

CHAPTER 69

FINANCE AND THE ENGINEERING FUNCTION

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69.1 INTRODUCTION AND OUTLINE

Finance is fundamental; accounting is merely the set of procedures, techniques, and reports that make possible the effective execution of the finance function. Harold Geneen, the legendary chairman of International Telephone and Telegraph, included in his *Sayings of Chairman Hal*, "The worst thing a manager can do is run out of money." He meant it! The corporate function of Finance is that function which makes the decisions, or rather provides the recommendations to top management who really make the decisions, that prevent the enterprise from running out of money. Accounting gathers, organizes, and disseminates information that make it possible to make these decisions accurately and timely. In modern business, accounting performs many correlative functions, some in such detail and so esoteric as to appear to be an end in themselves.

The objectives of this chapter on finance and accounting are to describe:

- How accounting systems work to provide information for top managers and owners
- How financial management is carried out

Additionally, this chapter provides a concise description of how an accounting system is constructed to provide for the needs of middle management and staff groups such as engineers and marketers.

The purposes and uses of accounting systems, data, and reports are quite different for different people and functions in the business community. The engineer needs to understand accounting principles and processes as they apply to his or her function and also to understand the way in which others of the enterprise view business and what their information needs are. The following are five major groups that have distinctly differing points of view and objectives:

- Owners, investors, lenders, and boards of directors
- Top managers
- Middle managers of line functions
- Staff groups such as product planners, engineers, and market researchers
- Accountants

69.1.1 Needs of Owners, Investors, and Lenders

The first group—owners, investors, and lenders—have as their primary concern the preservation and protection of the capital or the assets of the business. The Board of Directors represents the interest of the owners and can be considered to be the agents of the owners (stockholders). The board members provide continuing review of the performance of top management as well as approval or disapproval of policies and key investment decisions.

This entire group wants to be assured that the property of the business—fixed plant and equipment, inventories, etc.—is being conserved. Next, they want to be assured that there will be sufficient liquidity, which means only that there will be enough cash available to pay all the bills as they come due. Finally, they want to see evidence of some combination of regular payout or growth in value—a financial return such as regular dividends or indications that the enterprise is increasing in value. Increase in value may be evidenced by growth in sales and profits, by increases in the market value of the stock, or by increased value of the assets owned. If the dividend payout is small, the growth expectations will be large.

The information available to the owners is, at a minimum, that which is published for public companies—the balance sheet, cash flow, and profit and loss statement. Special reports and analyses are also provided when indicated.

69.1.2 Needs of Top Managers

The top managers must be sensitive to the needs and desires of the owners as expressed by the Board of Directors and of the bankers and other lenders so that all of the purposes and objectives of owners and lenders are also the objectives of top managers. Additionally, top management has the sole responsibility for:

- Developing long-range strategic plans and objectives
- Approving short-range operating and financial plans
- Ensuring that results achieved are measuring up to plan
- Initiating broad gauge corrective programs when results are not in conformance with objectives

Reports of financial results to this group must be in considerable detail and identified by major program, product, or operating unit in order to give insight sufficient to correct problems in time to prevent disasters. The degree of detail is determined by the management style of the top executive. Usually such reports are set up so that trouble points are automatically brought to the top executives' attention, and the detail is provided in order to make it possible to delve into the problems.

In addition to the basic financial reports to the owners, directors and top managers need:

- Long-term projections
- One-year budgets
- Periodic comparison of budget to actual
- Unit or facility results
- Product line results
- Performance compared to standard cost

69.1.3 Needs of Middle Managers of Line Functions

For our present purposes we will consider only managers of the sales and the manufacturing groups and their needs for financial, sales, and cost information. The degree to which the chief executive shares information down the line varies greatly among companies, ranging from a highly secretive

handling of all information to a belief that sharing all the facts of the business improves performance and involvement through greater participation. In the great bulk of publicly held, large corporations, with modern management, most of the financial information provided to top management is available to staff and middle management, either on routine basis or on request. There are additional data that are needed by lower-level line managers where adequate operational control calls for much greater detail than that which is routinely supplied to top executives.

The fundamental assignment of the line manager in manufacturing and sales is to execute the policies of top management. In order to do this effectively, the manager needs to monitor actions and evaluate results. In an accounting context this means the manufacturing manager, either by formal rules or by setting his or her personal rules of thumb, needs to:

- Set production goals
- Set worker and machine productivity standards
- Set raw material consumption standards
- Set overhead cost goals
- Establish product cost standards
- Compare actual performance against goals
- Develop remedial action plans to correct deficiencies
- Monitor progress in correcting variances

The major accounting and control tools needed to carry out this mission include:

- Production standards
- Departmental budgets
- Standard costs
- Sales and production projections
- Variance reports
- Special reports

It is important that the line manager understands the profit and loss picture in his or her area of control and that job performance is not merely measured against preset standards but that he or she is considered to be an important contributor to the entire organization. It is, then, important that managers understand the total commercial environment in which they are working, so that full disclosure of product profits is desirable. Such a philosophy requires that accounting records and reports be clear and straightforward, with the objective of exposing operating issues rather than being designed for a tax accountant or lawyer.

The top marketing executive must have a key role in the establishment of prices and the determination of the condition of the market so that he or she is a full partner in managing the enterprise for profits. He or she therefore needs to participate with the manufacturing executive in the development of budgets and longer-range financial plans. Thus the budget becomes a joint document of marketing and manufacturing, with both committed to its successful execution.

The marketing executive needs to be furnished with all of the information indicated above as appropriate for the manufacturing manager.

69.1.4 Needs of Staff Groups (Product Planners, Engineers, Market Researchers)

The major requirement of accounting information for staff is that it provide a way to measure the economic effect of proposed changes to the enterprise. For the engineer this may mean changes in equipment or tooling or redesign of the product as a most frequent kind of change that must be evaluated before funds can be committed.

Accounting records that show actual and standard costs by individual product and discrete operation are invaluable in determining the effect of change in design or process. If changes in product or process can result in changes in total unit sales or in price, the engineer needs to know those projected effects. His or her final projections of improved profits will then incorporate the total effect of engineering changes.

The accounting records need to be in sufficient detail that new financial projections can be made reliably, with different assumptions of product features, sales volume, cost, and price.

69.1.5 Needs of Accountants

The accounting system must satisfy the strategic, operational, and control requirements of the organization as outlined above, but it has other external demands that must be satisfied. The accountants have the obligation to maintain records and prepare reports to shareholders that are "in conformity with generally accepted accounting principles consistently applied." Therefore, traditional approaches

are essential so that the outside auditor as well as the tax collector will understand the reports and find them acceptable. There seems to be little need to sacrifice the development of good, effective control information for operating executives in order to satisfy the requirements of the tax collector or the auditor. The needs are compatible.

The key financial reporting and accounting systems typically used by each group are explained next.

69.2 A FINANCIAL MODEL

A major concern of the owners or the Board of Directors and the lenders to the business must be to ensure the security of the assets of the business. The obvious way to do this in a small enterprise is occasionally to take a look. It is certainly appropriate for directors to visit facilities and places where inventories are housed to ensure that the assets really do exist, but this can only serve as a spot check and an activity comparable to a military inspection—everything looks very good when the troops know that the general is coming. The most useful and convenient way, as well as the most reliable way, to protect the assets is by careful study of financial records and a comparison with recent history to determine the trends in basic values within the business. A clear and consistent understanding of the condition of the assets of the business requires the existence of a uniform and acceptable system of accounting for them and for reporting their condition. The accounting balance sheet provides this.

In the remainder of this chapter, a set of examples based on the experience of one fictitious company is developed. The first element in the case study is the corporate balance sheet. From there the case moves back to the profit and loss and the cash flow statements. The case moves eventually back to the basic statements of expense and revenue to demonstrate how these records are used by the people managing the business—how these records enable them to make decisions concerning pricing, product mix, and investment in new plant and processes. The case will also show how these records help management to direct the business into growth patterns, a strengthened financial position, or increased payout to the owners.

The name of the fictitious company is the Commercial Construction Tool Company, Incorporated, and will be referred to as CCTCO throughout the remainder of this chapter. The company manufactures a precision hand tool, which is very useful in the positioning and nailing of various wooden structural members as well as sheathing in the construction of frame houses. The tool is a proprietary product on which the patents ran out some time ago; however, the company has had a reputation for quality and performance that has made it very difficult for competition to gain much headway. The tool has a reputation and prestige among users such that no apprentice carpenter would be without one. The product is sold through hardware distributors who supply lumber yards and independent retail hardware stores. About three years ago the company introduced a lighter weight and somewhat simplified model for use in the “do-it-yourself” market. Sales of the home-use model have been good and growing rapidly, and there is some concern that the HOMMODEL (home model) is cannibalizing sales of the COMMODEL (commercial model).

The company has one manufacturing facility and its general offices and sales offices are at the same location.

At the first directors’ meeting after the year-end closing of the books the board is presented with the financial statements starting with the balance sheets for the beginning and end of the year. The principle of the balance sheet is that the enterprise has a net value to the owners (net worth) equal to the value of what is owned (the assets) less the amount owed to others (the liabilities).

69.3 BALANCE SHEET

When any business starts, the first financial statement is the balance sheet. In the case of CCTCO, the company was started many years ago to exploit the newly patented product. The beginning balance sheet was the result of setting up the initial financing. To get the enterprise started the original owners determined that \$1000 (represents one million dollars, since in all of the exhibits and tables the last three zeros are deleted) was needed. The inventor and friends and associates put up \$600 as the owners share—600,000 shares of common stock at a par value of \$1 per share. Others, familiar with the product and the originators of the business, provided \$400 represented by notes to be paid in 20 years—long-term debt. The original balance sheet was as shown below:

<u>Assets</u>		<u>Liabilities and Net Worth</u>	
Cash	1000	Liabilities	
		Long-term debt	400
		Net worth	–0–
		Capital stock	600
Total assets	1000	Total liabilities	
		and net worth	1000

The first financial steps of the company were to purchase equipment and machinery for \$640 and

raw materials for \$120. The equipment was sent COD, but the raw material was to be paid for in 30 days. Immediately the balance sheet became more complex. There were now current assets—cash and inventory of raw materials—as well as fixed assets—machinery. Current liabilities showed up now in the form of accounts payable—the money owed for the raw material. All this before anything was produced. Now the balance sheet had become:

Assets		Liabilities and Net Worth	
		<u>Liabilities</u>	
Cash	360	Accounts payable	120
Inventories	120	Current liabilities	120
Current assets	480	Long-term debt	400
Fixed assets	640	Total liabilities	560
		<u>Net worth</u>	
		Capital stock	600
Total assets	1120	Total liabilities and net worth	1120

After a number of years of manufacturing and selling product the balance sheet became as shown below in Table 69.1. This important financial report requires explanation.

Assets are generally of three varieties:

- *Current.* Usually liquid and will probably be turned over at least once each year.
- *Fixed.* Usually real estate and the tools of production, frequently termed plant, property, and equipment.
- *Intangible.* Assets without an intrinsic value, such as good will or development costs which are not written off as a current expense but are declared an asset until the development has been commercialized.

Table 69.1 Commercial Construction Tool Co., Inc.

Balance Sheet	Beginning
Assets	
Current assets	
Cash	52
Accounts receivable	475
Inventories	941
Total current assets	1468
Fixed assets	
Gross plant and equipment	2021
Less reserve for depreciation	471
Net plant and equipment	1550
Total assets	3018
Liabilities	
Current liabilities	
Accounts payable	457
Short-term debt	565
Long-term debt becoming current	130
Total current liabilities	1152
Long-term liabilities	
Interest-bearing debt	843
Total liabilities	1995
Net worth	
Capital stock	100
Earned surplus	923
Total net worth	1023
Total liabilities and net worth	3018

69.3.1 Current Assets

In CCTCO's balance sheet the first item to occur is cash, which the company tries to keep relatively low, sufficient only to handle the flow of checks. Any excess over that amount the treasurer applies to pay off short-term debt, which has been arranged with local banks at one-half of one percent over the prime rate.

Accounts receivable are trade invoices not yet paid. The terms offered by CCTCO are typical—2% 10 days net 30, which means that if the bill is paid by the customer within 10 days after receipt, he or she can take a 2% discount, otherwise the total amount is due within 30 days. Distributors in the hardware field are usually hard pressed for cash and are frequently slow payers. As a result, receivables are the equivalent of two and a half month's sales, tying up a significant amount of the company's capital.

Inventories are the major element of current assets and consist of purchased raw materials, primarily steel, paint, and purchased parts; work in process, which includes all material that has left the raw material inventory point but has not yet reached the stage of completion where it is ready to be shipped; and finished goods. In order to provide quick delivery service to customers, CCTCO finds it necessary to maintain inventories at the equivalent of about three months' shipments—normally about 25% of the annual cost of goods sold.

69.3.2 Current Liabilities

Skipping to the liability section of the report, in order to look at all the elements of the liquid segment of the balance sheet, we next evaluate the condition of current liabilities. This section is composed of two parts: interest-bearing debt and debt that carries no interest charge. The noninterest-bearing part is primarily accounts payable, which is an account parallel but opposite to accounts receivable. It consists of the trade obligations not yet paid for steel, paint, and parts as well as office supplies and other material purchases. Sometimes included in this category are estimates of taxes that have been accrued during the period but not yet paid as well as other services used but not yet billed or paid for.

69.3.3 Accrual Accounting

At this point it is useful to define the term "accrued" or "accrual" as opposed to "cash" basis accounting. Almost all individual, personal accounting is done on a cash basis, that is, for individual tax accounting, no transaction exists until the money changes hands—by either writing a check or paying cash. In commercial and industrial accounting the accrual system is normally used, in which the transaction is deemed to occur at the time of some other overt act. For example, a sale takes place when the goods are shipped against a bona fide order, even though money will not change hands for another month. Taxes are charged based on the pro rata share for the year even though they may not be paid until the subsequent year. Thus costs and revenues are charged when it is clear that they are in fact obligated. This tends to anticipate and level out income and costs and to reduce the effect of fluctuations resulting only from the random effect of the time at which payments are made. Business managers wish to eliminate, as far as possible, wide swings in financial results and accrual accounting assists in this, as well as providing a more clearly cause-related set of financial statements. It also complicates the art of accounting quite considerably.

69.3.4 Interest-Bearing Current Liabilities

Interest-bearing current obligations are of two types: short-term bank borrowings and that portion of long-term debt that must be paid during the current year. Most businesses, and particularly those with a seasonal variation in sales, find it necessary to borrow from banks on a regular basis. The fashion clothing industry needs to produce three or four complete new lines each year and must borrow from the banks to provide the cash to pay for labor and materials to produce the fall, winter, and spring lines. When the shipments have been made to the distributors and large retail chains and their invoices have been paid, the manufacturer can "get out of the banks," only to come back to finance the next season's line. Because CCTCO's sales have a significant summer bulge at the retail level, they must have heavy inventories in the early spring, which drop to a fairly low level in the fall. Bank borrowings are usually required in February through May, but CCTCO is normally out of the banks by year end, so that the year-end balance sheet has a sounder look than it would have in April. The item "short-term borrowings" of \$565 consists of bank loans that had not been paid back by the year's end.

The second part of interest-bearing current liabilities is that part of the long-term debt that matures within 12 months, and will have to be paid within the 12-month period. Such obligations are typically bonds or long-term notes. These current maturities represent an immediate drain on the cash of the business and are therefore classed as a current liability. As CCTCO has an important bond issue with maturities taking place uniformly over a long period, it has long-term debt maturing in practically every year.

69.3.5 Net Working Capital

The total of current assets less current liabilities is known as “net working capital.” Although it is not usually defined in the balance sheet, it is important in the financial management of a business because it represents a large part of the capitalization of an enterprise and because, to some degree, it is controllable in the short run.

In times of high interest rates and cash shortages, companies tend to take immediate steps to collect their outstanding bills much more quickly. They will carefully “age” their receivables, which means that an analysis showing receivables ranked by the length of time they have been unpaid will be made and particular pressure will be brought to bear on those invoices that have been outstanding for a long time. On the other hand, steps will be taken to slow the payment of obligations; discounts may be passed up if the need for cash is sufficiently pressing and a general slowing of payments will occur.

Considerable pressure will be exerted to reduce inventories in the three major categories of raw material, work in process, and finished goods as well as stocks of supplies. Annual inventory turns can sometimes be significantly improved. There are, however, irreducible minimums for net working capital, and going beyond those points may result in real damage to the business through reducing service, increasing delivery times, damaging credit ratings, and otherwise upsetting customer and supplier relationships.

The effect of reducing net working capital, in a moderate and constructive way, spreads through the financial structure of the enterprise. The need for borrowing is reduced and interest expense is thereby reduced and profits are increased. Also, another effect on the balance sheet further improves the financial position. As the total debt level is reduced and the net worth is increased, the ratio of debt to equity is reduced, thus improving the financial community’s assessment of strength. An improved rating for borrowing purposes may result, making the company eligible for lower interest rates. Other aspects of this factor will be covered in more detail in the discussion of net worth and long-term debt.

69.3.6 Current Ratio

The need to maintain the strength of another important analysis ratio puts additional resistance against the objective of holding net working capital to the minimum. Business owners feel the need to maintain a healthy “current ratio.” In order to be in a position to pay current bills, the aggregate of cash, receivables, and inventories must be available in sufficient amount. One measure of the ability to pay current obligations is the ratio of current assets to current liabilities, the current ratio. In more conservative times and before the days of leverage, a ratio of 2.0 or even 3.0 was considered strong, an indication of financial stability. In times of high interest rates and with objectives of rapid growth, much lower ratios are acceptable and even desirable. CCTCO’s ratio of 1.27 (\$1468/\$1152) is considered quite satisfactory.

69.3.7 Fixed Assets

Continuing the evaluation on the asset side of the balance sheet we find the three elements of fixed assets, that is, gross plant and equipment, reserve for depreciation, and net plant and equipment. Gross plant is the original cost of all the assets now owned and is a straightforward item. The concept of depreciation is one which is frequently misunderstood and partly because of the name “reserve for depreciation.” The name seems to indicate that there is a reserve of cash, put away somewhere that can be used to replace the old equipment when necessary. This is not the case. Accountants have a very special meaning for the word reserve in this application. It means, to an accountant, the sum of the depreciation expense that has been applied over the life, up to now, of the asset.

When an asset, such as a machine, is purchased, it is assigned an estimated useful life in years. In a linear depreciation system, the value of the asset is reduced each year by the same percentage that one year is to its useful life. For example, an asset with a 12-year useful life would have an 8.33% annual depreciation rate (100 times the reciprocal of 12). The critical reason for reducing the value each year is to reduce the profit by an amount equivalent to the degree to which equipment is transformed into product. With high income taxes, the depreciation rate is critical to ensuring that taxes are held to the legal minimum. When the profit and loss statement is covered, the effect on profits and cash flow as a result of using nonlinear, accelerated depreciation rates will be covered. The important point to understand is that the reserve for depreciation does not represent a reserve of cash but only an accounting artifice to show how much depreciation expense has been taken (charged against profits) so far and, by difference, to show the amount of depreciation expense that may be taken in the future.

The difference between gross plant and reserve for depreciation, net plant and equipment, is not necessarily the remaining market value of the equipment at all, but is the amount of depreciation expense that may be charged against profits in future years. The understanding of this principle of depreciation is critical to the later understanding of profits and cash flow.

69.3.8 Total Capital

Together, the remaining items (long-term debt and net worth) on the liability side of the balance sheet make up the basic investment in the business. In the beginning, the entrepreneurs looked for money to get the business started. It came from two sources, equity investors and lenders. The equity investors were given an ownership share in the business, with the right to a portion of whatever profits might be made or a pro rata share of the proceeds of liquidation, if that became necessary. The lenders were given the right to regular and prescribed interest payments and were promised repayment of principal on a scheduled basis. They were not to share in the profits, if any. A third source of capital became available as the enterprise prospered. Profits not paid out in dividends were reinvested in plant and equipment and working capital. Each of these sources has an official name.

Lenders:	Long-Term Debt
Equity Investors:	Capital Stock
Profits Reinvested:	Earned Surplus

In many cases the cash from equity investors is divided into two parts, the par value of the common shares issued, traditionally \$1 each, and the difference between par and the actual proceeds from the sale of stock. For example, the sale of 1000 shares of par value \$1 stock, for \$8000 net of fees, would be expressed:

Capital Stock (1000 shares at \$1 par):	\$1000
Paid in Surplus:	\$7000
Total Capitalization:	\$8000

The final item on the balance sheet, earned surplus or retained earnings, represents the accumulated profits generated by the business which have not been paid out, but were reinvested.

Net worth is the total of capital stock and earned surplus and can also be defined as the difference, at the end of an accounting period, between the value of the assets, as stated on the corporate books, and the obligations of the business.

All of this is a simplified view of the balance sheet. In actual practice there are a number of other elements that may exist and take on great importance. These include preferred stocks, treasury stock, deferred income taxes, and goodwill. When any of these special situations occur, a particular review of the specific case is needed in order to understand the implications to the business and their effect on the financial condition of the enterprise.

69.3.9 Second Year Comparison

The balance sheet in Table 69.1 is a statement of condition. It tells the financial position of the company at the beginning of the period. At the end of the year the Board of Directors is presented two balance sheets—the condition of the business at the beginning and at the end of the period, as shown in Table 69.2. The Board is interested in the trends represented by the change in the balance sheet over a 1-year period.

Total assets have increased by \$395 over the period—probably a good sign. Net worth or owners' equity has increased by \$27, which is \$368 less than the increase in assets. The money for the increase in assets comes from creating substantially more liabilities or obligations as well as the very small increase in the net worth. A look at the liabilities shows the following (note the errors from rounding that result from the use of computer models for financial statements):

	Increase
Accounts payable	\$ 46
Short-term debt	36
Long-term debt	286
	<u>\$368</u>

Changes in net working capital are evaluated to determine the efficiency in the use of cash and the soundness of the short-term position. No large changes that would raise significant questions have taken place. Current assets increased \$167 and current liabilities by \$82. These increases result from the fact that sales had increased, which had required higher inventories and receivables. The current ratio (current assets over current liabilities) had strengthened to 1.33 from 1.27 at the beginning of the period, indicating an improved ability to pay bills and probably increased borrowing power.

A major change in the left-hand (asset) side was the increase in fixed assets. Gross plant was up \$500, nearly 25%, indicating an aggressive expansion or improvement program.

Net worth and earned surplus were up by \$27, an important fact, sure to receive attention from the board.

Table 69.2 Commercial Construction Tool Co., Inc.—Costs and Revenues, Bad Year—Actual

Balance Sheet	Beginning	Ending	Change
Assets			
Current assets			
Cash	52	62	10
Accounts receivable	475	573	98
Inventories	941	1000	59
Total current assets	1468	1635	167
Fixed assets			
Gross plant and equipment	2021	2521	500
Less reserve for depreciation	471	744	273
Net plant and equipment	1550	1777	227
Total assets	3018	3413	395
Liabilities			
Current liabilities			
Accounts payable	457	503	46
Short-term debt	565	600	36
Long-term debt becoming current	130	130	0
Total current liabilities	1152	1233	82
Long-term liabilities			
Interest-bearing debt	843	1129	286
Total liabilities	1995	2362	368
Net worth			
Capital stock	100	100	0
Earned surplus	923	950	27
Total net worth	1023	1050	27
Total liabilities and net worth	3018	3413	395

In order to understand why the balance sheet had changed and to further evaluate the year's results, the directors needed a profit and loss statement and a cash flow statement.

69.4 PROFIT AND LOSS STATEMENT

The profit and loss statement (P&L) is probably the best understood and most used statement provided by accountants: It summarizes most of the important annual operating data and it acts as a bridge from one balance sheet to the next. It is a summary of transactions for the year—where the money came from and where most of it went. Table 69.3 is the P&L for CCTCO for the year.

For the sake of simplicity, net sales are shown as Sales. In many statements, particularly internal reports, gross sales are shown followed by returns and discounts to give a net sales figure. Cost of sales is a little more complex. Sales may be made from inventory or off the production line on special order. Stocks of finished goods or inventories are carried on the books at their cost of production. The formula for determining the cost of product shipped to customers is:

$$\text{beginning inventory} + \text{cost of production} - \text{ending inventory} = \text{cost of sales}$$

Additionally, CCTCO uses a standard burden rate system of applying overhead costs to production. The difference between the overhead charged to production at standard burden rates and the actual overhead costs for the period, in this case \$62, is called unabsorbed burden and is added to the cost of production for the year, or it may be charged off as a period cost. The procedures for developing burden rates will be treated in more detail in a subsequent section.

Gross margin is the difference between sales dollars and the cost of manufacture. After deducting the costs of administrative overhead and selling expense, operating profit remains. Interest expense is part of the total cost of capital of the business and is therefore separate from operations. The last item, income tax, only occurs when there is a profit.

69.4.1 Financial Ratios

The combination of the P&L and the balance sheet makes it possible to calculate certain ratios that have great significance to investors. The ratios are shown in Table 69.4. The first and most commonly

Table 69.3 Commercial Construction Tool Co., Inc.—Costs and Revenues, Bad Year—Actual

Profit and Loss Statement	(\$000)
Sales	4772
Cost of production	4097
Beginning inventory	941
Ending inventory	1000
Net change	59
Cost of sales	4038
Gross margin	734
Selling expense	177
Administrative	249
Operating profit	308
Interest	169
Profit before tax	138
Income tax	66
Net income	72

used as a measure of success is the return on sales. This is a valuable ratio to measure progress of a company from year to year, but is of less importance in comparing one company to another. A more useful ratio would be returns to value added. Value added is the difference between the cost of purchased raw materials and net sales, and represents the economic contribution of the enterprise. It is a concept used more extensively in Europe than the United States and is the basis of the Value Added Tax (VAT), quite common in Europe and at this writing being considered in the United States.

Return on assets begins to get closer to the real interest of the investor. It represents the degree to which assets are profitable, and would indicate, from an overall economic point of view, whether the enterprise was an economic and competitive application of production facilities.

A ratio even more interesting to the investor is the return on invested capital. Total assets, as was described earlier, are financed by three sources:

- Equity—made up of stock, that is, owners' investment and profits retained in the business
- Interest-bearing debt—composed of bonds, notes, and bank loans
- Current liabilities—composed of operating debts such as accounts payable and taxes payable, which do not require interest payments

Because the current liabilities are normally more than offset by current assets, the economic return is well described by the return on total or invested capital, which is net profit after taxes divided by the sum of equity plus interest-bearing debt.

A rate of return percentage of great interest to the owner is the return on equity. This rate of return compared to the return on total capital represents the degree to which the investment is or can be leveraged. It is to the interest of the investor to maximize the return on his or her dollars invested, so, to the degree that money can be borrowed at interest rates well below the capacity of the business to provide a return, the total profits to the owners will increase. Return on equity is a function of

Table 69.4 Commercial Construction Tool Co., Inc.—Costs and Revenues, Bad Year—Actual

Financial Ratios	
Return on sales	1.51
Return on assets	2.24
Return on invested capital	3.56
Return on equity	6.94
Asset to sales ratio	0.67
Debt percent to debt plus equity	69
Average cost of capital	20.67

the ratio of debt to debt plus equity (total capital) and is a measure of the leverage percentage in the business. It is to the advantage of the owners to increase this ratio in order to increase the return on equity up to the point that the investment community, including bankers, concludes that the company is excessively leveraged and is in unsound financial condition. At that point it becomes more difficult to borrow money and interest rates of willing lenders increase significantly. Fashions in leverage change depending on the business cycle. In boom times with low interest rates, highly leveraged enterprises are popular, but tend to fall into disfavor when times are tough.

A more direct measure of leverage is "debt percent to debt plus equity" or debt to total capital. The 69% for CCTCO indicates that lenders really "own" 69% of the company and investors only 31%.

Another ratio of interest to investors is the asset turnover or asset to sales ratio. If sales from a given asset base can be very high, the opportunity to achieve high profits appears enhanced. On the other hand, it is very difficult to change the asset to sales ratio very much without changing the basic business. Certain industries or businesses are characterized as being capital intensive, which means they have a high asset to sales ratio or a low asset turnover. It is fundamental to the integrated forest products industries that they have a high asset to sales ratio, typically one to one. The opposite extreme, for example, the bakery industry, may have a ratio of 0.3–0.35 and turn over assets about three times per year. Good management and very effective use of facilities coupled with low inventories can make the best industry performer 10% better than the average, but there is no conceivable way that the fundamental level can be dramatically and permanently changed.

The final figure in Table 69.4, that of average cost of capital, cannot be calculated from only the P&L and balance sheet. One component of the total cost of capital is the dividend payout, which is not included in either report. It was stated previously that the P&L shows where most of the money went—it does not include dividends and payments for new equipment and other capital goods. For this we need the cash flow, also known as the source and application of funds, shown in Table 69.5.

69.5 CASH FLOW OR SOURCE AND APPLICATION OF FUNDS

There are two sources of operating cash for any business: the net profits after tax and noncash expenses. In Table 69.5, the cash generated by the business is shown as \$344, the sum of net profit and depreciation. This is actually the operating cash generated and does not include financing cash sources, which are also very important. These sources include loans, capital contributions, and the sale of stock and are included in the cash flow statement as well as in the balance sheet where they have already been reviewed in a previous section of this chapter.

It seems clear and not requiring further explanation that the net profit after tax represents money remaining at the end of the period, but the treatment of noncash expenses as a source of operating funds is less self-evident. Included in the cost of production and sales in the previous section were materials and labor and many indirect expenses such as rent and depreciation, which were included in the P&L in order to achieve two objectives:

- Do not overstate annual earnings.
- Do not pay more income taxes than the law requires.

Table 69.5 Commercial Construction Tool Co., Inc.—Costs and Revenues, Bad Year—Actual

Source and Application of Funds	(\$000)
Net profit after tax	72
Depreciation expense	273
Cash generated	344
Increase in net working capital	
Change in cash	10
Change in receivables	98
Change in inventories	59
Change in payables	-46
Net change	121
Capital expenditures	500
Operating cash requirements	621
Operating cash flow	-276
Dividends	45
Net cash needs	-321
Increase in debt	321

In the section on fixed assets, when discussing the balance sheet, it was pointed out that the reserve for depreciation is not an amount of money set aside and available for spending. It is the total of the depreciation expense charged so far against a still existing asset. The example was a piece of equipment with a useful life of 12 years, the total value of which was reduced by 8.33% (the reciprocal of 12 times 100) each year. This accounting action is taken to reduce profits to a level that takes into consideration the decreasing value of equipment over time, to reduce taxes, and to avoid overstating the value of assets. Depreciation expense is not a cash expense—no check is written—it is an accounting convention. The cash profit to the business is therefore overstated in the P&L statement because less money was spent for expenses than indicated. The overstatement is the amount of depreciation and other noncash expenses included in costs for the year.

In the P&L in Table 69.4, included in the cost of sales of \$4038, is \$273 of depreciation expense. If this noncash item were not included as an expense of doing business, profit before tax would be increased from \$138 to \$411. Taxes were calculated at a 48% rate, so the revised net profit after tax would be \$214. This new net profit would also be cash generated from operations instead of the \$344 actually generated (\$72 profit plus \$273 depreciation) when noncash expenses are included as costs. The reduction in cash available to the business resulting from ignoring depreciation is exactly equal to the increase in taxes paid on profits. The anomaly is that the business has more money left at the end of the year when profits are lower!

69.5.1 Accelerated Depreciation

This is a logical place to examine various kinds of depreciation systems. So far, only a straight-line approach has been considered—the example used was a 12-year life resulting in an 8.33% annual expense or writedown rate. Philosophical arguments have been developed to support a larger writedown in the early years and reducing the depreciation rate in later years. Some of the reasons advanced include:

- A large loss in value is suffered when a machine becomes second hand.
- The usefulness and productivity of a machine is greater in the early years.
- Maintenance and repair costs of older machines are larger.
- The value of older machines does not change much from one year to the next.

The reason that accelerated systems have come into wide use is more practical than philosophical. With faster, early writedowns the business reduces its taxes now and defers them to a later date. Profits are reduced in the early years but cash flow is improved. There are two common methods of accelerating depreciation in the early years of a machine's life:

Sum of the digits

Double declining balance

Table 69.6 compares the annual depreciation expense for the two accelerated systems to the straightline approach. For these examples a salvage value of zero is assumed at the end of the period of useful life. At the time of asset retirement and sale, a capital gain or loss would be realized as compared to the residual, undepreciated value of the asset, or zero, if fully depreciated.

The methods of calculation are represented by the following equations and examples where:

- N = number of years of useful life
- A = year for which depreciation is calculated
- P = original price of the asset
- D_a = depreciation in year A
- B = book value at year end

The equation for straight-line depreciation is

$$D_a = \frac{1}{n} \times P$$

$$B = P - (D_1 + D_2 + \cdots + D_n)$$

In the example with an asset costing \$40,000 with an 8-year useful life:

$$D_a = \frac{1}{8} \times 40,000 = 0.125 \times 40,000 = 5000$$

To calculate depreciation by the sum of the years' digits method, use

Table 69.6 Accelerated Depreciation Methods^a

Straight-Line Method^b

Year	Rate	Depreciation Expense	Book Value, Year End
1	0.125	5000	35000
2	0.125	5000	30000
3	0.125	5000	25000
4	0.125	5000	20000
5	0.125	5000	15000
6	0.125	5000	10000
7	0.125	5000	5000
8	0.125	5000	0

Sum of the Years' Digits Method^c

Year	Rate	Depreciation Expense	Book Value, Year End
1	0.2222222	8889	31111
2	0.1944444	7778	23333
3	0.1666667	6667	16667
4	0.1388889	5556	11111
5	0.1111111	4444	6667
6	0.0833333	3333	3333
7	0.0555556	2222	1111
8	0.0277778	1111	0

Double the Declining Balance Method^d

Year	Rate	Depreciation Expense	Book Value, Year End
1	0.25	10000	30000
2	0.1875	7500	22500
3	0.140625	5625	16875
4	0.1054688	4219	12656
5	0.0791016	3164	9492
6	0.0593262	2373	7119
7	0.0444946	1780	5339
8	0.1334839	5339	0

^aBasic assumptions: equipment life, 8 years; original price, \$40,000; estimated salvage value, \$0.

^bAnnual rate equation: one divided by the number of years times the original price.

^cAnnual rate equation: sum of the number of years divided into the years of life remaining.

^dAnnual rate equation: twice the straight-line rate times the book value at the end of the preceding year.

$$D_a = [(N + 1 - A)/(N + N - 1 + N - 2 + \cdots + 1)] \times P$$

For the third year, for example,

$$D_3 = [(8 + 1 - 3)/(8 \times 7 + 6 + 5 + 4 + 3 + 2 + 1)] \times 40,000$$

$$D_3 = [(6)/(36)] \times 40,000 = 0.1667 \times 40,000 = 6667$$

The depreciation rates shown in Table 69.6 under the double declining balance method are calculated to show a comparison of write-off rates between systems. The actual calculations are done quite differently:

$$D_a = \frac{2}{n} \times B_{a-1}$$

$$B_a = P - (D_1 + D_2 + \cdots + D_{a-1})$$

In the third year, then,

$$D_3 = \frac{2}{8} \times 22,500 = 5625$$

and

$$B_3 = 40,000 - (10,000 + 7500 + 5625) = 16,875$$

Note in Table 69.6 that the double declining balance method, as should be expected, if allowed to continue forever, never succeeds in writing off the entire value. The residue is completely written off in the final year of the asset's life. The sum of the years' digits is a straight line and provides for a full write-off at the end of the period.

Figure 69.1 depicts, graphically, the annual depreciation expense using the three methods.

In many cases, a company will succeed in attaining both the advantages to cash flow and tax minimization of accelerated depreciation as well as the maximizing of earnings by using straight-line depreciation. This is done by having one set of books for the tax collector and another for the shareholders and the investing public. This practice is an accepted approach and, where followed, is explained in the fine print of the annual report.

A number of special depreciation provisions and investment tax credit arrangements are available to companies from time to time. The provisions change as tax laws are revised either to encourage investment and growth or to plug tax loopholes, depending on which is politically popular at the time. The preceding explains the theory—applications vary considerably with changes in the law and differences in corporate objectives and philosophy.

The cash generated by the business has, as its first use, the satisfaction of the needs for working capital, that is, the needs for funds to finance increases in inventories, receivables, and cash in the bank. Each of these assets requires cash in order to provide them. Offsetting these uses of cash are the changes that may take place in the short-term debts of the enterprise and accounts payable. In Table 69.5, we see that \$121 is required in increased net working capital, essentially all of which goes to provide for increased inventories and receivables needed to support sales increases.

The largest requirement for cash is the next item, that of capital expenditures, which has consumed \$500 of the cash provided to the business. The total needs of the company for cash—the operating cash requirements—have risen to \$621 compared to the cash generated of \$344, and that is not the end of cash needs. The shareholders have become accustomed to a return on their investment—an annual cash dividend. The dividend is not considered part of operating cash flow nor is it a tax deductible expense as interest payments are. The dividend, added to the net operating cash flow of -\$276, results in a borrowing requirement for the year of \$321.

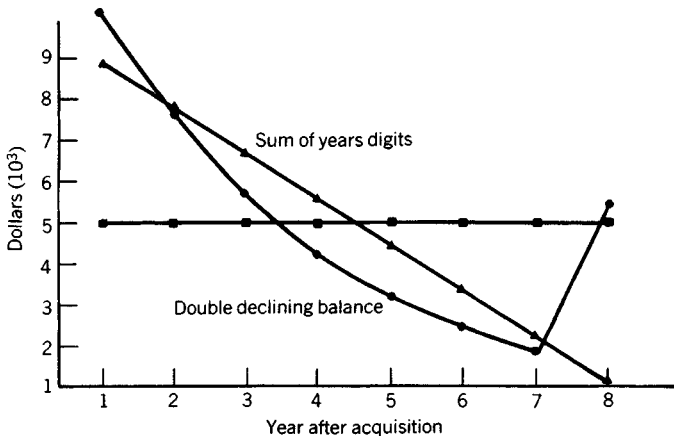


Fig. 69.1 Comparison of depreciation methods. (\$40,000 original price; 8-year life; and no residual salvage value.)

Table 69.7 Commercial Construction Tool Co., Inc.—P&L Statement (\$000)

	Budget	Actual	Variance	Percent
Sales	5261	4772	-489	-9.29
Cost of production	3972	4097	-1	-0.03
Beginning inventory	941	941	0	0.00
Ending inventory	1007	1000	-7	0.68
Net change	66	59	-7	-10.36
Cost of sales	3906	4038	-132	-3.37
Gross margin	1355	734	-621	-45.81
Selling expense	160	177	-17	-10.90
Administrative	231	249	-18	-7.88
Operating profit	964	308	-656	-68.08
Interest	154	169	-15	-9.93
Profit before tax	810	138	-671	-82.92
Income tax	389	66	322	82.92
Net income	421	72	-349	-82.92

To summarize, the Board of Directors has been furnished a set of operating statements and financial ratios as shown in Tables 69.2–69.5. These ratios show a superficial picture of the economics of the enterprise from a financial viewpoint and present some issues and problems to the directors. The condition of the ratios and rates of return for CCTCO are of great concern to the directors and lead to some hard questions for management.

Why, when the total cost of capital, that is, interest plus dividends as a percentage of debt plus equity is 20.67%, is the return on total capital only 3.56%? Why does it take \$0.67 worth of assets to provide \$1 worth of sales in a year? Why is it that profit after tax is only 1.5% of sales? The board will not be pleased with performance and will want to know what can and will be done to improve. The banks will perhaps have concerns about further loans and shareholders or prospective shareholders will wonder about the price of the stock.

The answers to these questions require a level of cost and revenue information normally supplied to top management.

69.6 EVALUATING RESULTS AND TAKING ACTION

Corporate chief executives who allowed themselves to be as badly surprised by poor results at the end of the year as the chief executive of CCTCO would be unlikely to last long enough to take corrective action. However, the results at CCTCO can provide clear examples of the usefulness of accounting records in determining the cause of business problems and in pointing in the direction of practical solutions.

69.6.1 Comparing Current Results with Budgets and Forecasts

The first step of the chief executive at CCTCO was to compare actual results with those projected for the year. It had been the practice at CCTCO to prepare a comprehensive business plan and budget at the beginning of each year. Monthly and yearly, reports comparing actual with budget were made available to top officers of the company. Tables 69.7–69.10 show a comparison of the budgeted P&L,

Table 69.8 Commercial Construction Tool Co., Inc.—Financial Ratios

	Budget	Actual	Variance
Return on sales	8.00	1.51	-6.50
Return on assets	12.98	2.24	-10.74
Return on invested capital	20.47	3.56	-16.92
Return on equity	34.76	6.94	-27.82
Asset to sales ratio	0.62	0.67	-0.06
Debt percent to debt plus equity	60	69	-9.53
Average cost of capital	16.43	20.67	-4.24

Table 69.9 Commercial Construction Tool Co., Inc.—Variance Analysis, Balance Sheet (\$000)

	Budget	Actual	Variance	Percent
Assets				
Current assets				
Cash	56	62	6	10.78
Accounts receivable	631	573	-59	-9.29
Inventories	1007	1000	-7	-0.68
Total current assets	1695	1635	-59	-3.51
Fixed assets				
Gross plant and equipment	2521	2521	0	0.00
Less reserve for depreciation	744	744	0	0.00
Net plant and equipment	1777	1777	0	0.00
Total assets	3472	3413	-59	-1.71
Liabilities				
Current liabilities				
Accounts payable	491	503	13	2.59
Short-term debt	604	600	-4	-0.68
Long-term debt becoming current	130	130	0	0.00
Total current liabilities	1225	1233	9	0.70
Long-term liabilities				
Interest-bearing debt	848	1129	281	33.17
Total liabilities	2073	2362	290	13.98
Net worth				
Capital stock	100	100	0	0.00
Earned surplus	1300	950	-349	-26.87
Total net worth	1400	1050	-349	-24.95
Total liabilities and net worth	3472	3413	-59	-1.71

Table 69.10 Commercial Construction Tool Co., Inc.—Variance Analysis, Source and Application of Funds (\$000)

	Budget	Actual	Variance	Percent
Net profit after tax	419	72	-347	-82.84
Depreciation expense	273	273	0	0.00
Cash generated	692	344	-347	-50.20
Increase in net working capital				
Change in cash	4	10	6	150.90
Change in receivables	156	98	-59	-37.53
Change in inventories	66	59	-7	-10.36
Change in payables	-34	-46	-13	37.85
Net change	193	121	-72	-37.40
Capital expenditures	500	500	0	0.00
Operating cash requirements	693	621	-72	-10.42
Operating cash flow	-1	-276	-275	27500.00
Dividends	45	45	0	0.00
Net cash needs	-46	-321	-275	593.31
Increase in debt	46	321	275	593.31

performance ratios, balance sheet, and cash flow for the year compared to the actual performance already reviewed by the board.

An examination of the budget/actual comparisons revealed many serious deviations from plan. Net worth and long-term debt were trouble spots. Profits were far from expected results, and cash flow was far below plan.

The president searched the reports for the underlying causes in order to focus his attention and questions on those corporate functions and executives that appeared to be responsible for the failures. He concluded that there were seven critical variances from the budget, which when understood, should eventually lead to the underlying real causes. They included

Element	Variance	Percent
Sales	-489	-9.29
Cost of sales	-132	-3.37
Selling expense	-17	-10.90
Administrative expense	-18	-7.88
Interest	-15	-9.93
Net working capital	-68	-14.50

The president asked the VP Sales and the VP Manufacturing to report to him as to what had happened to cause these variances from plan and what corrective action could be taken. He instructed the Controller to provide all the cost and revenue analyses needed to arrive at answers.

In two weeks the three executives made a presentation to the president that provided a comprehensive understanding of the problems, recommended solutions to them, and a timetable to implement the program. The following is a summary of that report.

69.6.2 Identifying Problems and Solutions

Causes of Last Year's Results

The poor operating results of last year are caused almost entirely by a change in product mix from the previous year and not contemplated in the budget established 15 months ago. The introduction of the HOMMODEL nearly two years ago resulted in very few sales in the early months following its initial availability. However, early last year, sales accelerated dramatically, caught up with, and passed those of the COMMOMODEL. For a number of reasons this has had a poor effect on the financial structure of our company:

- Lack of experience on the new product has resulted in costs higher than standard.
- Standard margins are lower for the HOMMODEL.
- Travel and communications costs were high because of the new product introduction.
- Prices on the HOMMODEL were lower than standard because of special introductory dealer discounts and deals.
- Receivables increased because of providing initial stocking plans for new dealers handling the HOMMODEL.
- Higher interest expense resulted from higher debt—a direct result of cash flow shortfall.

The only significant variance unrelated to the new product was the fact that factory and office rents were raised during the year.

The following product mix table summarizes a number of accounting documents and shows the effect of product mix on profits.

Recommended Corrective Action

As the major problems are caused by the new product cannibalizing sales of the old COMMOMODEL, action is directed toward increasing margins on the HOMMODEL to nearly that of the COMMOMODEL and increasing the proportion of sales of the latter. This will be accomplished by simultaneously reducing unit cost and increasing selling price of the new product. The following program will be undertaken:

- Increase the unit price to 3.52 and eliminate deals and promotion pricing for a margin improvement of 0.34.
- Productivity improvements realized in the last two months of the year will reduce costs by 0.15 for the year.
- Proposed changes in material and finish will further reduce costs by 0.032.

Table 69.11 Product Line Comparison: Unit Volume, Price, and Costs

	Budget	Actual	Variance
Commodel			
Sales (1000s)	740	530	(210)
Unit price	4.203	4.280	0.077
Unit cost	3.0612	3.139	0.078
Unit margin	1.142	1.141	-0.001
Sales \$	\$3,110,220	\$2,268,400	(841,820)
Cost \$	\$2,265,140	\$1,663,670	(\$16,380)
Margin \$	\$845,080	\$604,730	(240,350)
HOMMODEL			
Sales (1000s)	670	830	160
Unit price	3.210	3.016	(0.194)
Unit cost	2.449	2.932	(0.483)
Unit margin	0.761	0.084	(0.677)
Sales \$	\$2,150,700	\$2,503,280	352,580
Cost \$	\$1,640,830	\$2,433,560	792,730
Margin \$	\$509,870	\$69,720	(440,150)
Total			
Sales \$	\$5,260,920	\$4,771,680	(489,240)
Cost \$	\$3,905,970	\$4,097,230	\$776,350
Margin \$	\$1,354,950	\$674,450	(680,500)
Selling expense	\$160,000	\$177,000	17,000
Administrative expense	\$231,000	\$249,000	18,000
Operating profit	\$963,950	\$248,450	(\$715,500)

These changes in price and cost will bring the standard margin of the HOMMODEL to 1.21, slightly more than that of the COMMODEL, thus eliminating any unfavorable effect of cannibalizing.

This report enabled the president to assure the board that the recommended steps would be taken and the year to come would provide better results.

69.6.3 Initiating Action

Following Board approval, the president asked the manufacturing manager, in conjunction with marketing, to prepare a five-year projection of operating results. The projection, as shown in Table 69.12, was prepared in a personal computer spreadsheet by the manufacturing manager and showed an increase in operating profit to just over \$1,000,000 by the end of the five-year period.

The manufacturing manager was able to demonstrate the logic of his conclusions by showing the economic and operating assumptions on which the projections were based, as shown below:

Concerning the COMMODEL:

1. Unit sales will increase 1.5% annually.
2. Unit prices will increase at 2.5% annually, 0.5% less than the expected inflation rate of 3.0%.
3. Unit costs will increase at the same rate as prices.

Concerning the HOMMODEL:

1. Unit sales will increase at 4.0% annually.
2. Unit prices will increase at the same rate as for the COMMODEL, 2.5% annually.
3. Unit costs will increase at the same rate as prices.

Concerning expenses, both selling and administrative expenses will increase at 3.0% annually.

Using his model, the manufacturing manager was able to demonstrate to the board the reasonableness and the sensitivity of his projections. The cell formulae used in the spreadsheet are shown in Table 69.13.

69.7 FINANCIAL TOOLS FOR THE INDEPENDENT PROFESSIONAL ENGINEER

In the 1990s and for some years prior to that time, it became common for engineers to become independent consultants or "free lances." This was partly brought about by corporate downsizing and the tendency of companies to bring in part-time technical assistance for specific projects rather

Table 69.12 Product Line Comparison: Unit Volume, Price, and Costs

	Projections				
	Year 1	Year 2	Year 3	Year 4	Year 5
COMMODEL					
Sales (1000's)	700	717	735	754	773
Unit price	4.280	4.387	4.497	4.609	4.724
Unit cost	3.139	3.217	3.298	3.380	3.465
Unit margin	1.141	1.170	1.199	1.229	1.259
Sales \$	\$2,996,000	\$3,070,900	\$3,147,672	\$3,226,364	\$3,307,023
Cost \$	\$2,197,300	\$2,252,233	\$2,308,538	\$2,366,252	\$2,425,408
Margin \$	\$798,700	\$818,668	\$839,134	\$860,113	\$881,615
HOMMODEL					
Sales (1000's)	650	666	683	700	717
Unit price	3.520	3.608	3.698	3.791	3.885
Unit cost	2.750	2.819	2.889	2.961	3.035
Unit margin	0.770	0.789	0.809	0.829	0.850
Sales \$	\$2,288,000	\$2,403,830	\$2,525,524	\$2,653,379	\$2,787,706
Cost \$	\$1,787,500	\$1,877,992	\$1,973,066	\$2,072,952	\$2,177,895
Margin \$	\$500,500	\$525,838	\$552,458	\$580,427	\$609,811
Total					
Sales \$	\$5,284,000	\$5,474,730	\$5,673,196	\$5,879,743	\$6,094,729
Cost \$	\$3,984,800	\$4,130,225	\$4,281,604	\$4,439,204	\$4,603,303
Margin \$	\$1,299,200	\$1,344,505	\$1,391,593	\$1,440,539	\$1,491,426
Selling expense	\$177,000	\$182,310	\$187,779	\$193,413	\$199,215
Administrative expense	\$249,000	\$256,470	\$264,164	\$272,089	\$280,252
Operating profit	\$873,200	\$905,725	\$939,649	\$975,037	\$1,011,959

Table 69.13 Cell Formulae Used for Projections

	Product Line Comparison: Unit Volume, Price, and Costs		
	Year 1	Year 2	Formula
COMMODEL			
Sales (1000's)	700	710	+C7*1.015
Unit price	4.280	4.387	+C8*1.025
Unit cost	3.139	3.217	+C9*1.025
Unit margin	1.141	1.170	+D8-D9
Sales \$	\$2,996,000	\$3,116,963	+D7*D8*1000
Cost \$	\$2,197,300	\$2,286,016	+D7*D9*1000
Margin \$	\$798,700	\$830,948	+D11-D9*D7*1000
HOMMODEL			
Sales (1000's)	650	676	+C15*1.04
Unit price	3.520	3.608	+C16*1.025
Unit cost	2.750	2.819	+C17*1.025
Unit margin	0.770	0.789	+D16-D17
Sales \$	\$2,288,000	\$2,439,008	+D15*D16*1000
Cost \$	\$1,787,500	\$1,905,475	+D15*D17*1000
Margin \$	\$500,500	\$533,533	+D19-D17*D15*1000
Total			
Sales \$	\$5,284,000	\$5,555,971	+D19+D11
Cost \$	\$3,984,800	\$4,191,491	+D20+D12
Margin \$	\$1,299,200	\$1,364,481	+D21+D13
Selling expense	\$177,000	\$182,310	+C27*1.03
Administrative expense	\$249,000	\$256,470	+C28*1.03
Operating profit	\$873,200	\$925,701	+D25-D27-D28

In a like manner, relationship and cell formulae can be developed for year-by-year balance sheets and cash flows.

than to develop an in-house capability that was not needed at all times. One of the implications of this development is that the engineer needs to be able to account for his own expenses and income as a “business.” This accounting must satisfy the requirement of the U.S. Internal Revenue Service and records need to be adequate to convince the IRS that tax submissions are accurate, that they satisfy the tax law, and that there is no fraud or indication of deception.

69.7.1 Simple Record-Keeping

With present home and business accounting software for the personal computer, the keeping of basic records can be made accurate, simple, and convincing to an IRS investigator and to the engineer’s accountant.

The records of a private engineering practice should be *cash* rather than accrual and therefore can be based on bank and credit card transactions. Small cash transactions can be handled through a petty cash account that is replenished by check and that contains a journal of expenditures. A personal computer system can be set up that will automatically categorize each check written and even split a check into a number of categories, when necessary.

At the time of the publication of this edition the most popular program for personal finance was *QUICKEN*, but others are available and some banks will provide software and on-line access to a checking account. These systems make it possible to group and print out with full back-up and audit trail capability so that full quick disclosure is constantly available in a format that makes IRS audits become a matter solely of interpreting the law rather than tracking obscure expenditures or elements of income.

69.7.2 Getting the System Started

The first step should be to select an accountant. Although it is possible to maintain all needed records and prepare tax returns with computer software, the use of an accountant will probably save taxes through his knowledge of the law and is, for most engineers, essential. Following are some of the early decisions that should be made with the accountant:

- Incorporation or not
- Computer needs
- Software needs
- Definition of categories or accounts
- Setting up bank accounts
- Level of accountant involvement

69.7.3 Operating the System

The basic approach to relatively painless small business accounting is that when a check is written or a deposit made, the transaction is entered in the computer at the time of the transaction and never again! As bills become due, the check is entered in and printed by the software or base; the funds are even transferred to the payees by the software. From that base, transaction lists, tabulations, and groupings are all done without writing or performing manual arithmetic. Cross columns *always* balance.

At the end of the fiscal year, the data can be transferred into a tax preparation program that will sort data and calculate the tax. At that time, the data can be transmitted to the accountant with a detailed, by category, listing of each transaction in hard copy or machine language or both. The accountant has very little number-crunching to do and accounting fees are minimal.

In the past, the problems of accounting for a business were a significant deterrent to freelancing. Sound, simple computer approaches eliminate that part of the terror of being on your own.

69.8 CONCLUSIONS

This chapter is intended to portray the principles of financial reporting without describing the underlying cost accounting systems needed to manage a business. These become so complex and are so varied that they are beyond the scope of this work.

The capacity to understand the meaning of financial reports and to make time projections based on historical reports coupled with sound assumptions for the future is frequently important to the engineer. Additionally, the ability to devise and administer a simple accounting system used to manage an engineering practice is, especially today, a useful skill.

The section is designed to provide a basis in these capabilities.