prove quite misleading.

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9. Balanced Scorecard Approach to Performance Evaluation

Thus far, this chapter has focused on budgets, standards, and variances to assess entity performance. However, other nonfinancial metrics should also be employed in performance evaluation. This is sometimes referred to as maintaining a balanced scorecard, meaning that performance assessment should take a holistic approach. Long-term business success will not be achieved if the focus is only on near-term financial outcomes. At the same time, financial goals are not abandoned; the goal is to achieve balance.

With the balanced scorecard approach, an array of performance measurements are developed. Each indicator should be congruent with the overall entity objectives. Further, each measure should be easily determined and understood. These measurements can relate to financial outcomes, customer outcomes, or business process outcomes. Although a balanced scorecard approach may include target thresholds that should be met, the primary mantra is on improvement. This means that all participants are continually striving to beat pre-existing scores for each measure.

Early in this chapter, you saw how responsibility accounting concepts caused performance reports to be prepared for different steps in the corporate ladder. This notion is equally applicable to the balanced scorecard approach. The overall corporate entity may have macro targets and measures. Similarly, sub-units will have their own unique goals. A scorecard approach can even be pushed down to the individual employee level. For instance, a retail store may require that tellers complete a certain number of transactions per hour. This “quota” in essence would represent a nonfinancial metric that can be scored for each employee.

9.1 The Balance Scorecard in Operation

You saw for Blue Rail Manufacturing a number of examples of financial goals that could be included in a balanced scorecard assessment. Examples include the standard cost for material, the standard labor hours per rail set, the expected production level, and so forth. But, what would be some examples of customer outcomes and business process outcomes?

- Potential Customer Outcomes:
  - Results of a customer satisfaction survey
  - Product returns/warranty work rates
  - The frequency that customers reorder (or do not reorder)
  - Estimated market share
  - New customers that are based on referrals of existing customers
  - Frequency that customer bids lead to customer orders
  - Customer complaint/compliment rates
  - Price in comparison to competitors

- Potential Business Process Outcomes
  - Defect free units as a proportion of total production
  - Frequency/size of product liability claims
  - Time from order receipt to shipment
  - Size of customer order backlogs
  - Lost production days due to out-of-stock raw materials or equipment failure
  - Employee turnover rate
  - Employee morale survey results
  - Employee accident rates/claims for workers' compensation
  - Average experience level of employees

In reviewing this list of potential items for inclusion in a balanced scorecard performance appraisal, you have probably thought of some additional items for inclusion. The choice is up to management. The idea is to find those items that drive business success in a way that is consistent with the corporate philosophy. Perhaps Blue Rail has a goal of 100% customer satisfaction with respect to quality, but knows that its price will be 20% higher than competitors. Or, Blue Rail may have a goal of being the lowest cost provider and will tolerate some degree of customer discord.

The metrics are intended to measure progress toward fulfillment of the corporate objectives, and the managerial accountant is apt to be heavily involved in gathering the necessary data for inclusion in the balanced scorecard performance reports. These reports are often graphical in nature to facilitate easy use and interpretation, with particular emphasis on timely identification of trends. Sometimes, the metrics are prominently posted in the work place; perhaps you have seen a sign at a construction site noting the number of consecutive accident free work days. By prominent display of such data, employees are constantly reminded of, and vigilant to meet, key performance goals.

Reporting Techniques in Support of Managerial Decision Making

Part 3

Your goals for this "reporting" chapter are to learn about:

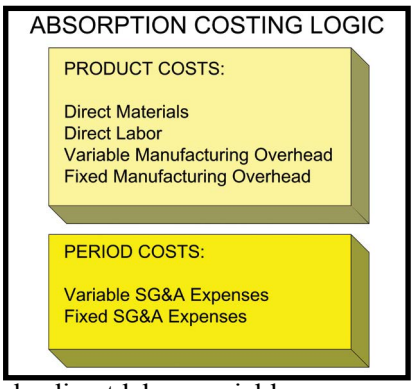
- Variable costing versus absorption costing.
- Segment reporting.
- Measures of residual income.
- Concepts in allocating service department costs.
- Leveraging modern information systems to enable better decisions.

10. Variable Versus Absorption Costing

Recall this statement from the first managerial accounting chapter: "Managerial accounting is quite different from financial accounting. External reporting rules are replaced by internal specifications as to how data are to be accumulated and presented. Hopefully, these internal specifications are sufficiently logical that they enable good economic decision making." Now that you have accumulated knowledge on various managerial accounting concepts, you are in a good position to look more closely at some of the techniques for internal reporting. This chapter's initial topic pertains to an internal reporting method for measuring and presenting inventory and income, known as variable costing.

10.1 Absorption Costing

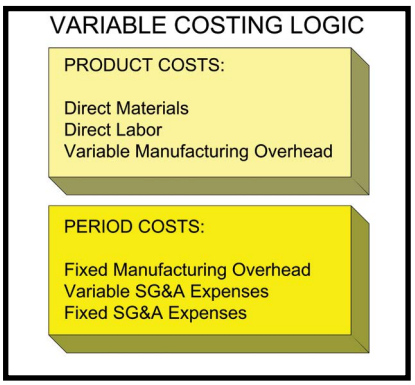
Before diving into the specifics of variable costing, let's revisit the basic tenants of the traditional approach known as absorption costing (also known as "full costing"). Generally accepted accounting principles require absorption costing for external reporting, and it formed the basis for the discussion of inventory costing found in preceding chapters. Under absorption costing, normal manufacturing costs are considered product costs and included in inventory. As sales occur, the cost of inventory is transferred to cost of goods sold; meaning that the gross profit is reduced by all costs of manufacturing, whether those costs relate to direct materials, direct labor, variable manufacturing overhead, or fixed manufacturing overhead. Selling, general, and administrative costs (SG&A) are classified as period expenses.



The rationale for absorption costing is that it causes a product to be measured and reported at its complete cost. Just because costs like fixed manufacturing overhead are difficult to identify with a particular unit of output does not mean that they were not a cost of that output. As a result, such costs are allocated to products. However valid the claims are in support of absorption costing, the method does suffer from some deficiencies as it relates to enabling sound management decisions. These deficiencies will become clear as you examine variable costing. For now, suffice it to say that absorption costing information may not always provide the best signals about how to price a product, reach conclusions about discontinuing a product, and so forth.

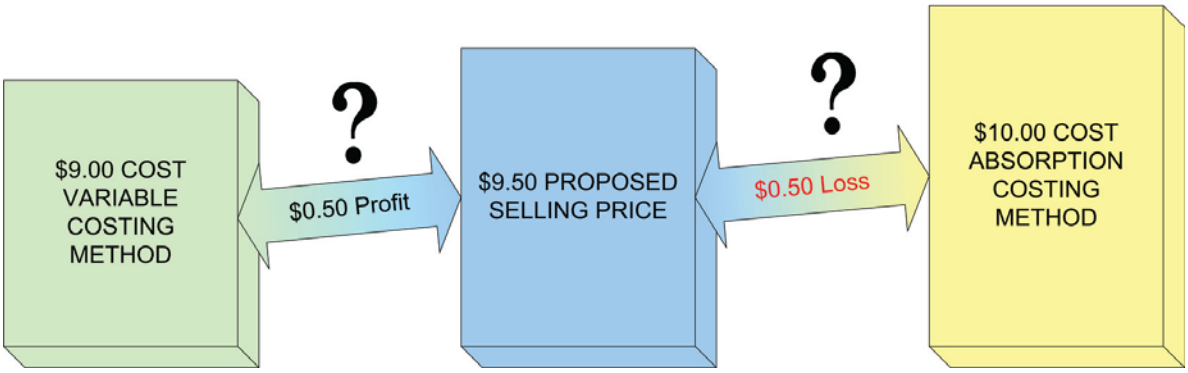
10.2 Variable Costing

To mitigate for deficiencies in absorption costing data, strategic finance professionals will often generate supplemental data based on variable costing techniques. As its name suggests, only variable production costs are assigned to inventory and cost of goods sold. These costs generally consist of direct materials, direct labor, and variable manufacturing overhead. Fixed manufacturing costs are regarded as period expenses along with SG&A costs.



The variable costing approach shifts fixed manufacturing costs from the product cost category to the period cost group. In some ways, this understates the true cost of production. How then can it aid in decision making? The short answer is that the fixed manufacturing overhead is going to be incurred no matter how much is produced. In the long run, a business must recover those costs to survive. But, on a case by case basis, including fixed manufacturing overhead in a product cost analysis can result in some very wrong decisions.

This last point can be made clear with a very simple illustration. Assume that a company produces 10,000 units of a product, and per unit costs are $2 for direct material, $3 for direct labor, and $4 for variable factory overhead. In addition, fixed factory overhead amounts to $10,000. The product cost under absorption costing is $10 per unit, consisting of the variable cost components ($2 + $3 + $4 = $9) and $1 of allocated fixed factory overhead ($10,000/10,000 units). Under variable costing, the product cost is limited to the variable production costs of $9. Now, let's consider a "management decision." Assume the company is approached to sell one additional unit at $9.50. This sale will not result in any added SG&A cost, or otherwise impact sales of other units.



Based on absorption costing methods, the additional unit appears to produce a loss of $0.50, and it appears that the correct decision is to not make the sale. Variable costing suggests a profit of $0.50, and the information appears to support a decision to make the sale. Management may well decide to sell the additional unit at $9.50, and produce an additional $0.50 for the bottom line. Remember, no other costs will be generated by accepting this proposed transaction. If management were limited to absorption costing information, this opportunity would likely have been passed up.

10.3 Variable Costing in Action

The preceding illustration highlights a common problem faced by many businesses. Consider the plight of a typical airline. As time nears for a scheduled departure, unsold seats represent lost revenue opportunities. The variable cost of adding one more passenger to an unfilled seat is quite negligible, and almost any amount of revenue that can be generated has a positive contribution to profit! An automobile manufacturer may have a contract with union labor requiring employees to be paid even when the production line is silent. As a result, the company may conclude that they are better off building cars at a “loss” to avoid an even “larger loss” that would result if production ceased. Professional sports clubs will occasionally offer steeply discounted ticks for unpopular games. Obviously, the variable cost of allowing someone to watch the game is nominal. Countless such examples exist in business. Likely, variable costing information is taken into account in making the decisions relating to the examples just cited. Each decision is intended to be in the best interest of the entity, even when a full costing approach causes the decision to look foolish.

10.4 A Double-Edge Sword

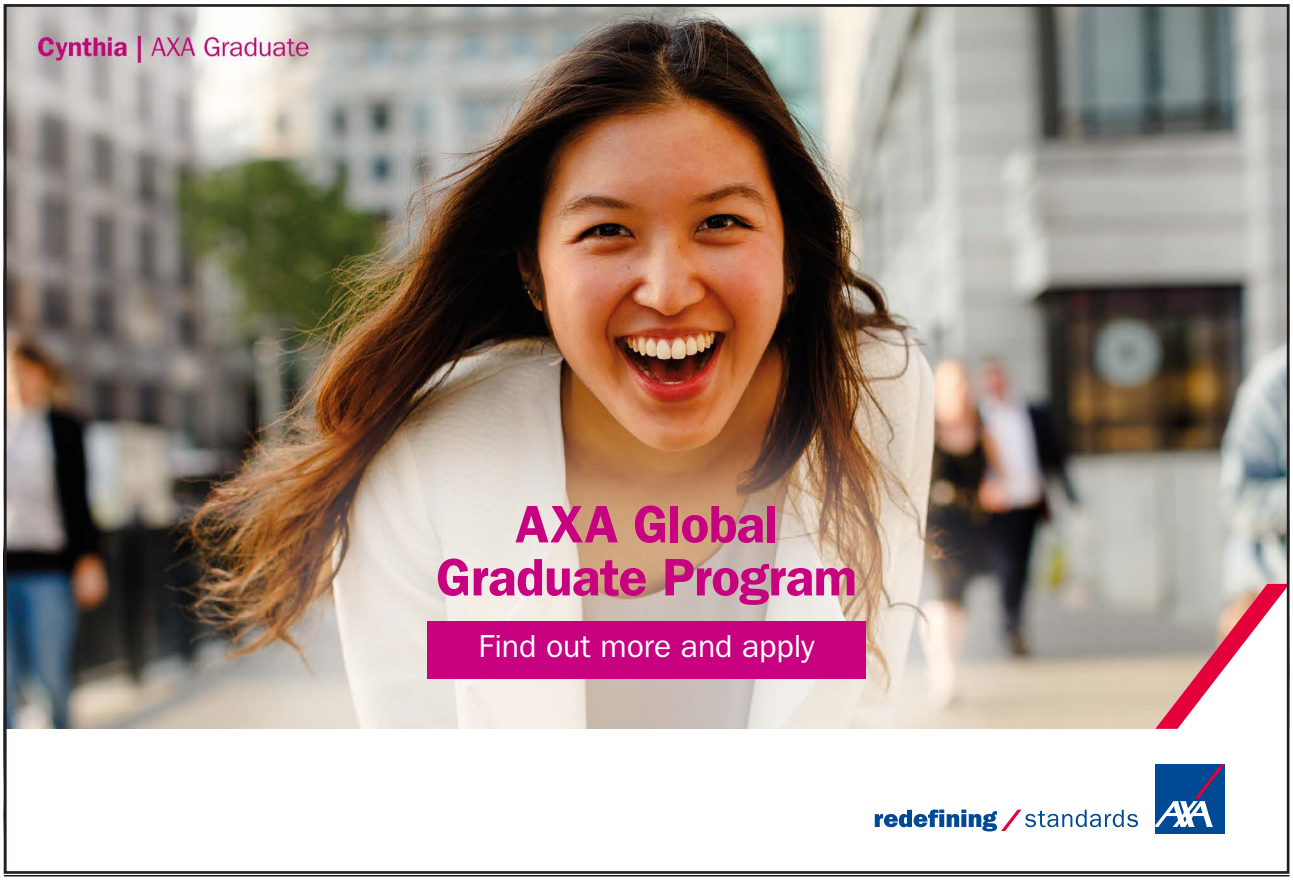
A typical textbook illustration of decision making based on variable costing data looks simple enough. But, such decisions are actually very tricky. Considerable business savvy and discipline are necessary, and there are several traps that must be avoided. First, a business must ultimately recover the fixed factory overhead and all other business costs; the total units sold must provide enough margin to accomplish this purpose. It would be easy to use up the full manufacturing capacity, one sale at a time, and not build in enough margin to take care of all the other costs. If every transaction were priced to cover only variable cost, the entity would quickly go broke. Second, word gets around . . . of a company offers special deals on a selective basis, other regular customers may become alienated or start to hold out for lower prices as well. The key point here is that variable costing information is useful, but it should not be the sole basis for decision making.

10.5 Avoiding a Downward Spiral

Variable costing data is quite useful in avoiding incorrect decisions about product discontinuation. Many businesses offer multiple products. Some will usually be more successful than others, and a logical business decision may be to focus on the best performing units, while discontinuing others.

Consider the data below. This company offers three products (A, B, and C). Each is being produced in equal proportion, and the company is fully able to meet customer demand from existing capacity (i.e., producing more will not increase sales). The company is not incurring any other variable costs relating to selling, general, and administration efforts. From the absorption costing data shaded in tan, it appears that Product A is yielding a negative gross profit. Logically, a manager may target that product for discontinuation. However, if that decision is reached, Products B and C will each have to absorb more fixed factory overhead. The revised cost data (in rose shading) show that eliminating Product A will actually reduce overall profitability!

	PRODUCTS				PRODUCTS	
	A	B	C		B	C
Direct Materials	$ 6	$ 5	$ 4		$ 5	$ 4
Direct Labor	5	2	1		2	1
Variable Factory Overhead	3	3	3		3	3
Fixed Factory Overhead	2	2	2	$6	3	3
Total Product Cost	$16	$12	$10		$13	$11
VS.						
Selling Price	$15	$15	$15		$15	$15
YIELDS						
Gross Profit	($ 1)	$ 3	$ 5		$ 2	$ 4
COMBINED PROFITS		$ 7			$ 6	



The decline in overall profits from discontinuing the "loser" occurs because the "loser" was absorbing some fixed cost of production. The $15 selling price for Product A at least covered its variable cost ($6 + $5 + $3 = $14). The lesson here is that a company must be very careful in eliminating "unprofi table" products. This decision can often result in a series of successive shifts in overhead to other remaining products. This, in turn, can cause other products to also appear unsuccessful. A downward spiral of product discontinuation decisions can ultimately destroy a business that was otherwise successful. This illustration underscores why a good manager will not rely exclusively on absorption costing data. Variable costing techniques that help identify product contribution margins (as more fully described in the following paragraphs) are essential to guiding the decision process.

10.6 Confused?

You may feel a bit whip-sawed by the preceding discussion. On the one hand, variable costing has been praised for its benefits in aiding decisions. On the other hand, you have been cautioned that variable costing is not a panacea and should not be used as the sole basis for making decisions.

Guiding a business is not easy. Decision making is not as simple as applying some mathematical algorithm to a single set of accounting data. A good manager must consider business problems from multiple perspectives. In the context of measuring inventory and income, a manager will want to understand both absorption costing and variable costing techniques. This information must be interlaced with knowledge of markets, customer behavior, and the like. The resulting conclusions can set in motion plans of action that bear directly on the overall fate of the organization.

10.7 An In-Depth Comparison of Variable Costing and Absorption Costing Income Statements

Much of the preceding discussion focused on per-unit cost assessments. In addition, the examples assumed that selling, general, and administrative costs were not impacted by specific actions. It is now time to consider aggregated financial data, and take into account shifting amounts of SG&A. The following income statements present information about Nepal Company; on the left is the income statement prepared using the absorption costing method, and on the right is the same information using variable costing. For now, assume that Nepal sells all that it produces, resulting in no beginning or ending inventory.

NEPAL COMPANY
Absorption Costing Income Statement
External Use Basis
For the Month Ending August 31, 20X7

Sales		$750,000
Less: Cost of goods sold		450,000
Gross profit		$300,000
Less: SG&A		
Variable SG&A	$112,500	
Fixed SG&A	100,000	212,500
Income		$ 87,500

NEPAL COMPANY
Variable Costing Income Statement
Internal Use Only
For the Month Ending August 31, 20X7

Sales		$750,000
Less: Var. product cost		300,000
Variable mfg. margin		$450,000
Less: Variable SG&A		112,500
Contribution margin		$327,500
Less: Fixed expenses		
Fixed factory cost	$150,000	
Fixed SG&A	100,000	250,000
Income		$ 87,500

With absorption costing, the income statement produces a subtotal (gross profit) which is derived by subtracting cost of goods sold from sales. Cost of goods sold includes the $450,000 total cost of production consisting of direct materials, direct labor, variable manufacturing overhead, and the allocated fixed manufacturing overhead. From gross profit, variable and fixed selling, general, and administrative costs are subtracted to arrive at net income. This approach should look very familiar. It is the presentation that is typical of financial statements that are generated for general use by shareholders and other persons external to the daily operations of a business.

With variable costing, all variable costs are subtracted from sales to arrive at the contribution margin. Nepal's presentation divides variable costs into two categories. The variable product costs include all variable manufacturing costs (direct materials, direct labor, and variable manufacturing overhead). These costs are subtracted from sales to produce the variable manufacturing margin. Some of Nepal's SG&A costs also vary with sales. As a result, these amounts must also be subtracted to arrive at the true contribution margin. Management must take into account all variable costs (whether related to manufacturing or SG&A) in making critical decisions. For instance, Nepal may pay sales commissions that are based on sales; to exclude those from consideration in evaluating the "margin" that is to be generated from a particular transaction or event would be quite incorrect. From the contribution margin are subtracted both fixed factory overhead and fixed SG&A costs.

Because Nepal does not carry inventory, the income is the same under absorption and variable costing. The difference is only in the manner of presentation. Carefully study the arrows that show how amounts appearing in the absorption costing approach would be repositioned in the variable costing income statement. Since the bottom line is the same under each approach, this may seem like much ado about nothing. But, remember the critical points discussed earlier. "Gross profit" is not the same thing as "contribution margin," and decision logic is often driven by consideration of contribution effects. Further, when inventory levels fluctuate, the periodic income will differ between the two methods.

10.8 The Impact of Inventory Fluctuations

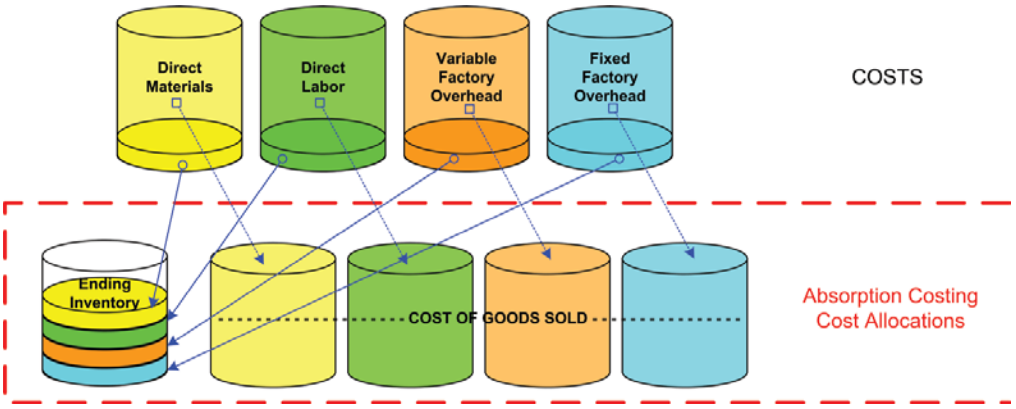
The following income statements are identical to those previously illustrated, except sales and variable expenses are reduced by 10%. Assume that the units relating to the "10% reduction" were nevertheless manufactured. What is the effect of this inventory build-up? The data below shows that income is higher under absorption costing by $15,000. This is consistent with a general rule of thumb: Increases in inventory will cause income to be higher under absorption costing than under variable costing, and vice versa.

NEPAL COMPANY Absorption Costing Income Statement External Use Basis For the Month Ending August 31, 20X7		
Sales		$675,000
Less: Cost of goods sold		405,000
Gross profit		$270,000
Less: SG&A		
Variable SG&A	$101,250	
Fixed SG&A	100,000	201,250
Income		$ 68,750

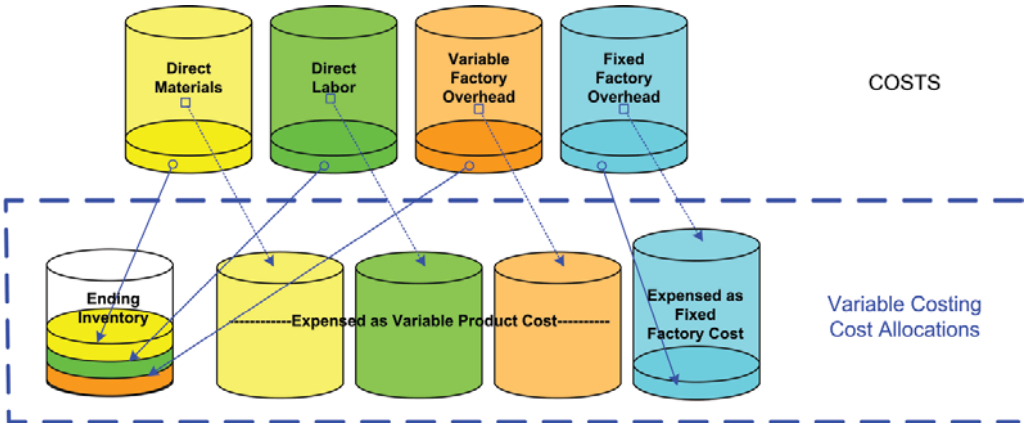
NEPAL COMPANY Variable Costing Income Statement Internal Use Only For the Month Ending August 31, 20X7		
Sales		$675,000
Less: Var. product cost		270,000
Variable mfg. margin		$405,000
Less: Variable SG&A		101,250
Contribution margin		$303,750
Less: Fixed expenses		
Fixed factory cost	$150,000	
Fixed SG&A	100,000	250,000
Income		$ 53,750

To further examine the reason income is higher, remember that $450,000 was attributed to total production under absorption costing. Of this amount, 10% ($45,000) is now diverted into inventory. However, under variable costing, total product costs were $300,000 and 10% ($30,000) of that amount would be assigned to inventory. As a result, $15,000 more is assigned to inventory under absorption costing. It is no coincidence that this $15,000 amount also coincides with the degree to which income is higher! After all, the balance sheet must balance -- the extra $15,000 in inventory is matched with an increase in equity brought about by the higher income under absorption costing.

Another way to view the impact of the inventory build-up is to examine the following "cups." The top set of cups initially contain the costs incurred in the manufacturing process. With absorption costing, those cups must be emptied into either cost of goods sold, or ending inventory. Trace the arrows, noting how the contents of the cups on top are split between the cups beneath.



Now, carefully compare the absorption costing drawing to the variable costing illustration that follows. You will note several important differences. Foremost among those differences is that the ending inventory cup contains less with variable costing than it does with absorption costing. Specifically, there is no fixed factory overhead in ending inventory!



These illustrations support the general conclusion about the relationships between absorption costing and variable costing income. Recognize that a reduction in inventory during a period will cause quite the opposite effect on income. Specifically, a portion of the contents of the beginning inventory cup would be transferred to expense commensurate with the decrease in inventory; since the inventory cup contains less under variable costing, expect expenses to be lower (and income to be higher).

11. Segment Reporting

The previous chapter provided insight into the preparation of performance reports by area of responsibility. The notion of holding unit managers accountable only for activities and costs under their control was introduced, along with a promise that the topic would be further developed within the present chapter. It is now time to give added consideration to the measurement and reporting of such segmented business data. A segment can be defined in many ways, but one prevailing view is that it is a discrete business unit for which separate financial information is prepared and evaluated by an operating decision maker within the organization. This decision maker usually has authority to allocate resources and judge performance of the unit, and typically relies upon the segment's financial reports in making those calls. Thus, it is quite important that segmented data be prepared in ways that facilitate thoughtful and correct decisions.

11.1 Internal of Segment Data

Within the scope of the introductory definition, a segment might be a region, territory, division, product category, department, or other classification. A "segment" as judged by upper management might be made up of "sub segments" that are, in turn, judged by middle managers. The segmentation of an entity is a highly subjective process. The goal is divide/allocate overall performance outcomes to the various moving pieces that make up the entire entity. In other words, segment data should indicate what each part of the entity is contributing to the overall basket of business outcomes.

11.2 The Problem of Segment Income Measurement

Great care must be taken to develop a very logical structure for evaluating the income of individual segments. Recall the distinction between direct costs and indirect costs. Direct costs are easily traced to and associated with a particular business segment; indirect costs are not. It is fairly easy to understand how direct costs should be pinned on a particular segment in measuring its results. Indirect costs are a more vexing problem. They may be necessary costs for the overall organization to function, but how are they to be allocated to segments? Virtually any allocation scheme is potentially arbitrary. Furthermore, such costs may be well beyond the control of the segment to which they are potentially assigned. For instance, a soft drink company may engage in an expensive national advertising campaign that benefits ten different bottling plants; how much (if any) advertising cost should be assigned to each plant? It is an interesting question -- especially if you are a plant manager whose compensation is tied to the profitability of your operation.

Another problem of segment profit measurement is that a direct cost can become indirect as it is pushed down within an organization. This problem can be understood from the perspective of an example that might be quite familiar to you. Suppose you share an apartment with a roommate. The apartment may have a separate electric meter, and you and your roommate probably get a single bill representing your shared usage. The electricity cost is a direct cost clearly matched to your apartment. But, how is the cost to be shared between you and your roommate? Probably, you and your roommate have an agreement to split the cost equally. This split will occur even though you and your roommate do not use exactly the same quantity of electricity. At the individual person level, the electricity cost is an indirect allocated cost, even though it is a direct cost of your

apartment. In similar fashion, many business costs can be traced to a segment at one level, but are simply allocated to the sub segments. Because these allocations impact the perceived profitability of individual business units, great care must be exercised in the allocation and interpretation process.

It is not uncommon for a business to develop a model for allocating indirect costs to business units. The allocation scheme is often the subject of debate and consternation. Depending on the scheme in play, there will likely be winners and losers. But, more likely than not, each business unit will feel that their profit measurement is unduly burdened by more than a fair share of indirect cost absorption.

11.3 Contribution Income Statement Format

To mitigate for the aforementioned allocation problems, managerial accountants sometimes prepare a contribution income statement for each segment. This internal use document is consistent with responsibility accounting. Rather than focusing on segment profit/loss after taking into account all business costs, it instead identifies each segment's controllable elements. The exact format of the statement can vary considerably, but it generally facilitates identification of each unit's contribution margin, controllable fixed costs, and uncontrollable fixed costs. The net of these cost elements comprise the segment margin. Costs that cannot be traced directly to a subunit are considered only at higher levels.

Zen Computers is a diversified company with two primary divisions -- Computer Hardware and Systems Support. The Hardware unit focuses on personal computers (PCs) and personal digital entertainment devices (PDE). Below are partial contribution income statements for Zen. Review these statements carefully, taking into consideration the various notes appended to the illustration:

Directly traced to overall division, but not individual product unit

Typical contribution margin as determined under variable costing method

Controllable by management and directly traceable to segment (e.g. supervisory salaries)

A key number in evaluating *management performance* for applicable unit

Not controllable by management but incurred by segment (e.g., property taxes, depreciation, etc.)

A key number in evaluating *business viability* for applicable unit

20X5 DIVISIONAL REPORT FOR HARDWARE
CONTRIBUTION INCOME STATEMENTS (in thousands of dollars)

	Division Total	PCs	PDEs	Non-Traceable
Net sales	$ 18,000	$ 12,000	$ 6,000	
Less:				
Variable Product Costs	$ 6,600	$ 4,800	$ 1,800	
Variable SG&A	1,800	1,200	600	
Total Variable Costs	$ 8,400	$ 6,000	$ 2,400	
Contribution Margin	$ 9,600	$ 6,000	$ 3,600	
Less: Controllable Fixed Costs	3,200	2,000	800	400
Controllable Contribution Margin	$ 6,400	$ 4,000	$ 2,800	$ (400)
Less: Uncontrollable Fixed Costs	1,000	500	300	200
Segment Margin	$ 5,400	$ 3,500	$ 2,500	$ (600)

20X5 CORPORATE SUMMARY REPORT
CONTRIBUTION INCOME STATEMENTS (in thousands of dollars)

	Company Total	Hardware	Systems
Net sales	$ 29,000	$ 18,000	$ 11,000
Less:			
Variable Product Costs	$ 12,100	$ 6,600	$ 5,500
Variable SG&A	2,900	1,800	1,100
Total Variable Costs	$ 15,000	$ 8,400	$ 6,600
Contribution Margin	$ 14,000	$ 9,600	$ 4,400
Less: Controllable Fixed Costs	5,200	3,200	2,000
Controllable Contribution Margin	$ 8,800	$ 6,400	$ 2,400
Less: Uncontrollable Fixed Costs	1,900	1,000	900
Segment Margin	$ 6,900	$ 5,400	$ 1,500
Less: General Corporate Costs	1,700		
Net Income	$ 5,200		

Not traceable to individual divisions

In examining the divisional report for the hardware business (shaded in yellow), notice that separate segment margins were computed for each product unit (PCs and PDEs). The segment margin helps identify if each product is supporting its imbedded cost structure. Within each product segment, a distinction is drawn between the segment margin and the controllable contribution margin. This distinction is important in differentiating between management performance vs. business viability. In other words, management is charged with controlling certain costs, and management performance can be judged based on the controllable margin. However, a business unit may necessarily incur additional fixed costs that are beyond the control of management; these uncontrollable fixed costs must be considered in evaluating the viability of a business unit, independent of the assessment of management performance.

Note that certain costs incurred by the hardware division could not be assigned to a specific product segment (these costs are noted in the separate column for non traceable costs). These costs are included in the totals of the hardware division, but are not useful in evaluating the performance of the individual products.

The hardware division is carried forward into the corporate summary report (shaded in green), and totaled together with results of the systems division. Certain general corporate expenses were not traceable to individual divisions/products, and are only taken into consideration in the overall corporate income calculations. This type of contribution income statement reporting helps remove the bias that can result from arbitrary allocation of common costs and is sometimes helpful in identifying which business segments are targets for expansion, restructure, or discontinuance.

11.4 External Reporting of Segment Data

For corporate management to correctly discharge their duties, it is quite apparent why overall financial data must be disaggregated into segmented information. However, this same management group may be reluctant to share such information for external reporting. The reasons can vary, but one important point is that some units may be performing very well, and management does not wish to attract the attention of potential competitors. Conversely, some units may be a drag and management would rather not call attention to business mistakes.

Nevertheless, rules developed by the Financial Accounting Standards Board do require public companies to present a limited amount of financial information for each business segment. Potential investors usually find these added disclosures to be quite revealing. Generally, a company must provide descriptive information about its reportable operating segments, and note the revenues, operating profits, and identifiable assets of each significant segment. The standard also requires that segment data be reconciled to corporate totals, specifically noting the general corporate costs that were not traceable to individual segments.

At the top of the following page is a reduced/edited/highlighted illustration (actual rules require other disclosures about capital expenditures, etc., by segment; those amounts are redacted from this illustration) of segment data prepared by a public company, as taken from filings with the Securities and Exchange Commission:.

The FASB rules require that companies identify their externally reported segments using the same logic that is used to identify and manage segments on an internal basis. Although it is not illustrated here, you might also find it interesting to know that these same rules require companies to externally report information about geographic areas of operation (in a global context, such as Asia, Europe, the Americas, etc.) and the existence of major customers who comprise over 10% of a company's revenue stream.

Operating segments
The Company has two reportable segments as defined by the FASB No. 131, Disclosures about Segments of an Enterprise and Related Information: (1) Electrical and Industrial Products and (2) Galvanizing Services. The Electrical and Industrial Products Segment provides highly engineered specialty components supplied to the power generation transmission and distribution market, as well as products to the industrial market. The Galvanizing Services Segment provides hot dip galvanizing services to the steel fabrication industry through facilities located throughout the south and southwest. Hot dip galvanizing is a metallurgical process by which molten zinc is applied to a customer's material. The zinc bonding renders a corrosive resistant coating enhancing the life of the material for up to fifty years.

Information regarding operations and assets by segment is as follows:

	20X5	20X4	20X3
		(In thousands)	
Net sales:			
Electrical and Industrial Products	$ 100,542	$ 88,916	$ 134,861
Galvanizing Services	51,886	47,285	48,509
	$ 152,428	$ 136,201	$ 183,370
Segment Operating income (a):			
Electrical and Industrial Products	$ 7,282	$ 6,363	$ 14,868
Galvanizing Services	9,556	8,642	8,963
Total Segment Operating Income	$ 16,838	$ 15,005	$ 23,831
Reconciliation of segment income to corporate income:			
General corporate expenses (b)	$ 7,718	$ 5,913	$ 5,869
Interest expense	1,637	2,407	3,945
Other (income) expense, net	76	(193)	122
	$ 9,431	$ 8,127	$ 9,936
Income before income taxes	$ 7,407	$ 6,878	$ 13,895
Total assets:			
Electrical and Industrial Products	$ 79,424	$ 74,061	$ 86,278
Galvanizing Services	45,042	42,222	44,036
Corporate	4,169	3,743	3,723
	$ 128,635	$ 120,026	$ 134,037

(a) Segment operating income consists of net sales less cost of sales, specifically identifiable selling, general and administrative expenses, and other income and expense items that are specifically identifiable to a segment.

(b) General Corporate Expense consists of selling, general and administrative expenses that are not specifically identifiable to a segment.

12. Measures of Residual Income

Look again, closely, at the 20X5 segment data for the illustrated company. In particular, note that the electrical segment produced operating income of $7,282,000. This compares to $9,556,000 for the galvanizing group. Even though the relative profitability bobbles a bit from year to year, the two units are not terribly far apart in overall profits. What is most interesting is that the electrical products segment deployed $79,424,000 in assets versus the $45,042,000 in use by galvanizing. In this context, it is quite apparent that galvanizing is producing a better rate of return on the invested assets (i.e., fewer assets produced more income). A good manager would probably take note of this conclusion by careful inspection of the data. However, a managerial reporting technique, known as residual income, is sometimes used to flesh out these effects.

Residual income is not a GAAP concept. It is an internal financial assessment technique to help scale the relative success or failure of specific business activities. It adjusts income for a presumed cost of capital (or other threshold rate of return). Although there are many variations of the residual income calculations, the general approach is portrayed by the following formula:

Residual Income = Operating Income - (Operating Assets X Cost of Capital)

For purposes of this illustration, assume that the company's cost of capital (or minimum required rate of return) is 10%. The accompanying table reveals the residual income for each segment. This information sheds a completely different light on the relative performance of each unit. Remember the opening observation: the two units are not terribly far apart in overall profits. Once the cost of capital is placed on the evaluative scale, it appears that one unit is doing far better than the other.

	Electrical	Galvanizing
Segment Operating Income	$ 7,282,000	$ 9,556,000
Less: Assumed Cost of Capital		
$79,424,000 X 10%	7,942,400	
$45,042,000 X 10%		4,504,200
Residual Income	$ (660,400)	$ 5,051,800

12.1 Keeping Residual Income in Perspective

Residual income is a powerful tool for identifying and ranking the performance of business units. However, a manager must be very careful in utilizing these calculations. First, there is the usual issue of short run vs. long run considerations. The preceding illustration painted the electrical segment in a less favorable light than galvanizing; repeat the analysis using the 20X3 data, and the situation reverses. A single year's residual income data is rarely conclusive in and of itself. And, managers need to be savvy to the impact of accounting rules. For instance, the electrical products segment may be investing heavily in research toward new products. These costs would be expensed as incurred, thereby substantially reducing operating income in current periods. As such, the unit's residual income would suffer relative to other units that might be investing in tangible assets! Finally, the 10% rate is an arbitrary hurdle rate. Selecting an alternative rate will change the measure of residual income. Despite its inherent limitations, reports of residual income can be very helpful in clearly and quickly pinpointing areas of management concern.

13. Concepts in Allocating service Department Costs

Not all discrete units within a business organization are focused on production of the end product. Janitorial departments, cafeterias, maintenance/repair shops, health clinics, and countless other units support the productive units. How are the costs of such service departments to be considered in forming judgments about the success or failure of the various operating units?

In general, service department costs are allocated to operating units via some adopted allocation scheme. This allocation occurs to support measurement of full product cost (as contemplated by GAAP), to make managers of operating units aware of the complete cost of their activities, and to discourage waste and inefficiency by over utilization of service departments. The allocation scheme will generally be based on either a direct or step allocation approach.

13.1 The Direct Method of Allocating Service Department Cost

The direct method transfers the cost of a service department directly to the productive departments that rely on the services. The allocation is usually based upon some logical benchmark. For example, janitorial services may be allocated to productive departments based on square footage used by the productive departments. Cafeteria costs may allocated based on the number of employees within each production department. Hopefully, the base selected bears a logical relationship to the consumption of services and their costs. Assume that Benjamin Printing

Company has two production departments: printing and binding. Printing is highly automated, with a number of complex printing presses. Binding also relies on mechanized devices, but is overall a far more labor intensive department. These departments are supported by maintenance and cafeteria service units. Maintenance activities are driven by the amount of machinery requiring service and repair. The utilization of cafeteria services is directly related to the size of the labor pool. As a result, a decision was reached to allocate costs incurred by the Maintenance Department based on number of machines used by each productive department. Cafeteria costs are allocated based on number of employees. The following table shows how the total costs were directly allocated to production activities:

DIRECT ALLOCATION OF SERVICE DEPARTMENT COSTS

	SERVICE DEPARTMENTS		PRODUCTIVE DEPARTMENTS	
	Cafeteria	Maintenance	Printing	Binding
Department Costs	$ 600,000	$ 900,000	$3,700,000	$2,500,000
Cafeteria Allocation	(600,000)	-	150,000	450,000
Maintenance Allocation*	-	(900,000)	675,000	225,000
Total Cost After Allocation	-	-	$4,525,000	$3,175,000
Key Statistics:				
Number of employees	n/a	n/a	5	15
Number of machines	n/a	n/a	30	10

Allocation Calculations:

Cafeteria to Printing: cafeteria cost times ratio of printing employees to total productive department employees
$600,000 X 5/(5+15) = $150,000

Cafeteria to Binding: cafeteria cost times ratio of binding employees to total productive department employees
$600,000 X 15/(5+15) = $450,000

Maintenance to Printing: maintenance cost times ratio of printing machines to total productive depart. machines
$900,000 X 30/(30+10) = $675,000

Maintenance to Binding: maintenance cost times ratio of binding machines to total productive depart. machines
$900,000 X 10/(30+10) = $225,000

13.2 The Step Method of allocating Service Department Cost

The direct approach ignores one potentially important issue. Some service departments may provide support to other service departments. For instance, Benjamin's maintenance employees likely eat in the cafeteria, too! This issue is mitigated by a step method of allocation. With the step method, an identified service department's cost is first allocated to other units, including other service departments. Then, the "resulting costs" of the other service departments are allocated to production. This step allocation process is demonstrated for Benjamin, assuming that cafeteria costs benefit maintenance, printing, and binding operations:

STEP ALLOCATION OF SERVICE DEPARTMENT COSTS

	SERVICE DEPARTMENTS		PRODUCTIVE DEPARTMENTS	
	Cafeteria	Maintenance	Printing	Binding
Department Costs	$ 600,000	$ 900,000	$3,700,000	$2,500,000
Cafeteria Allocation	(600,000)	200,000	100,000	300,000
Maintenance Allocation	-	(1,100,000)	825,000	275,000
Total Cost After Allocation	-	-	$4,625,000	$3,075,000
Key Statistics:				
Number of employees	n/a	10	5	15
Number of machines	n/a	n/a	30	10

Allocation Calculations:

Cafeteria to Maintenance: cafeteria cost times ratio of maintenance employees to total department employees
$600,000 X 10/(10+5+15) = $200,000

Cafeteria to Printing: cafeteria cost times ratio of printing employees to total department employees
$600,000 X 5/(10+5+15) = $100,000

Cafeteria to Binding: cafeteria cost times ratio of binding employees to total department employees
$600,000 X 15/(10+5+15) = $300,000

Maintenance to Printing: maintenance cost times ratio of printing machines to total productive depart. machines
$1,100,000 X 30/(30+10) = $825,000

Maintenance to Binding: maintenance cost times ratio of binding machines to total productive depart. machines
$1,100,000 X 10/(30+10) = $275,000

13.3 Multiple Steps and Simultaneous Allocations

A large organization can have many service departments, and it is quite possible to identify a number of interactions between various service departments. The design to achieve a logical allocation of costs can entail numerous sequential steps (e.g., Department A serves Departments B, C, D, and E; then Department B serves Departments C, D, and E, etc.). Or, a it may be observed that service departments benefit each other (e.g., the maintenance staff eats in the cafeteria, but the cafeteria utilizes maintenance employees to repair ovens). There is no mathematical limit to the number of step allocations that can be made. In the alternative, calculus could be used to achieve numerous simultaneous allocations. These situations provide intellectually stimulating challenges, but they may not be worth the cost of implementation. As a result, companies are usually content to rely on direct or very simplified step allocations of service department costs.

14. Leveraging the Power of Modern Information Systems

In this chapter you have seen how various reporting methods can be employed to facilitate managerial decision making. Before departing, you should consider that the same internal data can often be generated and displayed in many ways. There is not a single correct method for "slicing and dicing" a company's overall results into unitized information sets. And, there is no reason to think that a manager should be forced to make decisions based upon a single display of data. Modern information systems empower managers to look at the same data from multiple perspectives, and good managers will avail themselves of these tools as they consider data and make decisions based thereon.

14.1 Line Item VS. Object of Expenditure

Factory	$16,247,500
Sales	3,772,000
General	1,515,000
Administrative	3,285,000
	$24,819,500

For instance, consider the data set at left. It reveals that $24,819,500 was spent on compensation. Of that amount, $16,247,500 was spent on factory labor, and so forth. Each line item corresponds to an employee grouping, and those lines roughly relate to the individual categories that would be compiled in developing an overall income statement. Suppose you were the manager for this business, and charged with reducing total compensation costs to $24,000,000. What category would you consider cutting? Would it be wise to cut each category in equal proportion to "spread the pain?" Is there a better way? Indeed, it is difficult to say by reviewing the data from a single perspective. Consider the same data, rearranged in a different fashion below. Here, you can see the same total cost of $24,819,500, this time distributed to match the object of expenditure:

Salaries and wages	$15,000,000
Health insurance	1,500,000
Unemployment taxes	359,000
FICA taxes	858,000
Retirement contributions	975,000
401K matching contributions	562,000
Workers' compensation insurance	1,542,000
Bonuses and stock-based compensation	2,150,000
Vacation accruals	1,125,000
Sick leave accruals	629,500
Reimbursed employee tuition/training	119,000
	$24,819,500

Perhaps the revised display provides added insight into cost control opportunities. Some specific expenditure category might be targeted for reduction if it is viewed as discretionary or not critical to the productive mission of the entity.

The data might be further arranged into an even more detailed matrix format for an even closer inspection:

	Factory	Sales	General	Administrative	Total
Salaries and wages	$10,500,000	$ 2,300,000	$ 1,000,000	$ 1,200,000	$15,000,000
Health insurance	1,050,000	230,000	100,000	120,000	1,500,000
Unemployment taxes	315,000	23,000	15,000	6,000	359,000
FICA taxes	735,000	69,000	30,000	24,000	858,000
Retirement contributions	525,000	230,000	100,000	120,000	975,000
401K matching contributions	210,000	92,000	80,000	180,000	562,000
Workers' compensation insurance	1,470,000	46,000	20,000	6,000	1,542,000
Bonuses and stock-based compensation	25,000	575,000	50,000	1,500,000	2,150,000
Vacation accruals	787,500	172,500	75,000	90,000	1,125,000
Sick leave accruals	577,500	23,000	20,000	9,000	629,500
Reimbursed employee tuition/training	52,500	11,500	25,000	30,000	119,000
	$16,247,500	$ 3,772,000	$ 1,515,000	$ 3,285,000	$24,819,500

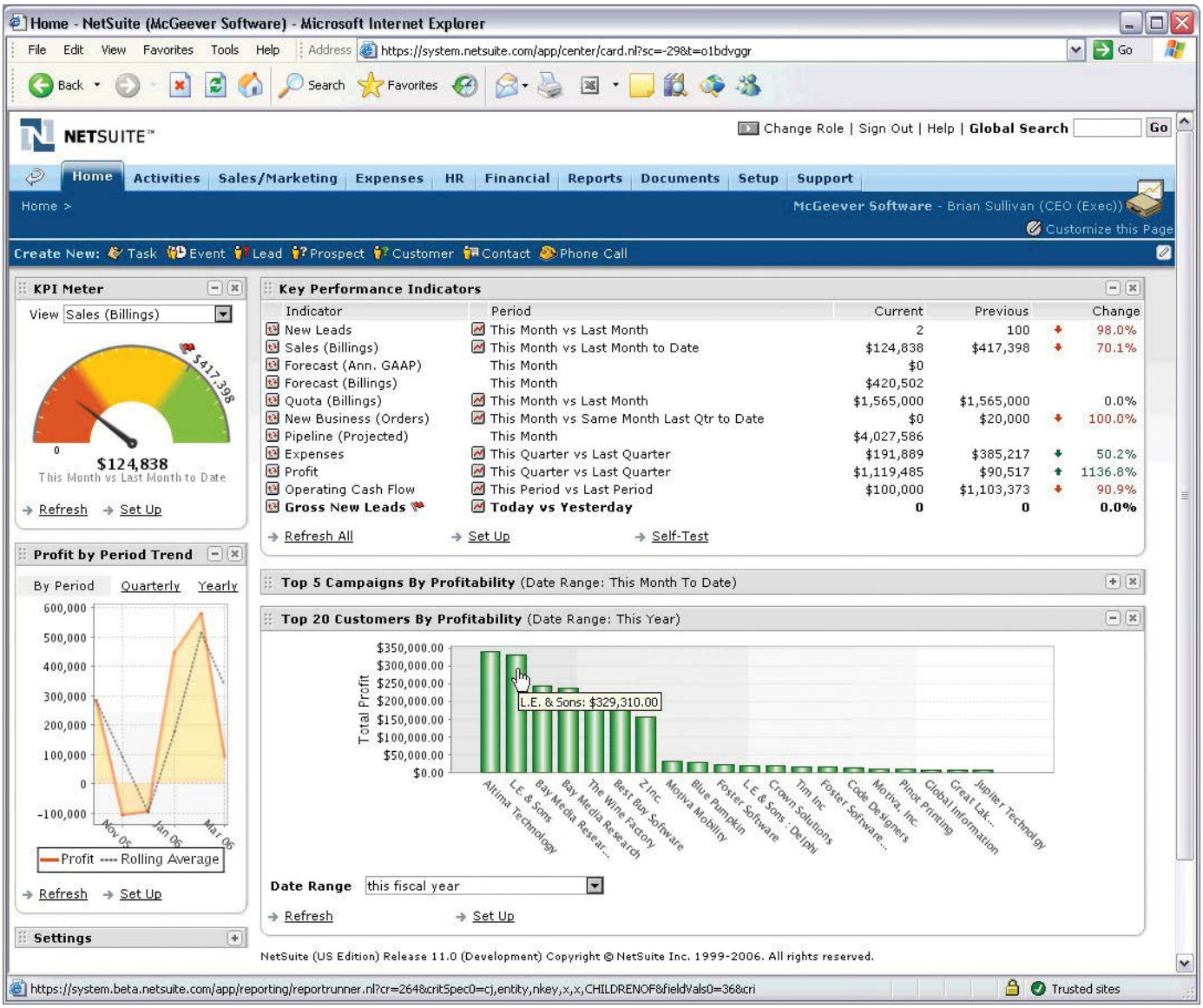
The column totals correspond to the information in the first report, and the row totals correspond to the information in the second report. The individual cells within the matrix bring to light a number of areas where added cost control might be effectively implemented. For instance, workers' compensation insurance for factory labor is $1,470,000. Perhaps a different insurance carrier might provide a better rate for this policy, contributing a significant amount of the targeted overall cost reduction. Or, maybe the bonus plan for administrative staff ($1,500,000) should be targeted; perhaps this category is in "runaway mode" since it exceeds the base amount for administrative salaries. Examine the data yourself and you will likely see other areas that peek your interest for potential cost reduction.

The key point is that managers should be prepared to consider alternative or expanded data sets as they contemplate difficult decisions. Viewing data only by line item or only by object of expenditure can greatly limit insight into business operations. Modern accounting systems enable organizing and rearranging data sets with relative ease. These modern systems are usually costly to design and implement, but they can pay great returns when managers take advantage of the robust information they are capable of producing. As a business manager, it is well worth your time to study and understand the full range of capabilities of the business information system you have at your disposal!

14.2 Business Dashboard

A rapidly growing trend is for business managers to utilize “dashboards” to monitor business information on a real time basis. These packages present corporate information on personal computers. The information is constantly updated to reflect the latest developments, much like a car’s dashboard reflects current speed, water temperature, oil pressure, and so forth. On the next page is a screenshot of a sample dashboard. This particular illustration is from a business using NetSuite, a leading provider of Web-based accounting and customer relationship management software which helped pioneer the use of dashboard technology.

Dashboards are easily customized by each manager. You will note that the sample dashboard is contemplated for an executive. But, personalized dashboards can easily be set up that are specifically tailored to the information needs of a sales manager, CFO, or other decision maker. Typically, specific line items on a dashboard can be “clicked” to open windows of additional data in support of the key metrics displayed. An important feature of a business dashboard is secure internet access so that an on-the-go executive always has critical information readily available.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Indicator Period Current Previous Change
New Leads This Month vs Last Month 2 100 98.0%
Sales (Billings) This Month vs Last Month to Date $124,838 $417,398 70.1%
Forecast (Ann. GAAP) This Month $0
Forecast (Billings) This Month $420,502
Quota (Billings) This Month vs Last Month $1,565,000 $1,565,000 0.0%
New Business (Orders) This Month vs Same Month Last Qtr to Date $0 $20,000 100.0%
Pipeline (Projected) This Month $4,027,586
Expenses This Quarter vs Last Quarter $191,889 $385,217 50.2%
Profit This Quarter vs Last Quarter $1,119,485 $90,517 1136.8%
Operating Cash Flow This Period vs Last Period $100,000 $1,103,373 90.9%
Gross New Leads Today vs Yesterday 0 0 0.0%
Refresh All Set Up Self-Test
Top 5 Campaigns By Profitability (Date Range: This Month To Date)
Top 20 Customers By Profitability (Date Range: This Year)
Total Profit
$350,000.00
$300,000.00
$250,000.00
$200,000.00
$150,000.00
$100,000.00
$50,000.00
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L.E. & Sons: $329,310.00
Altima Technology
L.E. & Sons
Bay Media Resear...
Bay Media Research
The Wine Factory
Best Buy Software
Z Inc.
Moriva Mobility
Blue Pumpkin
Foster Software
L.E. & Sons - Delphi
Crown Solutions
Tim Inc
Foster Software...
Code Designers
Motiva, Inc.
Pinot Printing
Global Information
Great Lak...
Jupiter Technology
Date Range this fiscal year
Refresh Set Up
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Analytics for Managerial Decision Making

Part 4

Your goals for this "managerial analytics" chapter are to learn about:

- Cost characteristics and the impact on decisions.
- A general framework for making rational business decisions.
- Capital expenditure decisions.
- Compound interest and present value.
- Tools for evaluating capital projects.

15. Cost Characteristics and Decision-Making Ramifications

As a student, you can probably think of many things you wish you could do over. You may have taken an exam and regretted some stupid mistake. You knew the material but fumbled in your execution. Or, maybe you did not really know the material; your judgment about how much to study left you doomed from the start!

Business people will experience similar feelings. Perhaps inventory was shipped using costly overnight express when less expensive ground shipping would have worked as well. Perhaps parking lot lights were unnecessarily left on during daylight hours. Hundreds of examples can be cited, and management must be diligent to control against these types of business execution errors. Earlier chapters discussed numerous methods for monitoring and controlling against waste. Remember, each dollar wasted comes right off the bottom line. For a public company that is valued based on a multiple of reported income, a dollar wasted can translate into many times that in lost market value.

On a broader scale, business plans and decisions might be faulty from the outset. There is really no excuse for stepping into a business plan when it has little or no chance for success. This is akin to going into a tough exam without preparing. Regret is perhaps the only lasting outcome. The overall theme of this chapter is to impart knowledge about sound principles and methods that can be employed to make sound business decisions. These techniques won't eliminate execution errors, but they will help you avoid many of the judgment errors that are all too common among failing businesses.

15.1 Sunk Costs VS. Relevant Costs

One of the first things to understand about sound business judgment is that a distinction must be made between sunk costs and relevant costs. There is an old adage that cautions against throwing good money after bad. This has to do with the concept of a sunk cost, and it is an appropriate warning. A sunk cost relates to the historical amount that has already been expended on a project or object. For example, you may have purchased an expensive shirt that was hopelessly shrunk in the dryer. Would you now attempt to buy a matching pair of pants because you had invested so much in the shirt? Obviously not. The amount you previously spent on the shirt is no longer relevant to your decision; it is a sunk cost and should not influence your future actions.

In business decision making, sunk costs should be ignored. Instead, the focus should be on relevant costs. Relevant items are those where future costs and revenues are expected to differ for the alternative decisions under consideration. The objective will be to identify the decision yielding the best incremental outcome as it relates to relevant costs/benefits.

15.2 A Basic Illustration of Relevant Cost/Benefit Analysis

During a recent ice storm, Dillaway Company's delivery truck was involved in a traffic accident. The truck originally cost $60,000, and was 40% depreciated. An insurance company has provided Dillaway $30,000 for the damages that were incurred. Dillaway took the truck to a local dealer who offered two options: (a) repair the truck for $24,000, or (b) buy the truck "as is, where is" for $10,000. Dillaway has found an undamaged, but otherwise identical, used truck for sale on the internet for $32,000 what decision is in order?

The truck's original cost of $60,000 is sunk, and irrelevant to the decision process. The degree to which it is depreciated is equally irrelevant. The financial statement "gain" that would be reported on a sale is irrelevant. The $30,000 received from the insurance company is the same whether the truck is sold or repaired; because it does not vary among the two alternatives it is irrelevant (i.e., it is not necessary to factor it into the decision process). All that matters is to note that the truck can be repaired for $24,000, or the truck can be sold for $10,000 and a similar one purchased for $32,000. in the former case, Dillaway is up and running for $24,000; in the later, Dillaway is up and running for $22,000 ($32,000 - $10,000). it seems clear that the better option is to sell the damaged truck and buy the one for sale on the internet.

The logic implied by the preceding discussion is to focus on incremental items that differ between the alternatives. The same conclusion can be reached by a more comprehensive analysis of all costs and benefits. The following portrays one such analysis. This analysis also supports sale and replacement because the income and cash flow impacts are $2,000 better than with the repair option:

ANALYSIS FOR SALE OF TRUCK			ANALYSIS FOR REPAIR OF TRUCK	
Cost of damaged truck	$ 60,000		Cost of damaged truck	$ 60,000
Accumulated depreciation on damaged truck	24,000		Accumulated depreciation on damaged truck	24,000
Net book value of damaged truck	$ 36,000		Net book value of damaged truck	$ 36,000
Less: Insurance recovery	30,000		Less: Insurance recovery	30,000
Resulting reduced basis	$ 6,000		Resulting reduced basis	$ 6,000
			Plus: Money to repair truck	24,000
Sales price of damaged truck	$ 10,000		Resulting basis	$ 30,000
Less: Reduced basis (from above)	6,000			
Gain on sale of truck	$ 4,000			
Future depreciation (purchase price/new truck)	$ 32,000		Future depreciation (resulting basis)	$ 30,000
Lifetime income effect:			Lifetime income effect:	
Gain on sale of truck	$ 4,000		Gain on sale of truck	$ -
Future depreciation	(32,000)		Future depreciation	(30,000)
Net impact on income	$ (28,000)		Net impact on income	$ (30,000)
Cash flow impacts:			Cash flow impacts:	
Insurance recovery	$ 30,000		Insurance recovery	$ 30,000
Sales price of damaged truck	10,000		Repair costs	(24,000)
Purchase price of truck	(32,000)			-
Net impact on cash	$ 8,000		Net impact on cash	$ 6,000

Your head is likely swimming in information based on this comprehensive analysis. Although it is more descriptive of the entirety of the two alternatives, it is unnecessarily confusing. it bears repeating that decision making should be driven only by relevant costs/benefits -- those that differ among the alternatives! To toss in the extraneous data may help describe the situation, but it is of no benefit in attempting to guide decisions.

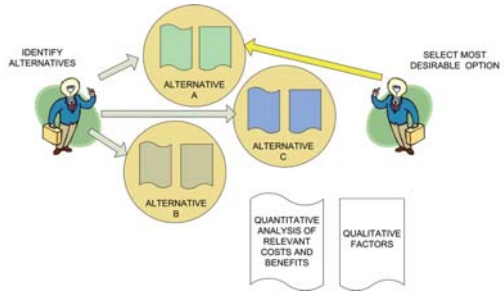
In one sense, Dillaway was lucky. The insurance proceeds were more than enough to put Dillaway back in operation. Many times, a favorable outcome cannot be identified. Each potential decision leads to a negative result. Nevertheless, decisions must be made. As a result, proper incremental analysis often centers on choosing the option of least incremental harm or loss.

15.3 Complicating Factors

Relevant costs/benefits are rarely so obvious as illustrated for Dillaway. Suppose the local truck dealer offered Dillaway a third option: A $27,000 trade-in allowance toward a new truck costing $80,000. The incremental cost of this option is $53,000 ($80,000 - $27,000). This is obviously more costly than either of the other two options. But, Dillaway would have a brand new truck. As a result, Dillaway must now begin to consider other qualitative factors beyond those evident in the incremental cost analysis. This is often the case in business decision making. Rarely are two (or more) options under consideration driven only by quantifiable mathematics. Managers must be mindful of the impacts of decisions on production capacity, customers, employees, and other qualitative factors.

Therefore, as you develop your awareness of the analytical techniques presented throughout this chapter, please keep in mind that they are based on concrete textbook illustrations and logic. However, your ultimate success in business will depend upon adapting these sound conceptual approaches in a business world that is filled with uncertain and abstract problems. Do not assume that analytical methods can be used to solve all business problems, but do not abandon them in favor of wild guess work!

16. Business Decision Logic



It is virtually impossible to develop a listing of every type of business decision you will confront. Classic examples include whether to outsource or not, when to accept special orders, and whether to discontinue a product or project. Although each of these examples will be considered in more detail, what is most important is for you to develop a general frame of reference for business decision making. In general, that approach requires identification of decision alternatives, logging relevant costs/benefits of each choice, evaluating qualitative issues, and selecting the most desirable option based on judgmental balancing of quantitative and qualitative factors. As you reflect on this process, recognize that it begins with judgment (what are the alternatives?) and ends with judgment (which alternative presents the best blend of quantitative and qualitative factors). Analytics support decision making, but they do not supplant judgment.

16.1 Outsourcing

Companies must frequently choose between using outside vendors/suppliers or producing a good or service internally. Outsourcing occurs across many functional areas. For instance, some companies outsource data processing, tech support, payroll services, and similar operational aspects of running a business. Manufacturing companies also may find it advantageous to outsource certain aspects of production (frequently termed the “make or buy” decision). Further, some companies (e.g., certain high profile sporting apparel companies) have broad product lines, but actually produce no tangible goods. They instead focus on branding/marketing and outsource all of the actual manufacturing. Outsourcing has been around for decades, but it has received increased media/political attention with the increase in global trade. Tax, regulation, and cost factors can vary considerably from one global region to another. As a result, companies must constantly assess the opportunities for improved results via outsourcing.

The outsourcing decision process should include an analysis of all relevant costs and benefits. Items that differ between the “make” alternative and the “buy” alternative should be studied. As usual, avoid the temptation to consider sunk costs as part of the decision analysis. Generally, one would compare the variable production/manufacturing cost of a service/product with the purchase price of the service/product. Unless the outsourcing option results in a complete elimination of a factory or facilities, the fixed overhead is apt to continue whether the service/product is purchased or produced. As a result, unavoidable fixed overhead does not vary between the alternatives and can be disregarded. On the other hand, if some fixed factory overhead can be avoided by outsourcing, it should be taken into consideration as a relevant item.

16.2 Outsourcing Illustration

Pilot Corporation produces software for handheld global positioning systems. The software provides a robust tool for navigational support and mapping. It is used by airline pilots, mariners, and others. Because these applications are often of critical importance, Pilot maintains a tech support

department that is available around the clock to answer questions that are received via e-mail, phone, and IM. The annual budget for the tech support department is shown below. Direct labor to staff the tech support department consists of three persons always available during each 8-hour shift, at an hourly rate of $12 per hour (3 persons per shift X 8 hours per shift X 3 shifts per day X 365 days per year X $12 per hour = $315,360). The utilities and maintenance are fixed, but would be avoided if the unit were shut down. The building is leased under a long-term contract, and the rent is unavoidable. Phone and computer equipment is leased under a flat rate contract, but the agreement is cancelable without penalty. The annual depreciation charge on furniture and fixtures reflects a cost allocation of expenditures made in prior years.

Direct labor	$ 315,360
Utilities and maintenance	40,000
Building rent	120,000
Phone/computer leasing	60,000
Annual depreciation of furniture and fixtures	100,000
	$ 635,360

Pilot has been approached by Chandra Corporation, a leading provider of independent tech support services. Chandra has offered to provide a turn-key tech support solution at the rate of $12 per support event. Pilot estimates that it generates about 50,000 support events per year. Chandra's proposal to Pilot notes that the total expected cost of $600,000 (50,000 events X $12 per event) is less than the amount currently budgeted for tech support. However, a correct analysis for Pilot focuses only on the relevant items (following). Even if Chandra is engaged to provide the support services, building rent will continue to be incurred (it is not relevant to the decision). The cost of furniture and fixtures is a sunk cost (it is not relevant to the decision). The total cost of relevant items is much less than the $600,000 indicated by Chandra's proposal. Therefore, the quantitative analysis suggests that Pilot should continue to provide its own tech support in the near future. After all, why spend $600,000 to avoid $415,360 of cost? Once the building lease matures, the furniture and fixtures are in need of replacement, or if tech support volume drops off, Chandra's proposal might be worthy of reconsideration.

Direct labor	$ 315,360
Utilities and maintenance	40,000
~~Building rent~~	~~120,000~~
Phone/computer leasing	60,000
~~Annual depreciation of furniture and fixtures~~	~~100,000~~
	$ 415,360

16.4 Capacity Considerations in Outsourcing

Outsourcing analysis is made more complicated if a business is operating at capacity. If outsourcing will free up capacity to be used on other services or products, then the contribution margin associated with the additional services or products also becomes a relevant item in the decision process. In other words, if a company continues to manufacture a product in lieu of outsourcing, it foregoes the chance to produce the alternative product. The loss of this opportunity has a cost that must be considered in the final decision. Accountants (and economists and others) may use the term "opportunity cost" to describe the cost of foregone opportunities. It is appropriate to factor opportunity costs into any outsourcing analysis.

16.5 Illustration of Capacity Considerations

Mueller Building Systems manufactures customized steel components that are sold in kits for the do-it-yourself rancher. The kits include all of the parts necessary to easily construct metal barns of various shapes and sizes. Mueller's products are very popular and its USA manufacturing plants have been running at full capacity. In an effort to free up capacity, Mueller contracted with Zhang Manufacturing of China to produce all roof truss components to be included in the final kits. The capacity that was released by the outsourcing decision enabled a 10% increase in the total number of kits that were produced and sold. Mueller's accounting department prepared the following analysis that was used as a basis for negotiating the contract with Zhang:

Direct labor to produce trusses	$ 3,800,000
Direct material to produce trusses	4,000,000
Variable factory overhead to produce trusses	2,000,000
Avoidable fixed factory overhead to produce trusses	1,000,000
Relevant costs to produce trusses	$ 10,800,000
Contribution margin associated with 10% increase in kit production	3,000,000
Maximum amount to spend (including transportation) for purchased trusses	$ 13,800,000

N rcing, b d o one.

One must be very careful to fully capture the true cost of outsourcing. Oftentimes, the costs of placing and tracking orders, freight, customs fees, commissions, or other costs can be overlooked in the analysis. Likewise, if outsourcing results in employee layoffs, expect increases in unemployment taxes, potential acceleration of pension costs, and other costs that should not be ignored in the quantitative analysis. Finally, a situation like that faced by Mueller may indicate the need for additional capital expenditures to increase overall capacity. Capital budgeting decisions are covered later in this chapter.

16.6 Qualitative Issues in Outsourcing

Companies must be very careful to consider qualitative issues in making decisions about outsourcing. Outsourcing places quality control, production scheduling, and similar issues in the hands of a third party. One must continually monitor the supplier's financial health and ability to continue to deliver quality products on a timely basis. If goods are being moved internationally, goods may be subject to high freight costs, customs fees, taxes, and other costs. Delays are often associated with the uncertain logistics of moving goods through brokers, large sea ports, and homeland security inspections. Hopefully rare, but not to be ignored are risks associated with relying on suppliers in politically unstable environments; significant disruptions are not without precedent. Language barriers can be problematic. Although global trade is increasingly reliant on English, there are still many miscues brought about by a failure to have full and complete communication. Additionally, some global outsourcing can be met with customer resistance. Examples include frustrations with call centers and tech support lines where language barriers become apparent, and customer protest/ rejection because of perceived unfair labor practices in certain global regions. Despite the potential problems, there are decided trends suggesting that the most successful businesses learn to utilize logical outsourcing opportunities in both local and global markets.

16.7 Special Orders

A business may receive a special order at a price that is significantly different from the normal pricing scheme. The quantitative analysis will focus on the contribution margin associated with the special order. In other words, it must be determined whether the special order sales price exceeds the variable production and selling costs associated with the special order.

To illustrate, assume that Lunker Lures Company produces the popular Rippin' Rogue pictured at right. The "cost" to produce a Rippin' Rogue is $1.10, consisting of $0.20 direct materials, $0.40 direct labor, and $0.50 factory overhead. The overhead is 30% variable and 70% fixed cost allocation. Lunker Lures are sold to retailers across the country through an established network of manufacturers' representatives who are paid $0.10 for each lure sold in their respective territories.

Lunker Lures has been approached by Walleye Pro Fishing World to produce a special run of 1,000,000 units. These lures would be sold under the Walleye Wiggler brand name and would not otherwise compete with sales of Rippin' Rogues. Walleye Pro Fishing World's offer is priced at $1.00 per unit. Lunker Lures is obligated to pay its representatives half of the normal rep fee for such private label transactions. On the surface it appears that Lunker Lures should not accept this order. After all, the offer is priced below the noted cost of production. However, so long as Walleye Wigglers do not compete with sales of Rippin' Rogues, and Lunker Lures has plenty capacity to produce lures without increasing fixed costs, profit will be enhanced by $200,000 ($0.20 X 1,000,000) by accepting the order. The following analysis focuses on the relevant items in reaching this conclusion:

Selling price per unit		$ 1.00
Direct material per unit	$ 0.20	
Direct labor per unit	0.40	
Variable factory overhead per unit ($0.50 X 30%)	0.15	0.75
Manufacturing margin		$ 0.25
Variable selling costs (50% of normal)		0.05
Contribution margin		$ 0.20

Note: Aggregate fixed costs will be the same whether the special order is accepted or not. The per unit allocation of fixed costs is not relevant.

16.8 Capacity Constraints and the Impact on Special Order Pricing

A potential error in special order pricing is acceptance of special orders offering the highest contribution margin per dollar of sales, while ignoring capacity constraints. Notice that the special order for Walleye Wigglers offered a 20% contribution margin ($0.20/$1.00). Suppose Bass Pro Fishing World also placed a special order for a Bass Buzzer lure, and that special order afforded a 30% margin on a $1.00 per unit selling price. At first glance, one would assume that the Bass Pro Fishing World would represent the better choice. But, what if you were also informed that remaining plant capacity would allow production of either 1,000,000 Walleye Wigglers or 600,000

Bass Buzzers? Now, the total contribution margin on the Wiggler is $200,000 (1,000,000 units X $0.20) while the total contribution on the Buzzer is $180,000 (600,000 X 30%). The better choice is to go with the Wiggler, as that option maximizes the total contribution margin. This important distinction gives consideration to the fact that producing a few units (with a high per-unit contribution margin) may be less profitable than producing many units (with a low per-unit contribution margin). Contribution margin analysis should never be divorced from consideration of factors that limit its generation! The goal will be to optimize the total contribution margin, not the per unit contribution margin.

16.9 Discontinuing a Product Department, or Project

One of the more difficult decisions management must make is when to abandon a business unit that is performing poorly. Such decisions can have far reaching effects on the company, shareholder perceptions about management, employees, and suppliers. Chapter 22 provided insight into performance evaluation methods that are helpful in identifying lagging sectors, and Chapter 23 showed how misuse of absorption costing information can invoke a series of successive product discontinuation decisions that bring about a downward business spiral. So, what analytical methods should be employed to support a final decision to pull the plug on a business unit?

Management should not merely conclude that any unit generating a net loss is to be eliminated! This is an all too common error made by those who lack sufficient accounting knowledge to look beyond the bottom line. Sometimes, eliminating a unit with a loss can reduce overall performance. Consider that some fixed costs identified with a discontinued unit may continue and must be absorbed by other units. This creates a potential domino effect where each falling unit pushes down the next. Instead, the appropriate analysis is to compare company wide net income "with" and "without" the unit targeted for elimination.

Casa de Deportes is a mega sporting goods store occupying 80,000 square feet of space in a rented retail center. Each department is evaluated for profitability based on the following information:

	Fishing	Hunting	Camping	Golf	Total
Sales	$ 6,000,000	$ 8,000,000	$ 4,000,000	$ 3,000,000	$21,000,000
Variable expenses	3,600,000	4,800,000	2,400,000	1,800,000	12,600,000
Contribution margin	$ 2,400,000	$ 3,200,000	$ 1,600,000	$ 1,200,000	$ 8,400,000
Less fixed costs:					
General/administrative	$ 600,000	$ 800,000	$ 400,000	$ 300,000	$ 2,100,000
Selling	1,200,000	1,600,000	800,000	600,000	4,200,000
Rent	250,000	250,000	250,000	250,000	1,000,000
Utilities	40,000	40,000	40,000	40,000	160,000
Depreciation	50,000	35,000	60,000	40,000	185,000
Total fixed costs	$ 2,140,000	$ 2,725,000	$ 1,550,000	$ 1,230,000	$ 7,645,000
Net income (loss)	$ 260,000	$ 475,000	$ 50,000	$ (30,000)	$ 755,000

Management is quite concerned about the Golf Department. It has had plenty of time to flourish, but has never turned a profit. Further, no one at Casa de Deportes, including the Golf Department manager, believes this situation is apt to change anytime soon. The accounting department was asked to prepare a report of the overall financial impacts if Golf is discontinued. In preparing the "without golf" report, it was learned that only 70% of the General and Administrative costs would be eliminated, rent and depreciation would continue to be incurred, and utilities would be reduced by only half. The selling costs would be completely eliminated. The unavoidable costs from the golf department are assumed to be shifted equally to the other departments (although other allocation methods could be used, the overall conclusions would not change). The income report "without golf" appears as follows:

	Fishing	Hunting	Camping	Golf	Total
Sales	$ 6,000,000	$ 8,000,000	$ 4,000,000	$ -	$18,000,000
Variable expenses	3,600,000	4,800,000	2,400,000	-	10,800,000
Contribution margin	$ 2,400,000	$ 3,200,000	$ 1,600,000	$ -	$ 7,200,000
Less fixed costs:					
General/administrative	$ 630,000	$ 830,000	$ 430,000	$ -	$ 1,890,000
Selling	1,200,000	1,600,000	800,000	-	3,600,000
Rent	333,334	333,333	333,333	-	1,000,000
Utilities	46,666	46,667	46,667	-	140,000
Depreciation	63,333	48,333	73,334	-	185,000
Total fixed costs	$ 2,273,333	$ 2,858,333	$ 1,683,334	$ -	$ 6,815,000
Net income (loss)	$ 126,667	$ 341,667	$ (83,334)	$ -	$ 385,000

Obviously, discontinuing the Golf Department will not help the overall situation. The reallocation of unavoidable costs not only reduces overall profitability, but it also paints the Camping Department in a precarious light. Further, this analysis does not take into account potential sales reductions in other departments that might occur from reductions in overall store traffic (e.g., a "golfing only" customer might nevertheless buy an occasional flashlight from the camping department, etc.). Another factor not included above are the incremental costs from closing a department (e.g., inventory write-offs, increased unemployment compensation costs for laid off workers, etc.). As you can see, the decision to discontinue a product, department, or project is far more complex than it might at first seem.

16.10 The 80/20 Concept

Many businesses have broad product lines and large customer bases. However, an in-depth evaluation is likely to reveal that a significant portion of its success is centered around a narrow set of products, customers, and services. The remainder of the business activity may be very marginal. For example, a technology-based business may find that some of its lowest-volume customers consume the largest amount of the tech support staff's time (due to customer inexperience with the product) while the large volume customers require almost no assistance with the company's product.

It requires a great deal of business discipline to "abandon" a product, customer, or service, but such decisions can actually contribute to business success. Consider the following quote from ITW, a large and successful corporation that embraces the 80/20 concept:

"A key element of the Company's business strategy is its continuous 80/20 business process for both existing businesses and new acquisitions. The basic concept of this 80/20 business process is to focus on what is most important (the 20% of the items which account for 80% of the value) and to spend less time and resources on the less important (the 80% of the items which account for 20% of the value). The Company's operations use this 80/20 business process to simplify and focus on the key parts of their business, and as a result, reduce complexity that often disguises what is truly important. The Company's 700 operations utilize the 80/20 process in various aspects of its business. Common applications of the 80/20 business process include:

- Simplifying manufactured product lines by reducing the number of products offered by combining the features of similar products, outsourcing products or, as a last resort, eliminating products.

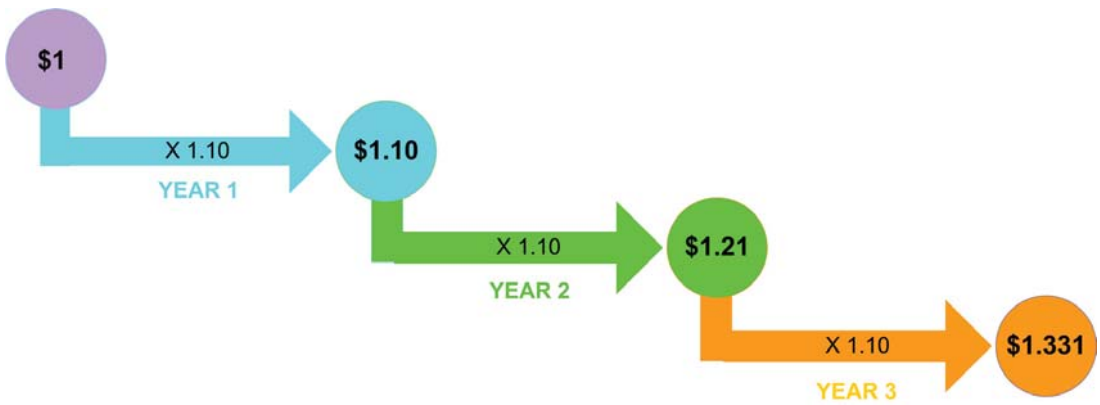
- Simplifying the customer base by focusing on the 80/20 customers and finding different ways to serve the 20/80 customers.

- Simplifying the supplier base by partnering with key 80/20 suppliers and reducing the number of 20/80 suppliers.

- Designing business processes and systems around the key 80/20 activities.

The result of the application of this 80/20 business process is that the Company improves its operating and financial performance. These 80/20 efforts often result in restructuring projects that reduce costs and improve margins. Corporate management works closely with those business units that have operating results below expectations to help the unit apply this 80/20 business process and improve their results."

Some contend that this approach results in sacrificing long-term opportunities to enhance short-term profitability. For instance, a "small and inexperienced" customer that is abandoned today might eventually grow to be a major player. As a result, the 80/20 philosophy is not always the optimum strategy and good business judgment should always be exercised in the decision-making process.



The annual interest each year is larger than the year before because of "compounding." Compounding simply means that your investment is growing with accumulated interest, and you are earning interest on previously accrued interest that becomes part of your total investment pool. This formula expresses the basic mathematics of compound interest:

$$(1+i)^{n}$$

Where "i" is the interest rate per period and "n" is the number of periods

So, how much would $1 grow to in 25 years at 10% interest? The answer can be determined by taking 1.10 to the 25th power [(1.10)25], and the answer is $10.83. Future value tables provide predetermined values for a variety of such computations (such a table is found at the FUTURE

18. Compound Interest and Present Value

You have heard the expression that "time is money." In capital budgeting this concept is measured and brought to bear on the decision process. The fundamental idea is that a dollar received today is worth more than a dollar to be received in the future. This result occurs because a dollar in hand can be invested to generate additional returns; such would not be the case with a dollar received in the future.

In the context of capital budgeting, assume two alternative investments have the same upfront cost. Investment Alpha returns $100 per year for each of the next five years. Investment Beta returns $50 per year for each of the next 10 years. Based solely on this information, you should conclude that Alpha is preferred to Beta. Although the total cash returns are the same, the time value of money is better for Alpha than Beta. With Alpha, the money is returned sooner, allowing for enhanced reinvestment opportunities. Of course, very few capital expenditure choices are as clear cut as Alpha and Beta. Therefore, accountants rely on precise mathematical techniques to quantify the time value of money.

18.1 Compound Interest

The starting point for understanding the time value of money is to develop an appreciation for compound interest. "The most powerful force in the universe is compound interest." The preceding quote is often attributed to Albert Einstein, the same chap who unlocked many of the secrets of nuclear energy. While it is not clear that he actually held compound interest in such high regard, it is clear that understanding the forces of compound interest is a powerful tool. Very simply, money can be invested to earn money. In this context, consider that when you spend a dollar on a soft drink, you are actually foregoing 10¢ per year for the rest of your life (assuming a 10% interest rate). And, as you will soon see, that annual dime of savings builds to much more because of interest that is earned on the interest! This is the almost magical power of compound interest.

Compound interest calculations can be used to compute the amount to which an investment will grow in the future. Compound interest is also called future value. If you invest $1 for one year, at 10% interest per year, how much will you have at the end of the year? The answer, of course, is $1.10. This is calculated by multiplying the $1 by 10% ($1 X 10% = $0.10) and adding the $0.10 to the original dollar. And, if the resulting $1.10 is invested for another year at 10%, how much will you have? The answer is $1.21. That is, $1.10 X 110%. This process will continue, year after year.

The annual interest each year is larger than the year before because of "compounding." Compounding simply means that your investment is growing with accumulated interest, and you are earning interest on previously accrued interest that becomes part of your total investment pool. This formula expresses the basic mathematics of compound interest:

$$(1+i)^{n}$$

Where "i" is the interest rate per period and "n" is the number of periods

So, how much would $1 grow to in 25 years at 10% interest? The answer can be determined by taking 1.10 to the 25th power [(1.10)25], and the answer is $10.83. Future value tables provide predetermined values for a variety of such computations (such a table is found at the FUTURE

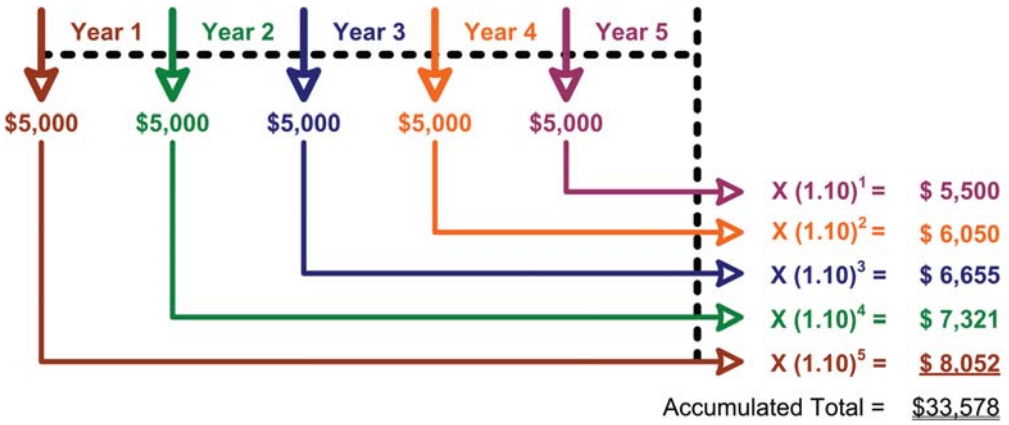
VALUE OF $1 link on the companion website). To experiment with the future value table, determine how much $1 would grow to in 10 periods at 5% per period. The answer to this question is $1.63, and can be found by reference to the value in the "5% column/10-period row." If the original investment was $5,000 (instead of $1), the investment would grow to $8,144.45 ($5,000 X 1.62889). In using the tables, be sure to note that the interest rate is the rate per period. The "period" might be years, quarters, months, etc. It all depends on how frequently interest is to be compounded. For instance, a 12% annual interest rate, with monthly compounding for two years, would require you to refer to the 1% column (12% annual rate equates to a monthly rate of 1%) and 24-period row (two years equates to 24 months). If the same investment involved annual compounding, then you would refer to the 12% column and 2-period row. The frequency of compounding makes a difference in the amount accumulated -- for the given example, monthly compounding returns 1.26973, while annual compounding returns only 1.25440!

18.2 Future Value of Annuities

Annuities are level streams of payments. Each payment is the same amount, and occurs at a regular interval. Sometimes, one may be curious to learn how much a recurring stream of payments will grow to after a number of periods.

18.3 Future Value of an Annuity Due

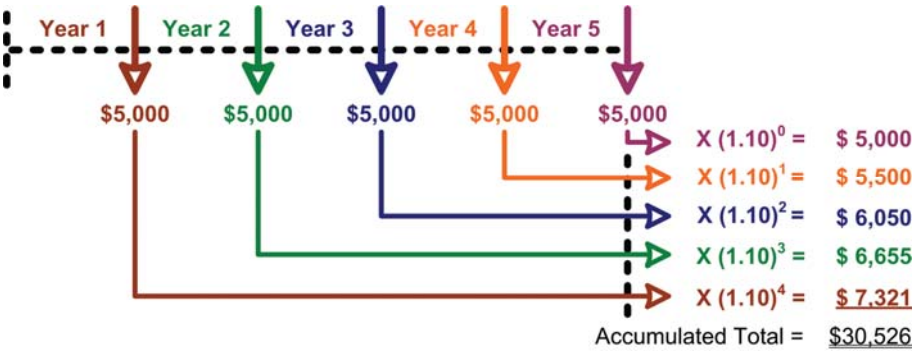
An annuity due (also known as an annuity in advance) involves a level stream of payments, with the payments being made at the beginning of each time period. For instance, perhaps you plan on saving for retirement by investing $5,000 at the beginning of each year for the next 5 years. If the annual interest rate is 10% per year, how much will you accumulate by the end of the 5-year period? The following graphic shows how each of the five individual payments would grow, and the accumulated total would reach $33,578:



Although the graphic provides a useful explanatory tool, it is a bit cumbersome to implement. The same conclusion can be reached by reference to a FUTURE VALUE OF AN ANNUITY DUE TABLE. Examine the table linked at the website to find the value of 6.71561 (10% column/5-period row). Multiplying the $5,000 annual payment by this factor yields $33,578 ($5,000 X 6.71561). This means that the $25,000 paid in will have grown to $33,578; perhaps Albert Einstein was right!

18.4 Future Value of an Ordinary Annuity

Sometimes an annuity will be based on "end of period" payments. These annuities are called ordinary annuities (also known as annuities in arrears). The next graphic portrays a 5-year, 10%, ordinary annuity involving level payments of $5,000 each. Notice the similarity to the preceding graphic -- except that each year's payment is shifted to the end of the year. This means each payment will accumulate interest for one less year, and the final payment will accumulate no interest! Be sure to note the striking difference between the accumulated total under an annuity due versus and ordinary annuity ($33,578 vs. $30,526). The moral is to save early and save often (and live long!) to take advantage of the power of compound interest.



As you might have guessed, there are also tables that reflect the FUTURE VALUE OF AN ORDINARY ANNUITY. Review the table found in the appendix to satisfy yourself about the $30,526 amount ($5,000 X 6.10510).

18.5 Present Value

Future value calculations provide useful tools for financial planning. But, many decisions and accounting measurements will be based on a reciprocal concept known as present value. Present value (also known as discounting) determines the current worth of cash to be received in the future. For instance, how much would you be willing to take today, in lieu of $1 in one year. If the interest rate is 10%, presumably you would accept the sum that would grow to $1 in one year if it were invested at 10%. This happens to be $0.90909. In other words, invest 90.9¢ for a year at 10%, and it will grow to $1 ($0.90909 X 1.1 = $1). Thus, present value calculations are simply the reciprocal of future value calculations:

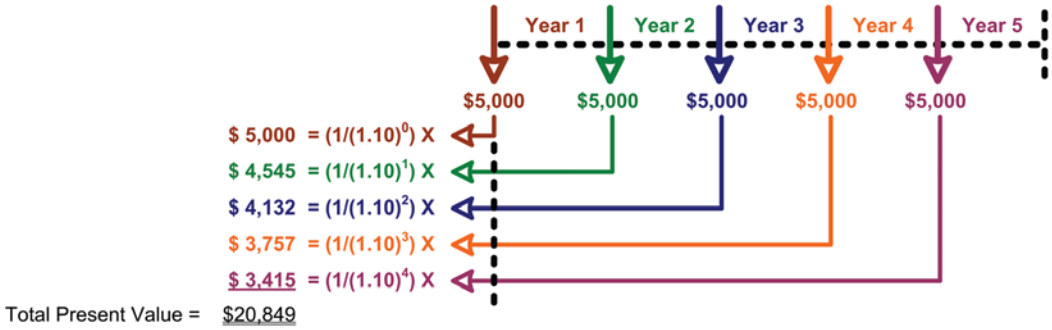
$$1/(1+i)^n$$

Where "i" is the interest rate per period and "n" is the number of periods

The PRESENT VALUE OF $1 TABLE (found in the appendix) reveals predetermined values for calculating the present value of $1, based on alternative assumptions about interest rates and time periods. To illustrate, a $25,000 lump sum amount to be received at the end of 10 years, at 8% annual interest, with semiannual compounding, would have a present value of $11,410 (recall the earlier discussion, and use the 4% column/20-period row -- $25,000 X 0.45639).

18.6 Present Value of an Annuity Due

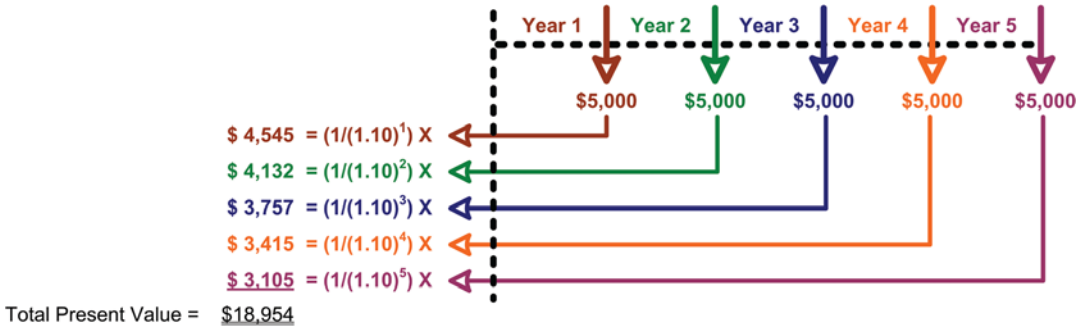
Present value calculations are also applicable to annuities. Perhaps you are considering buying an investment that returns $5,000 per year for five years, with the first payment to be received immediately. What should you pay for this investment in you have a target rate of return of 10%?



The graphic shows that the annuity has a present value of $20,849. Of course, there is a PRESENT VALUE OF AN ANNUITY DUE TABLE (see the link at the companion website) to ease the burden of this calculation ($5,000 X 4.16897 = $20,849).

18.7 Present Value of an Ordinary Annuity

Many times, the first payment in an annuity occurs at the end of each period. The PRESENT VALUE OF AN ORDINARY ANNUITY TABLE provides the necessary factor to determine that $5,000 to be received at the end of each year, for a five-year period, is worth only $18,954, assuming a 10% interest rate ($5,000 X 3.79079 = $18,954). The following graphic confirms this conclusion:



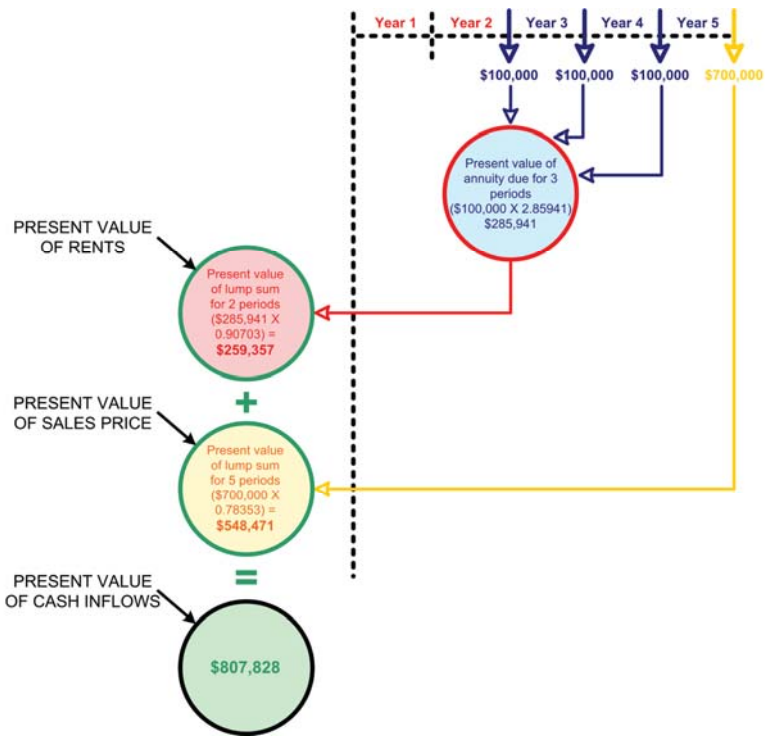
18.8 Electronic Spreadsheet Functions

Be aware that most electronic spreadsheets also include functions for calculating present and future value amounts by simply completing a set of predetermined queries. You can see a screen shot of the present value function applied to the preceding illustration by clicking on the link at this location on the website.

18.9 Challenge Your Thinking

Many scenarios represent a combination of lump sum and annuity cash flow amounts. There are a variety of approaches to calculating the future or present value for such scenarios. Perhaps the safest approach is to diagram the anticipated cash flows and apply logical manipulations. To illustrate, assume that Markum Real Estate is considering buying an office building. The building will be vacant for two years while it is being renovated. Then, it will produce annual rents of $100,000 at the beginning of each of the next three years. The building will be sold in five years for $700,000. Markum desires to know the present value of the anticipated cash inflows, assuming 5% annual interest rate.

As you can see below, the rental stream has a present value of $285,941 as of the beginning of Year 3. That value is discounted back to the beginning of Year 1 value ($259,357) by treating it as a lump sum. The sales price is separately discounted to its present value of $548,471. The present value of the rents and sales price are combined to produce the total present value for all cash inflows ($807,828). This type of cash flow manipulation is quite common in calculating present values for many investment decisions.



For the more inspired mind, you will at least find it interesting to note that an alternative way to value the rental stream would be to subtract the value for a two year annuity from the value for a five year annuity (4.54595 - 1.95238 = 2.59357; $100,000 X 2.59357 = $259,357). This result occurs because it assumes a five-year annuity and backs out the amount relating to the first two years, leaving only the last three years in the resulting present value factor. Like all things mathematical, the more you study them, the more power you find buried within!

C17 8%

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
6%	Present value factor	1.00000	0.94340	0.89000	0.83962	0.79209	0.74726
	Present value of cash flow	$ (500,000)	$ 120,755	$ 113,920	$ 107,471	$ 101,388	$ 95,649
	Net Present Value			$39,183			

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
8%	Present value factor	1.00000	0.92593	0.85734	0.79383	0.73503	0.68058
	Present value of cash flow	$ (500,000)	$ 118,519	$ 109,739	$ 101,611	$ 94,084	$ 87,115
	Net Present Value			$11,067			

=1/(1 +$C$17)^3

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
10%	Present value factor	1.00000	0.90909	0.82645	0.75131	0.68301	0.62092
	Present value of cash flow	$ (500,000)	$ 116,364	$ 105,785	$ 96,168	$ 87,426	$ 79,478
	Net Present Value			($14,779)			

In the above spreadsheet, formulas were used to determine present value factors. For example, the "balloon" shows the specific formula for cell H17 -- $(1/(1+i)^n)$ -- where "i" is drawn from cell C17 which is set at 8%. Similar formulas are used for other present value factor cells. This simple approach allows rapid recalculation of net present value by simply changing the value in the interest rate cell.

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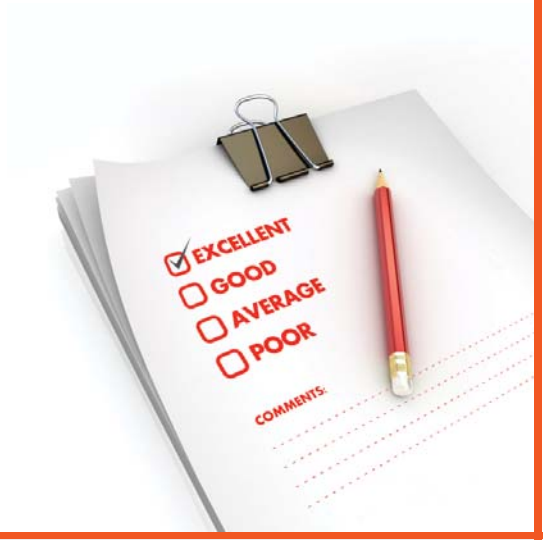

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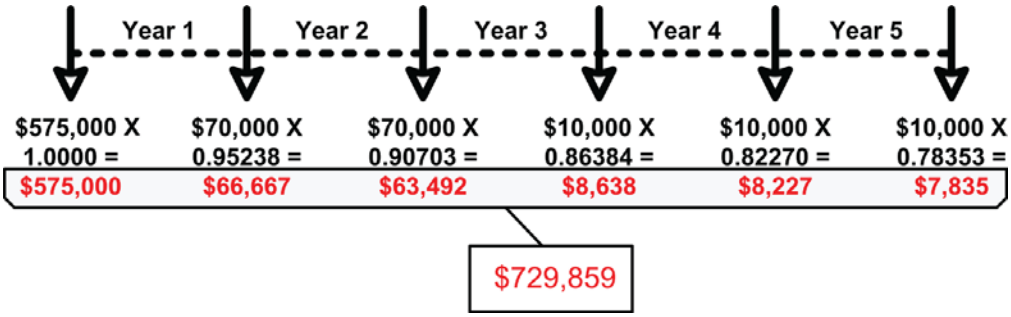
To illustrate NPV, let's return to our illustration for Markum Real Estate. Assume that the firm's cost of capital is 5%. You already know the present value of the cash inflows is $807,828. Let's additionally assume that the up-front purchase price for the building is $575,000. $60,000 per year will be spent on the remodel effort at the end of Year 1 and Year 2. Maintenance, insurance, and taxes on the building will amount to $10,000 per year, payable at the end of each of the five years. The present value of the cash outflows is $729,859:



This project has a positive net present value of $77,969 ($807,828 - $729,859). This suggests the project's returns exceed the 5% cost of capital threshold. Had the up-front investment been $675,000 (instead of $575,000), the project would have a negative net present value of $22,031 ($807,828 - $829,859).

19.2 Impact of Changes in Interest Rates

Carefully consider the mathematics (or table values), and you will observe that higher interest rates produce lower present value factors, and vice versa. You also know that the logic of making certain investments changes with interest rates. Perhaps you have considered buying a house or car on credit; in considering your decision, the interest rates on the deal likely made a big difference in how you viewed the proposed transaction. Even a casual observer of macro-economic trends knows that government policies about interest rates influence investment activity and consumer behavior. In simple terms, lower rates can stimulate borrowing and investment, and vice versa.

To illustrate the impact of shifting interest rates, consider that Greenspan is considering a $500,000 investment that returns $128,000 at the end of each year for five years. The following spreadsheet shows how the net present value shifts from a positive net present value of $39,183 (when interest rates are 6%), to positive $11,067 (when interest rates are 8%), to negative $14,779 (when interest rates rise to 10%). This means that the investment would make sense if the cost of capital was 6%, but not 10%.

C17 8%

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
6%	Present value factor	1.00000	0.94340	0.89000	0.83962	0.79209	0.74726
	Present value of cash flow	$ (500,000)	$ 120,755	$ 113,920	$ 107,471	$ 101,388	$ 95,649
	Net Present Value			$39,183			

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
8%	Present value factor	1.00000	0.92593	0.85734	0.79383	0.73503	0.68058
	Present value of cash flow	$ (500,000)	$ 118,519	$ 109,739	$ 101,611	$ 94,084	$ 87,115
	Net Present Value			$11,067			

=1/(1 +$C$17)^3

		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Cash outflows	$ (500,000)					
	Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
	Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000
		X	X	X	X	X	X
10%	Present value factor	1.00000	0.90909	0.82645	0.75131	0.68301	0.62092
	Present value of cash flow	$ (500,000)	$ 116,364	$ 105,785	$ 96,168	$ 87,426	$ 79,478
	Net Present Value			($14,779)			

In the above spreadsheet, formulas were used to determine present value factors. For example, the "balloon" shows the specific formula for cell H17 -- $(1/(1+i)^n)$ -- where "i" is drawn from cell C17 which is set at 8%. Similar formulas are used for other present value factor cells. This simple approach allows rapid recalculation of net present value by simply changing the value in the interest rate cell.

19.3 Emphasis on After Tax Cash Flows

In computing NPV, notice that the focus is on cash flows, not "income." Items like depreciation do not impact the cash flows, and are not included in the present value calculations. That is why the illustration for Markum Real Estate did not include deductions for deprecation. However, when applying net present value considerations in practice, one must be well versed in tax effects. Some noncash expenses like deprecation can reduce taxable income, which in turn reduces the amount of cash that must be paid for taxes. Therefore, cash inflows and outflows associated with a particular investment should be carefully analyzed on an after-tax basis. This often entails the preparation of pro forma cash flow statements and consultation with professionals well versed in the details of specific tax rules!

As a simple illustration, let's assume that Mirage Company purchases a tract of land with a prolific spring-fed creek. The land cost is $100,000, and $50,000 is spent to construct a water bottling facility. Net water sales amount to $40,000 per year (for simplicity, assume this amount is collected at the end of each year, and is net of all cash expenses). The bottling plant has a five-year life, and is depreciated by the straight-line method. Land is not depreciated. At the end of five years, it is anticipated that the land will be sold for $100,000. Mirage has an 8% cost of capital, and is subject to a 35% tax rate on profits. The following spreadsheet shows the calculation of annual income and cash flows in blue. The annual cash flow from water sales (not the net income!) is incorporated into the schedule of all cash flows. The annual net cash flows are then multiplied by the appropriate present value factors corresponding to an 8% discount rate. The project has a positive net present value of $35,843. Interestingly, had the annual net income of $19,500 been erroneously substituted for the $29,500 annual cash flow, this analysis would have produced a negative net present value!

One cannot underestimate the importance of considering tax effects on the viability of investment alternatives.

	Water Sales	
	Income	Cash Flows
Net sales	$ 40,000	$ 40,000
Less: Depreciation	10,000	
Income before tax	$ 30,000	
Less: Taxes (35%)	10,500	10,500
Net income	$ 19,500	$ 29,500

		PERIODS					
		Initial	Year 1	Year 2	Year 3	Year 4	Year 5
	Purchase/sale of land	$(100,000)					$ 100,000
	Build plant	(50,000)					
	Water sales	-	29,500	29,500	29,500	29,500	29,500
	Net cash flows	$(150,000)	$ 29,500	$ 29,500	$ 29,500	$ 29,500	$ 129,500
		X	X	X	X	X	X
	Present value factor	1.00000	0.92593	0.85734	0.79383	0.73503	0.68058
	Present value of cash flow	$(150,000)	$ 27,315	$ 25,291	$ 23,418	$ 21,683	$ 88,136
	Net Present Value			$35,843			

19.4 Accounting Rate of Return

The accounting rate of return is an alternative evaluative tool that focuses on accounting income rather than cash flows. This method divides the average annual increase in income by the amount of initial investment. For Mirage's project above, the accounting rate of return is 13% ($19,500/$150,000). The accounting rate of return is simple and easy. The decision rule is to accept investments which exceed a particular accounting rate of return. But, the method ignores the time value of money, the duration of cash flows, and terminal returns of invested dollars (e.g., notice that Mirage plans to get the $100,000 back at the end of the project). As a result, by itself, the accounting rate of return can easily misidentify the best investment alternatives. It should be used with extreme care.

19.5 Internal Rate of Return

The internal rate of return (also called the time-adjusted rate of return) is a close cousin to NPV. But, rather than working with a predetermined cost of capital, this method calculates the actual discount rate that equates the present value of a project's cash inflows with the present value of the cash outflows. In other words, it is the interest rate that would cause the net present value to be zero. IRR is a ranking tool. The IRR would be calculated for each investment opportunity. The decision rule is to accept the projects with the highest internal rates of return, so long as those rates are at least equal to the firm's cost of capital. This contrasts with NPV, which has a general decision rule of accepting projects with a "positive NPV," subject to availability of capital. Fundamentally, the mathematical basis of IRR is not much different than NPV.

The manual calculation of IRR using present value tables is a true pain. One would repeatedly try rates until they zeroed in on the rate that caused the present value of cash inflows to equal the present value of cash outflows. If the available tables are not sufficiently detailed, some interpolation would be needed. However, spreadsheet routines are much easier. Let's reconsider the illustration for Greenspan. Below is a spreadsheet, using an interest rate of 8.8361%. Notice that this rate caused the net present value to be zero, and is the IRR. This rate was selected by a higher-lower guessing process (trying each interest rate guess in cell C7). This does not take nearly as many guesses as you might think; with a little logic, you can quickly zero in on the exact correct rate.

C7 8.8361%

	A	B	C	D	E	F	G	H	I	J	K
1											
2					Initial	Year 1	Year 2	Year 3	Year 4	Year 5	
3				Cash outflows	$ (500,000)						
4				Cash inflows	-	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000	
5				Net cash flows	$ (500,000)	$ 128,000	$ 128,000	$ 128,000	$ 128,000	$ 128,000	
6					X	X	X	X	X	X	
7			8.8361%	Present value factor	1.00000	0.91881	0.84422	0.77568	0.71270	0.65484	
8				Present value of cash flow	$ (500,000)	$ 117,608	$ 108,060	$ 99,287	$ 91,226	$ 83,820	
9											
10					Net Present Value			($0)			

19.6 Payback Method

The payback method could be called "investment decision making for dummies." It is a popular and easy method, and can be valuable when the key investment goal is to find projects where the initial investment is quickly recovered. But, it is not very strong in otherwise pinpointing the best capital investment decisions.

Payback is calculated by dividing the initial investment by the annual cash inflow. The earlier illustration for Greenspan has a payback of approximately 3.9 years ($500,000/$128,000 = 3.9). If an investment involves uneven cash flows, the computation requires scheduling cash inflows and outflows. The payback period is the point at which the cumulative net cash inflows begin to exceed the cumulative net cash outflows.

The method is deficient in that it does not take into account the time value of money. It also fails to reveal what happens after the payback period. For example, some investments may payback rapidly, but have little residual cash flow after the payback period. Other investments may take years to payback, and then continue to generate future returns for many more years to come. Although the investment with the shorter payback may be viewed as favorable, it could easily turn out to be the worst choice. All in all, be very cautious using the payback method for making business decisions.

19.7 Conclusion

Capital budgeting decisions are not much different than the whole of managerial accounting. There are many tools at your disposal. You should understand these tools and how to use them. But, in the final analysis, good decision making will be driven by your own reasoned judgment.

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20. Appendix

Periods	FUTURE VALUE OF $1																
	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	1.00250	1.00500	1.00750	1.01000	1.01500	1.02000	1.02500	1.03000	1.04000	1.05000	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000
2	1.00501	1.01003	1.01506	1.02010	1.03023	1.04040	1.05063	1.06090	1.08160	1.10250	1.12360	1.14490	1.16640	1.18810	1.21000	1.23210	1.25440
3	1.00752	1.01508	1.02267	1.03030	1.04568	1.06121	1.07689	1.09273	1.12486	1.15763	1.19102	1.22504	1.25971	1.29503	1.33100	1.36763	1.40493
4	1.01004	1.02015	1.03034	1.04060	1.06136	1.08243	1.10381	1.12551	1.16986	1.21551	1.26248	1.31080	1.36049	1.41158	1.46410	1.51807	1.57352
5	1.01256	1.02525	1.03807	1.05101	1.07728	1.10408	1.13141	1.15927	1.21665	1.27628	1.33823	1.40255	1.46933	1.53862	1.61051	1.68506	1.76234
6	1.01509	1.03038	1.04585	1.06152	1.09344	1.12616	1.15969	1.19405	1.26532	1.34010	1.41852	1.50073	1.58687	1.67710	1.77156	1.87041	1.97382
7	1.01763	1.03553	1.05370	1.07214	1.10984	1.14869	1.18869	1.22987	1.31593	1.40710	1.50363	1.60578	1.71382	1.82804	1.94872	2.07616	2.21068
8	1.02018	1.04071	1.06160	1.08286	1.12649	1.17166	1.21840	1.26677	1.36857	1.47746	1.59385	1.71819	1.85093	1.99256	2.14359	2.30454	2.47596
9	1.02273	1.04591	1.06956	1.09369	1.14339	1.19509	1.24886	1.30477	1.42331	1.55133	1.68948	1.83846	1.99900	2.17189	2.35795	2.55804	2.77308
10	1.02528	1.05114	1.07758	1.10462	1.16054	1.21899	1.28008	1.34392	1.48024	1.62889	1.79085	1.96715	2.15892	2.36736	2.59374	2.83942	3.10585
11	1.02785	1.05640	1.08566	1.11567	1.17795	1.24337	1.31209	1.38423	1.53945	1.71034	1.89830	2.10485	2.33164	2.58043	2.85312	3.15176	3.47855
12	1.03042	1.06168	1.09381	1.12683	1.19562	1.26824	1.34489	1.42576	1.60103	1.79586	2.01220	2.25219	2.51817	2.81266	3.13843	3.49845	3.89598
13	1.03299	1.06699	1.10201	1.13809	1.21355	1.29361	1.37851	1.46853	1.66507	1.88565	2.13293	2.40985	2.71962	3.06580	3.45227	3.88328	4.36349
14	1.03557	1.07232	1.11028	1.14947	1.23176	1.31948	1.41297	1.51259	1.73168	1.97993	2.26090	2.57853	2.93719	3.34173	3.79750	4.31044	4.88711
15	1.03816	1.07768	1.11860	1.16097	1.25023	1.34587	1.44830	1.55797	1.80094	2.07893	2.39656	2.75903	3.17217	3.64248	4.17725	4.78459	5.47357
16	1.04076	1.08307	1.12699	1.17258	1.26899	1.37279	1.48451	1.60471	1.87298	2.18287	2.54035	2.95216	3.42594	3.97031	4.59497	5.31089	6.13039
17	1.04336	1.08849	1.13544	1.18430	1.28802	1.40024	1.52162	1.65285	1.94790	2.29202	2.69277	3.15882	3.70002	4.32763	5.05447	5.89509	6.86604
18	1.04597	1.09393	1.14396	1.19615	1.30734	1.42825	1.55966	1.70243	2.02582	2.40662	2.85434	3.37993	3.99602	4.71712	5.55992	6.54355	7.68997
19	1.04858	1.09940	1.15254	1.20811	1.32695	1.45681	1.59865	1.75351	2.10685	2.52695	3.02560	3.61653	4.31570	5.14166	6.11591	7.26334	8.61276
20	1.05121	1.10490	1.16118	1.22019	1.34686	1.48595	1.63862	1.80611	2.19112	2.65330	3.20714	3.86968	4.66096	5.60441	6.72750	8.06231	9.64629
21	1.05383	1.11042	1.16989	1.23239	1.36706	1.51567	1.67958	1.86029	2.27877	2.78596	3.39956	4.14056	5.03383	6.10881	7.40025	8.94917	10.80385
22	1.05647	1.11597	1.17867	1.24472	1.38756	1.54598	1.72157	1.91610	2.36992	2.92526	3.60354	4.43040	5.43654	6.65860	8.14027	9.93357	12.10031
23	1.05911	1.12155	1.18751	1.25716	1.40838	1.57690	1.76461	1.97359	2.46472	3.07152	3.81975	4.74053	5.87146	7.25787	8.95430	11.02627	13.55235
24	1.06176	1.12716	1.19641	1.26973	1.42950	1.60844	1.80873	2.03279	2.56330	3.22510	4.04893	5.07237	6.34118	7.91108	9.84973	12.23916	15.17863
25	1.06441	1.13280	1.20539	1.28243	1.45095	1.64061	1.85394	2.09378	2.66584	3.38635	4.29187	5.42743	6.84848	8.62308	10.83471	13.58546	17.00006
30	1.07778	1.16140	1.25127	1.34785	1.56308	1.81136	2.09757	2.42726	3.24340	4.32194	5.74349	7.61226	10.06266	13.26768	17.44940	22.89230	29.95992
35	1.09132	1.19073	1.29890	1.41660	1.68388	1.99989	2.37321	2.81386	3.94609	5.51602	7.68609	10.67658	14.78534	20.41397	28.10244	38.57485	52.79962
40	1.10503	1.22079	1.34835	1.48886	1.81402	2.20804	2.68506	3.26204	4.80102	7.03999	10.28572	14.97446	21.72452	31.40942	45.25926	65.00087	93.05097
50	1.13297	1.28323	1.45296	1.64463	2.10524	2.69159	3.43711	4.38391	7.10668	11.46740	18.42015	29.45703	46.90161	74.35752	117.3909	184.5648	289.0022

FUTURE VALUE OF ANNUITY DUE
(annuity in advance -- beginning of period payments)

Periods	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	1.00250	1.00500	1.00750	1.01000	1.01500	1.02000	1.02500	1.03000	1.04000	1.05000	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000
2	2.00751	2.01502	2.02256	2.03010	2.04522	2.06040	2.07563	2.09090	2.12160	2.15250	2.18360	2.21490	2.24640	2.27810	2.31000	2.34210	2.37440
3	3.01503	3.03010	3.04523	3.06040	3.09090	3.12161	3.15252	3.18363	3.24646	3.31013	3.37462	3.43994	3.50611	3.57313	3.64100	3.70973	3.77933
4	4.02506	4.05025	4.07556	4.10101	4.15227	4.20404	4.25633	4.30914	4.41632	4.52563	4.63709	4.75074	4.86660	4.98471	5.10510	5.22780	5.35285
5	5.03763	5.07550	5.11363	5.15202	5.22955	5.30812	5.38774	5.46841	5.63298	5.80191	5.97532	6.15329	6.33593	6.52333	6.71561	6.91286	7.11519
6	6.05272	6.10588	6.15948	6.21354	6.32299	6.43428	6.54743	6.66246	6.89829	7.14201	7.39384	7.65402	7.92280	8.20043	8.48717	8.78327	9.08901
7	7.07035	7.14141	7.21318	7.28567	7.43284	7.58297	7.73612	7.89234	8.21423	8.54911	8.89747	9.25980	9.63663	10.02847	10.43589	10.85943	11.29969
8	8.09053	8.18212	8.27478	8.36853	8.55933	8.75463	8.95452	9.15911	9.58280	10.02656	10.49132	10.97799	11.48756	12.02104	12.57948	13.16397	13.77566
9	9.11325	9.22803	9.34434	9.46221	9.70272	9.94972	10.20338	10.46388	11.00611	11.57789	12.18079	12.81645	13.48656	14.19293	14.93742	15.72201	16.54874
10	10.13854	10.27917	10.42192	10.56683	10.86326	11.16872	11.48347	11.80780	12.48635	13.20679	13.97164	14.78360	15.64549	16.56029	17.53117	18.56143	19.65458
11	11.16638	11.33556	11.50759	11.68250	12.04121	12.41209	12.79555	13.19203	14.02581	14.91713	15.86994	16.88845	17.97713	19.14072	20.38428	21.71319	23.13313
12	12.19680	12.39724	12.60139	12.80933	13.23683	13.68033	14.14044	14.61779	15.62684	16.71298	17.88214	19.14064	20.49530	21.95338	23.52271	25.21164	27.02911
13	13.22979	13.46423	13.70340	13.94742	14.45038	14.97394	15.51895	16.08632	17.29191	18.59863	20.01507	21.55049	23.21492	25.01919	26.97498	29.09492	31.39260
14	14.26537	14.53655	14.81368	15.09690	15.68214	16.29342	16.93193	17.59891	19.02359	20.57856	22.27597	24.12902	26.15211	28.36092	30.77248	33.40536	36.27971
15	15.30353	15.61423	15.93228	16.25786	16.93237	17.63929	18.38022	19.15688	20.82453	22.65749	24.67253	26.88805	29.32428	32.00340	34.94973	38.18995	41.75328
16	16.34429	16.69730	17.05927	17.43044	18.20136	19.01207	19.86473	20.76159	22.69751	24.84037	27.21288	29.84022	32.75023	35.97370	39.54470	43.50084	47.88367
17	17.38765	17.78579	18.19472	18.61475	19.48938	20.41231	21.38635	22.41444	24.64541	27.13238	29.90565	32.99903	36.45024	40.30134	44.59917	49.39594	54.74971
18	18.43362	18.87972	19.33868	19.81090	20.79672	21.84056	22.94601	24.11687	26.67123	29.53900	32.75999	36.37896	40.44626	45.01846	50.15909	55.93949	62.43968
19	19.48220	19.97912	20.49122	21.01900	22.12367	23.29737	24.54466	25.87037	28.77808	32.06595	35.78559	39.99549	44.76196	50.16012	56.27500	63.20283	71.05244
20	20.53341	21.08401	21.65240	22.23919	23.47052	24.78332	26.18327	27.67649	30.96920	34.71925	38.99273	43.86518	49.42292	55.76453	63.00250	71.26514	80.69874
21	21.58724	22.19443	22.82230	23.47159	24.83758	26.29898	27.86286	29.53678	33.24797	37.50521	42.39229	48.00574	54.45676	61.87334	70.40275	80.21431	91.50258
22	22.64371	23.31040	24.00096	24.71630	26.22514	27.84496	29.58443	31.45288	35.61789	40.43048	45.99583	52.43614	59.89330	68.53194	78.54302	90.14788	103.6029
23	23.70282	24.43196	25.18847	25.97346	27.63352	29.42186	31.34904	33.42647	38.08260	43.50200	49.81558	57.17667	65.76476	75.78981	87.49733	101.1742	117.1552
24	24.76457	25.55912	26.38488	27.24320	29.06302	31.03030	33.15776	35.45926	40.64591	46.72710	53.86451	62.24904	72.10594	83.70090	97.34706	113.4133	132.3339
25	25.82899	26.69191	27.59027	28.52563	30.51397	32.67091	35.01171	37.55304	43.31174	50.11345	58.15638	67.67647	78.95442	92.32398	108.1818	126.9988	149.3339
30	31.19109	32.44142	33.75417	35.13274	38.10176	41.37944	45.00027	49.00268	58.32834	69.76079	83.80168	101.0730	122.3459	148.5752	180.9434	220.9132	270.2926
35	36.62056	38.33610	40.15272	42.07688	46.27597	50.99437	56.30141	62.27594	76.59831	94.83632	118.1209	147.9135	186.1021	235.1247	298.1268	379.1644	483.4631
40	42.11824	44.37964	46.79483	49.37524	55.08191	61.61002	69.08762	77.66330	98.82654	126.8398	164.0477	213.6096	279.7810	368.2919	486.8518	645.8269	859.1424
50	53.32165	56.92839	60.84721	65.10781	74.78807	86.27099	99.92146	116.1808	158.7738	219.8154	307.7561	434.9860	619.6718	888.4411	1280.299	1852.336	2688.020

FUTURE VALUE OF ORDINARY ANNUITY
(annuity in arrears -- end of period payments)

Periods	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
2	2.00250	2.00500	2.00750	2.01000	2.01500	2.02000	2.02500	2.03000	2.04000	2.05000	2.06000	2.07000	2.08000	2.09000	2.10000	2.11000	2.12000
3	3.00751	3.01502	3.02256	3.03010	3.04522	3.06040	3.07563	3.09090	3.12160	3.15250	3.18360	3.21490	3.24640	3.27810	3.31000	3.34210	3.37440
4	4.01503	4.03010	4.04523	4.06040	4.09090	4.12161	4.15252	4.18363	4.24646	4.31013	4.37462	4.43994	4.50611	4.57313	4.64100	4.70973	4.77933
5	5.02506	5.05025	5.07556	5.10101	5.15227	5.20404	5.25633	5.30914	5.41632	5.52563	5.63709	5.75074	5.86660	5.98471	6.10510	6.22780	6.35285
6	6.03763	6.07550	6.11363	6.15202	6.22955	6.30812	6.38774	6.46841	6.63298	6.80191	6.97532	7.15329	7.33593	7.52333	7.71561	7.91286	8.11519
7	7.05272	7.10588	7.15948	7.21354	7.32299	7.43428	7.54743	7.66246	7.89829	8.14201	8.39384	8.65402	8.92280	9.20043	9.48717	9.78327	10.08901
8	8.07035	8.14141	8.21318	8.28567	8.43284	8.58297	8.73612	8.89234	9.21423	9.54911	9.89747	10.25980	10.63663	11.02847	11.43589	11.85943	12.29969
9	9.09053	9.18212	9.27478	9.36853	9.55933	9.75463	9.95452	10.15911	10.58280	11.02656	11.49132	11.97799	12.48756	13.02104	13.57948	14.16397	14.77566
10	10.11325	10.22803	10.34434	10.46221	10.70272	10.94972	11.20338	11.46388	12.00611	12.57789	13.18079	13.81645	14.48656	15.19293	15.93742	16.72201	17.54874
11	11.13854	11.27917	11.42192	11.56683	11.86326	12.16872	12.48347	12.80780	13.48635	14.20679	14.97164	15.78360	16.64549	17.56029	18.53117	19.56143	20.65458
12	12.16638	12.33556	12.50759	12.68250	13.04121	13.41209	13.79555	14.19203	15.02581	15.91713	16.86994	17.88845	18.97713	20.14072	21.38428	22.71319	24.13313
13	13.19680	13.39724	13.60139	13.80933	14.23683	14.68033	15.14044	15.61779	16.62684	17.71298	18.88214	20.14064	21.49530	22.95338	24.52271	26.21164	28.02911
14	14.22979	14.46423	14.70340	14.94742	15.45038	15.97394	16.51895	17.08632	18.29191	19.59863	21.01507	22.55049	24.21492	26.01919	27.97498	30.09492	32.39260
15	15.26537	15.53655	15.81368	16.09690	16.68214	17.29342	17.93193	18.59891	20.02359	21.57856	23.27597	25.12902	27.15211	29.36092	31.77248	34.40536	37.27971
16	16.30353	16.61423	16.93228	17.25786	17.93237	18.63929	19.38022	20.15688	21.82453	23.65749	25.67253	27.88805	30.32428	33.00340	35.94973	39.18995	42.75328
17	17.34429	17.69730	18.05927	18.43044	19.20136	20.01207	20.86473	21.76159	23.69751	25.84037	28.21288	30.84022	33.75023	36.97370	40.54470	44.50084	48.88367
18	18.38765	18.78579	19.19472	19.61475	20.48938	21.41231	22.38635	23.41444	25.64541	28.13238	30.90565	33.99903	37.45024	41.30134	45.59917	50.39594	55.74971
19	19.43362	19.87972	20.33868	20.81090	21.79672	22.84056	23.94601	25.11687	27.67123	30.53900	33.75999	37.37896	41.44626	46.01846	51.15909	56.93949	63.43968
20	20.48220	20.97912	21.49122	22.01900	23.12367	24.29737	25.54466	26.87037	29.77808	33.06595	36.78559	40.99549	45.76196	51.16012	57.27500	64.20283	72.05244
21	21.53341	22.08401	22.65240	23.23919	24.47052	25.78332	27.18327	28.67649	31.96920	35.71925	39.99273	44.86518	50.42292	56.76453	64.00250	72.26514	81.69874
22	22.58724	23.19443	23.82230	24.47159	25.83758	27.29898	28.86286	30.53678	34.24797	38.50521	43.39229	49.00574	55.45676	62.87334	71.40275	81.21431	92.50258
23	23.64371	24.31040	25.00096	25.71630	27.22514	28.84496	30.58443	32.45288	36.61789	41.43048	46.99583	53.43614	60.89330	69.53194	79.54302	91.14788	104.6029
24	24.70282	25.43196	26.18847	26.97346	28.63352	30.42186	32.34904	34.42647	39.08260	44.50200	50.81558	58.17667	66.76476	76.78981	88.49733	102.1742	118.1552
25	25.76457	26.55912	27.38488	28.24320	30.06302	32.03030	34.15776	36.45926	41.64591	47.72710	54.86451	63.24904	73.10594	84.70090	98.34706	114.4133	133.3339
30	31.11331	32.28002	33.50290	34.78489	37.53868	40.56808	43.90270	47.57542	56.08494	66.43885	79.05819	94.46079	113.2832	136.3075	164.4940	199.0209	241.3327
35	36.52924	38.14538	39.85381	41.66028	45.59209	49.99448	54.92821	60.46208	73.65222	90.32031	111.4348	138.2369	172.3168	215.7108	271.0244	341.5896	431.6635
40	42.01320	44.15885	46.44648	48.88637	54.26789	60.40198	67.40255	75.40126	95.02552	120.7998	154.7620	199.6351	259.0565	337.8824	442.5926	581.8261	767.0914
50	53.18868	56.64516	60.39426	64.46318	73.68283	84.57940	97.48435	112.7969	152.6671	209.3480	290.3359	406.5289	573.7702	815.0836	1163.909	1668.771	2400.018

PRESENT VALUE OF $1

Periods	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	0.99751	0.99502	0.99256	0.99010	0.98522	0.98039	0.97561	0.97087	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286
2	0.99502	0.99007	0.98517	0.98030	0.97066	0.96117	0.95181	0.94260	0.92456	0.90703	0.89000	0.87344	0.85734	0.84168	0.82645	0.81162	0.79719
3	0.99254	0.98515	0.97783	0.97059	0.95632	0.94232	0.92860	0.91514	0.88900	0.86384	0.83962	0.81630	0.79383	0.77218	0.75131	0.73119	0.71178
4	0.99006	0.98025	0.97055	0.96098	0.94218	0.92385	0.90595	0.88849	0.85480	0.82270	0.79209	0.76290	0.73503	0.70843	0.68301	0.65873	0.63552
5	0.98759	0.97537	0.96333	0.95147	0.92826	0.90573	0.88385	0.86261	0.82193	0.78353	0.74726	0.71299	0.68058	0.64993	0.62092	0.59345	0.56743
6	0.98513	0.97052	0.95616	0.94205	0.91454	0.88797	0.86230	0.83748	0.79031	0.74622	0.70496	0.66634	0.63017	0.59627	0.56447	0.53464	0.50663
7	0.98267	0.96569	0.94904	0.93272	0.90103	0.87056	0.84127	0.81309	0.75992	0.71068	0.66506	0.62275	0.58349	0.54703	0.51316	0.48166	0.45235
8	0.98022	0.96089	0.94198	0.92348	0.88771	0.85349	0.82075	0.78941	0.73069	0.67684	0.62741	0.58201	0.54027	0.50187	0.46651	0.43393	0.40388
9	0.97778	0.95610	0.93496	0.91434	0.87459	0.83676	0.80073	0.76642	0.70259	0.64461	0.59190	0.54393	0.50025	0.46043	0.42410	0.39092	0.36061
10	0.97534	0.95135	0.92800	0.90529	0.86167	0.82035	0.78120	0.74409	0.67556	0.61391	0.55839	0.50835	0.46319	0.42241	0.38554	0.35218	0.32197
11	0.97291	0.94661	0.92109	0.89632	0.84893	0.80426	0.76214	0.72242	0.64958	0.58468	0.52679	0.47509	0.42888	0.38753	0.35049	0.31728	0.28748
12	0.97048	0.94191	0.91424	0.88745	0.83639	0.78849	0.74356	0.70138	0.62460	0.55684	0.49697	0.44401	0.39711	0.35553	0.31863	0.28584	0.25668
13	0.96806	0.93722	0.90743	0.87866	0.82403	0.77303	0.72542	0.68095	0.60057	0.53032	0.46884	0.41496	0.36770	0.32618	0.28966	0.25751	0.22917
14	0.96565	0.93256	0.90068	0.86996	0.81185	0.75788	0.70773	0.66112	0.57748	0.50507	0.44230	0.38782	0.34046	0.29925	0.26333	0.23199	0.20462
15	0.96324	0.92792	0.89397	0.86135	0.79985	0.74301	0.69047	0.64186	0.55526	0.48102	0.41727	0.36245	0.31524	0.27454	0.23939	0.20900	0.18270
16	0.96084	0.92330	0.88732	0.85282	0.78803	0.72845	0.67362	0.62317	0.53391	0.45811	0.39365	0.33873	0.29189	0.25187	0.21763	0.18829	0.16312
17	0.95844	0.91871	0.88071	0.84438	0.77639	0.71416	0.65720	0.60502	0.51337	0.43630	0.37136	0.31657	0.27027	0.23107	0.19784	0.16963	0.14564
18	0.95605	0.91414	0.87416	0.83602	0.76491	0.70016	0.64117	0.58739	0.49363	0.41552	0.35034	0.29586	0.25025	0.21199	0.17986	0.15282	0.13004
19	0.95367	0.90959	0.86765	0.82774	0.75361	0.68643	0.62553	0.57029	0.47464	0.39573	0.33051	0.27651	0.23171	0.19449	0.16351	0.13768	0.11611
20	0.95129	0.90506	0.86119	0.81954	0.74247	0.67297	0.61027	0.55368	0.45639	0.37689	0.31180	0.25842	0.21455	0.17843	0.14864	0.12403	0.10367
21	0.94892	0.90056	0.85478	0.81143	0.73150	0.65978	0.59539	0.53755	0.43883	0.35894	0.29416	0.24151	0.19866	0.16370	0.13513	0.11174	0.09256
22	0.94655	0.89608	0.84842	0.80340	0.72069	0.64684	0.58086	0.52189	0.42196	0.34185	0.27751	0.22571	0.18394	0.15018	0.12285	0.10067	0.08264
23	0.94419	0.89162	0.84210	0.79544	0.71004	0.63416	0.56670	0.50669	0.40573	0.32557	0.26180	0.21095	0.17032	0.13778	0.11168	0.09069	0.07379
24	0.94184	0.88719	0.83583	0.78757	0.69954	0.62172	0.55288	0.49193	0.39012	0.31007	0.24698	0.19715	0.15770	0.12640	0.10153	0.08170	0.06588
25	0.93949	0.88277	0.82961	0.77977	0.68921	0.60953	0.53939	0.47761	0.37512	0.29530	0.23300	0.18425	0.14602	0.11597	0.09230	0.07361	0.05882
30	0.92783	0.86103	0.79919	0.74192	0.63976	0.55207	0.47674	0.41199	0.30832	0.23138	0.17411	0.13137	0.09938	0.07537	0.05731	0.04368	0.03338
35	0.91632	0.83982	0.76988	0.70591	0.59387	0.50003	0.42137	0.35538	0.25342	0.18129	0.13011	0.09366	0.06763	0.04899	0.03558	0.02592	0.01894
40	0.90495	0.81914	0.74165	0.67165	0.55126	0.45289	0.37243	0.30656	0.20829	0.14205	0.09722	0.06678	0.04603	0.03184	0.02209	0.01538	0.01075
50	0.88263	0.77929	0.68825	0.60804	0.47500	0.37153	0.29094	0.22811	0.14071	0.08720	0.05429	0.03395	0.02132	0.01345	0.00852	0.00542	0.00346

PRESENT VALUE OF ORDINARY ANNUITY
(annuity in arrears -- end of period payments)

Periods	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	0.99751	0.99502	0.99256	0.99010	0.98522	0.98039	0.97561	0.97087	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286
2	1.99252	1.98510	1.97772	1.97040	1.95588	1.94156	1.92742	1.91347	1.88609	1.85941	1.83339	1.80802	1.78326	1.75911	1.73554	1.71252	1.69005
3	2.98506	2.97025	2.95556	2.94099	2.91220	2.88388	2.85602	2.82861	2.77509	2.72325	2.67301	2.62432	2.57710	2.53129	2.48685	2.44371	2.40183
4	3.97512	3.95050	3.92611	3.90197	3.85438	3.80773	3.76197	3.71710	3.62990	3.54595	3.46511	3.38721	3.31213	3.23972	3.16987	3.10245	3.03735
5	4.96272	4.92587	4.88944	4.85343	4.78264	4.71346	4.64583	4.57971	4.45182	4.32948	4.21236	4.10020	3.99271	3.88965	3.79079	3.69590	3.60478
6	5.94785	5.89638	5.84560	5.79548	5.69719	5.60143	5.50813	5.41719	5.24214	5.07569	4.91732	4.76654	4.62288	4.48592	4.35526	4.23054	4.11141
7	6.93052	6.86207	6.79464	6.72819	6.59821	6.47199	6.34939	6.23028	6.00205	5.78637	5.58238	5.38929	5.20637	5.03295	4.86842	4.71220	4.56376
8	7.91074	7.82296	7.73661	7.65168	7.48593	7.32548	7.17014	7.01969	6.73274	6.46321	6.20979	5.97130	5.74664	5.53482	5.33493	5.14612	4.96764
9	8.88852	8.77906	8.67158	8.56602	8.36052	8.16224	7.97087	7.78611	7.43533	7.10782	6.80169	6.51523	6.24689	5.99525	5.75902	5.53705	5.32825
10	9.86386	9.73041	9.59958	9.47130	9.22218	8.98259	8.75206	8.53020	8.11090	7.72173	7.36009	7.02358	6.71008	6.41766	6.14457	5.88923	5.65022
11	10.83677	10.67703	10.52067	10.36763	10.07112	9.78685	9.51421	9.25262	8.76048	8.30641	7.88687	7.49867	7.13896	6.80519	6.49506	6.20652	5.93770
12	11.80725	11.61893	11.43491	11.25508	10.90751	10.57534	10.25776	9.95400	9.38507	8.86325	8.38384	7.94269	7.53608	7.16073	6.81369	6.49236	6.19437
13	12.77532	12.55615	12.34235	12.13374	11.73153	11.34837	10.98318	10.63496	9.98565	9.39357	8.85268	8.35765	7.90378	7.48690	7.10336	6.74987	6.42355
14	13.74096	13.48871	13.24302	13.00370	12.54338	12.10625	11.69091	11.29607	10.56312	9.89864	9.29498	8.74547	8.24424	7.78615	7.36669	6.98187	6.62817
15	14.70420	14.41662	14.13699	13.86505	13.34323	12.84926	12.38138	11.93794	11.11839	10.37966	9.71225	9.10791	8.55948	8.06069	7.60608	7.19087	6.81086
16	15.66504	15.33993	15.02431	14.71787	14.13126	13.57771	13.05500	12.56110	11.65230	10.83777	10.10590	9.44665	8.85137	8.31256	7.82371	7.37916	6.97399
17	16.62348	16.25863	15.90502	15.56225	14.90765	14.29187	13.71220	13.16612	12.16567	11.27407	10.47726	9.76322	9.12164	8.54363	8.02155	7.54879	7.11963
18	17.57953	17.17277	16.77918	16.39827	15.67256	14.99203	14.35336	13.75351	12.65930	11.68959	10.82760	10.05909	9.37189	8.75563	8.20141	7.70162	7.24967
19	18.53320	18.08236	17.64683	17.22601	16.42617	15.67846	14.97889	14.32380	13.13394	12.08532	11.15812	10.33560	9.60360	8.95011	8.36492	7.83929	7.36578
20	19.48449	18.98742	18.50802	18.04555	17.16864	16.35143	15.58916	14.87747	13.59033	12.46221	11.46992	10.59401	9.81815	9.12855	8.51356	7.96333	7.46944
21	20.43340	19.88798	19.36280	18.85698	17.90014	17.01121	16.18455	15.41502	14.02916	12.82115	11.76408	10.83553	10.01680	9.29224	8.64869	8.07507	7.56200
22	21.37995	20.78406	20.21121	19.66038	18.62082	17.65805	16.76541	15.93692	14.45112	13.16300	12.04158	11.06124	10.20074	9.44243	8.77154	8.17574	7.64465
23	22.32414	21.67568	21.05331	20.45582	19.33086	18.29220	17.33211	16.44361	14.85684	13.48857	12.30338	11.27219	10.37106	9.58021	8.88322	8.26643	7.71843
24	23.26598	22.56287	21.88915	21.24339	20.03041	18.91393	17.88499	16.93554	15.24696	13.79864	12.55036	11.46933	10.52876	9.70661	8.98474	8.34814	7.78432
25	24.20547	23.44564	22.71876	22.02316	20.71961	19.52346	18.42438	17.41315	15.62208	14.09394	12.78336	11.65358	10.67478	9.82258	9.07704	8.42174	7.84314
30	28.86787	27.79405	26.77508	25.80771	24.01584	22.39646	20.93029	19.60044	17.29203	15.37245	13.76483	12.40904	11.25778	10.27365	9.42691	8.69379	8.05518
35	33.47243	32.03537	30.68266	29.40858	27.07559	24.99862	23.14516	21.48722	18.66461	16.37419	14.49825	12.94767	11.65457	10.56682	9.64416	8.85524	8.17550
40	38.01986	36.17223	34.44694	32.83469	29.91585	27.35548	25.10278	23.11477	19.79277	17.15909	15.04630	13.33171	11.92461	10.75736	9.77905	8.95105	8.24378
50	46.94617	44.14279	41.56645	39.19612	34.99969	31.42361	28.36231	25.72976	21.48218	18.25593	15.76186	13.80075	12.23348	10.96168	9.91481	9.04165	8.30450