

BASIC ACCOUNTING: TRACKING THE PAST AND PLANNING THE FUTURE

4.1 Relevance of Accounting to the Engineer

Accounting is the process of recording, summarizing, analyzing, verifying, and reporting in monetary terms the transactions of a business or other organization. Aspiring and already practicing engineers and other technical personnel should understand the basic terminology and concepts of accounting so they can effectively function.

The general, overriding reason for accounting is to determine where an organization has been in financial terms and, by analysis, extrapolation, and planning, to determine where the organization is likely to be going, again in financial terms. Some of an organization's accounting is done for internal reasons and some of it is done to satisfy external needs.

Some internal reasons for doing accounting include "score keeping," that is, determining how closely an organization is adhering to its business plan; providing the basis for pricing products or setting charge-out rates for professional services; and guiding internal resource allocation and optimum marginal investing. External reasons for accounting include reporting to stockholders; providing data to lenders in support of loan applications; satisfying the requirements of federal, state, and other tax laws; and giving information to insurance companies as part of a process of securing professional liability insurance. Liability insurance premiums are based partly on annual billings and similar financial measures.

4.2 The Balance Sheet: How Much Is It Worth?

The balance sheet, which is one of two financial statements that define the financial condition of an organization, is prepared at regular intervals such as monthly, quarterly, and annually and meets internal and external needs. The other financial statement is the income statement.

The balance sheet is referred to by other names such as financial statement, statement of financial condition, statement of worth, and statement of assets and liabilities.

The balance sheet shows, at a given time, assets (A), liabilities (L), and net worth (NW) or equity (E) in monetary terms. The basic equation for the balance sheet is:

$$A - L = NW(\text{or } E)$$

A balance sheet is a snapshot of the financial condition of a person or organization at a specific point in time. While it shows the financial status at that instant, it does not indicate what financial transactions lead to the current situation.

Personal Balance Sheet

Table 4.1 presents the assets and liabilities of a hypothetical young engineer or other technical person within several years after graduation from college. Two observations are in order:

- This balance sheet, and balance sheets in general, are not as accurate as they may appear to be, particularly when line items are entered to the nearest cent. For consistency, accountants usually show all items to the nearest cent. Some line items such as the current balance of a checking account or the amount owed on an automobile loan, can be determined and stated, on any day, to the nearest cent. However, in general, the overall accuracy of a balance sheet is less than that because some values are estimates, such as the current market value of a condominium or other personal property. This inconsistency in a balance sheet is further complicated by the difficulty of getting all values to be simultaneous or coincident.
- While absolute values of line items, assets, and liabilities at any time are important, changes and trends, such as a gradual increase in net worth for an individual, a couple, or a company are even more important. A balance sheet is a snapshot of net worth at a point in time. A series of balance sheets provides a moving picture of a changing situation. For example, a young professional might exhibit a negative net worth shortly after graduation from college, but as a result of sound personal financial management, quickly improve the situation so that in a few years assets exceed liabilities and the difference grows.

Table 4.1 This hypothetical end-of-the-calendar-year balance sheet provides an estimate of a young person's net worth.

	Assets	Ksh
Condominium		16,500,000.00
Personal property (e.g., furniture)		1,400,000.00
XYZ stock		528,300.00
Car		1,600,000.00
Retirement (vested)		750,000.00
Cash/checking		89,300.00
Insurance (cash value)		101,200.00
Total		20,968,800.00
	Liabilities	Ksh
Mortgage on condo		14,329,300.00
Car loan		1,215,100.00
Credit cards		254,200.00
College loan		201,600.00
Total		16,000,200.00
	Net worth (or equity)	
Total(NW)		4,968,600.00

If you owe or own anything, you have the basis for a personal balance sheet and should consider developing a balance sheet for your personal finances. Use spreadsheet software (like MS Excel) to construct your balance sheet and update it at least annually, at the end of the calendar year, on your birthday, or on some other day of significance to you, by adding a column for the end of the most recent year. By preparing and maintaining a personal balance sheet you will realize two benefits. First, you will have an on-going measure of how well you are managing your finances as measured, in part, by the upward, static, or downward trend in your net worth. Second, you will have ready access to the kinds of asset and liability data typically required by banks and other lending institutions in support of applications for home mortgages, automobile loans, and other common financial transactions.

Business Balance Sheet

The second example balance sheet, which is shown in Table 4.2, applies to a hypothetical construction company and represents the last day of a calendar year.

Assets

Current assets are short-lived working capital, that is, assets that are cash or could be converted to cash typically within a year. Current assets in the balance sheet are as explained as follows:

- Cash: The construction company needs to have ready access to cash for miscellaneous uses.
- Notes receivable, current: Perhaps they have loaned money to someone or a business and it is due now.
- Accounts receivable: These are funds due to the construction company for work completed and billed. It may include retainage which is a portion of the total contract amount (typically 10 percent) retained by owner until the contractor finishes all work. It is in addition to performance and payment bonds.
- Deposits: An example is a security deposit paid to an engineering/architectural firm for a set of plans to use in bidding.
- Inventory: Examples are items and materials to be used for construction such as pumps, motors, pipe, and aggregate.
- Prepaid expenses: This might be the prepaid purchase price of pipe not yet delivered or dues to a contractor organization. These items are assets because the contractor is entitled to receive something of value.

In contrast with current assets, fixed assets usually require more than a year to convert to cash and then only after a major organizational reorientation.

Fixed assets in Table 4.2 are explained as follows:

- Land: Occupied or not yet used land owned by the construction company.
- Buildings: This includes buildings actively used in the construction business and other buildings owned by the company.
- Construction equipment: Examples are specialty items such as back hoes, frontend loaders, pavers, and construction cranes.
- Vehicles: This would typically be company cars and trucks.
- Less accumulated depreciation: Accounts for the gradual loss in value of various fixed assets. This amount is subtracted from the fixed assets subtotal.

Table 4.2 This hypothetical end-of-the-fiscal-year construction company balance sheet provides a net worth estimate.

	Assets	Ksh
Current		
Cash		43,921,563.00
Notes receivable, current		1,862,448.00
Accounts receivable		140,569,810.00
Deposits		140,000.00
Inventory		3,104,000.00
Prepaid expenses		959,781.00
Total		190,557,602.00
Fixed		
Land		2,634,598.00
Buildings		8,408,319.00
Construction equipment		45,347,815.00
Vehicles		8,637,892.00
Subtotal		65,028,624.00
Less accumulated depreciation		48,917,845.00
Total fixed assets		16,110,779.00
Total assets		206,668,381.00
	Liabilities	Ksh
Current		
Accounts payable		40,318,200.00
Due to subcontractors		89,343,600.00
Equipment contracts		10,893,700.00
Long-term notes payable		1,891,500.00
Total liabilities		142,447,000.00
	Net worth (or equity)	Ksh
Common stock, 3860 shares		38,600,000.00
Retained earnings		25,621,381.00
Total		64,221,381.00

Liabilities

The construction company's financial obligations, that is, its liabilities, are explained as follows:

- Accounts payable: Funds owed for miscellaneous products, materials, and services.
- Due to subcontractors: Based on invoices received.
- Provision for income taxes: A projection of funds that will be needed
- . Equipment contracts: The Company leases some of the equipment used on its projects.
- Long-term notes payable: Maybe the company borrowed money to acquire another company.

Net Worth

The company's net worth, which is its assets 206,668,381.00 minus its liabilities 142,447,000.00, that is, 64,221,381.00, consists of these two components:

- Common stock: Investment in company by its stockholders – 3860 shares at KSh10, 000.00 each.
- Retained earnings: These funds, also called earned surplus, are available for use within company.

The book value of the construction company $64,221,381.00/3860 = \text{KSh}16, 637.66$ per share. The market value of each share of stock, for example, what a buyer of the company would be willing to pay, is unknown and is very likely to be different than the common stock value or book value.

Balance sheets are routinely prepared for a wide variety of businesses, such as manufacturing organizations and consulting firms, and not-for-profit entities. Accounts receivable often dominate the assets of consulting engineering firms, that is, accounts receivable are very large compared to tangible items, and may approximate a firm's net worth.

4.3 The Income Statement: Inflow and Outflow

The income statement is another important type of business financial statement. As does the balance sheet, the income statement also has different names in that it is sometimes referred to as the profit and loss statement, statement of earnings, statement of loss and gain, income sheet, summary of income and expense, profit and loss summary, statement of operations, and operating statement

The income statement presents the type and amount of income (I) and expense (E), along with the difference over a specified period of time, and shows the net income (NI). Any time period is

possible, but typically income statements are prepared on a monthly, quarterly, or annual basis. The basic equation for the income statement is:

$$I - E = NI$$

As is the case with the balance sheet, two example income statements are presented—the first applies to personal income and expenses and the second applies to a business.

Personal Income Statement

Refer to Table 4.3, which might apply to a young professional a few years after completing his or her formal education. This might be the income statement for the individual whose balance sheet is presented in Table 10.1. Note, again, that the income statement shows income received and expenses incurred over a period of time, that is, one year.

Table 4.3 This hypothetical annual income statement shows a young person's income, expenses, and net income.

	Income	Ksh
Salary(gross)		6,805,229.00
Interest/dividends		59,681.00
Sale of stock		110,823.00
Total(I)		6,975,733.00
	Expenses	Ksh
Mortgage (interest and principal)		2,189,067.00
Utilities and electronic services		384,561.00
Food including restaurants		510,000.00
Clothing		360,000.00
Car payments		761,189.00
Insurances		362,109.00
Taxes		1,150,000.00
Entertainment/travel		350,000.00
Miscellaneous		210,000.00
Total (E)		6,276,926.00
	Net Income	
Net Income(N)		698,807.00

A personal income statement like that shown in Table 4.3 could be used in a postmortem mode to review income and expenses during the past year. In addition, a personal income statement could also be used in a prospective mode to plan income and its use in the near future. Retrospective and prospective uses of income statements are routine in the business environment.

The earlier observation about the variation in accuracy of line items in the balance sheet also applies to the income statement. For example, while items such as salary and interest and dividends earned can be listed to the nearest penny in a retrospective income statement, expense items such as entertainment/travel and clothing would be estimates unless unusually meticulous records were kept. Variation of accuracy within the income statement does not in any significant way detract from its usefulness as an analysis and planning tool.

Finally, note that there is no obvious quantitative connection between Table 4.3, the income statement, and Table 4.1, the balance sheet, even though they could be for the same hypothetical young person. The first applies to a point in time and the second to an interval of time. However, both are needed to understand the young person's financial situation.

Business Income Statement

Table 4.4 follows the same general format as the example of personal income statement but applies to a hypothetical construction company. The hypothetical business for which the income statement was developed is for the same business in the calendar year for which Table 10.2, the balance sheet, was developed.

Table 4.4 This hypothetical annual income statement shows income, expenses, and net income for a construction company.

	Income	Ksh
Contracting income		1,036,519,568.00
Discounts earned		2,809,562.00
Equipment rental		2,678,945.00
Interest revenue		345,691.00
Miscellaneous		1,455,678.00
Total		1,043,809,444.00
	Expenses	Ksh
Project costs		981,866,578.00
Office overhead		25,667,890.00
Marketing		11,123,467.00

Miscellaneous		230,567.00
Total		1,018,888,502.00
	Net Income	Ksh
Net income before income taxes		24,920,942.00
State taxes on income		10,466,778.00
Net income after taxes on income		14,454,164.00
	Retained Earnings	Ksh
Balance on January 1		22,156,845.00
Dividends paid		11,335,488.00
Total retained earnings		10,821,357.00
Balance on December 31		25,275,521.00
Earnings per share on net income (net income after taxes divided by the number of shares)		3,745.00

Note also that the accrual method of accounting is being used, not the cash method or basis. With the accrual approach, income is recognized and entered into the books as it is earned (not when the revenue is actually received as when the cash basis is used). Expenses are recognized and entered when they are incurred (not when payments are actually made as when the cash basis is used).

Income

- Contracting income: Done on completed project basis, this is the sum of all income for all projects completed during the calendar year. Discounts earned: This may be a credit or cash payment for volume purchases.
- Equipment rental: Perhaps this is income from rental of some of the company's equipment to other contractors.
- Interest revenue: This may be earnings on company checking and/or savings accounts.
- Miscellaneous: An example would be sale of building materials to other contractors.

Expenses

- Project costs: This may be raw labor, fringe benefits, equipment rental, materials, subcontracts, and a portion of general overhead allocated to completed projects.

- Office overhead: This is the portion of overhead not allocated to projects.
- Marketing: The company tracks personnel costs and expenses.
- Miscellaneous: An example is legal fees.

Net Income

- Net income before income taxes: The income minus expenses. Note how small this is relative to the total income, that is, net income before taxes is only 2.39 percent of the total income. This suggests risky profitability.
- State taxes on income: This is 42.0 percent of the net income before taxes.
- Net income after taxes on income: The difference of the preceding two items. This is discretionary income to be used for purposes such as paying dividends to stockholders, raising salaries, putting back into the business, and holding onto as a cushion.
- Retained earnings: What follows is an accounting of the changes in retained earnings over the year.
 - Balance on January 1: The retained earnings at the beginning of the year.
 - Dividends paid: Payments to stockholders during the year. 11,335,488.00 of the retained earnings carried over from the beginning of the year was paid to stockholders during the year.
 - Total retained earnings: The difference between the preceding two items.
 - Balance on December 31: This is the preceding item plus the difference between the net income after taxes and the dividends paid. The company may be in the process of building its retained earnings to help finance a new venture.
- Earnings per share on net income: Recall from Table 10.2, that there are 3860 shares so that the earnings per share are $14,454,164.00/3860 = 3,745.00$ which is an index of company performance.

4.4 Relationship between the Balance Sheet and the Income Statement

The balance sheet and income statement for an individual or for an organization are inextricably linked. Consider a reservoir, with its continuously-varying inflows, outflows, contents, and water level, as an analogy. The balance sheet for the end of a reporting period is analogous to the current contents of the reservoir. The income statement is analogous to an accounting of how much water

came into the reservoir and from where, and how much water went out of the reservoir and where it went during the time period. Another common analogy to the balance statement and income statement is a checking account. The end-of-month (or end-of-reporting-period) balance is like the balance sheet. The listing of deposits, checks written, fees charged, interest earned, and other transactions for the month, is like an income statement.

Recall the balance sheet (Table 4.2) and the income statement (Table 4.4) for the hypothetical construction company. The one explicit connection between the two financial statements was the retained earnings at the end of the year. The income statement showed the basis for the retained earnings on the balance sheet. While not immediately apparent, the balance sheet and income statement for an organization or individual are completely linked. The linkage may be presented as follows:

- Balance sheet at end of period
- Income statement for next period
- Balance sheet at end of period
- Income statement for next period
- Etc.

In a business or other organization, or even in one's personal financial affairs, neither the balance sheet nor the income statement is sufficient for a full understanding of organizational or individual financial condition. Using the reservoir analogy again, even if all inflows to and outflows from the reservoir were known for a year (income statement), the reservoir contents at the end of the year (balance sheet) could not be determined without having the reservoir contents (balance sheet) for the end of the preceding year.

There may be some exceptions to the general statement that both a balance sheet and income statement are desired. For example, a modest sole proprietorship consulting business will need an income statement. However, it may not require a balance sheet because it operates on a cash basis with no significant liabilities and has little property or other assets.

4.4 Accounting for Your Future

A person's life can be viewed, in a very simple way, as consisting of three phases, learning, earning, and returning (Maxwell 2003). The three phases are interrelated. For example, the

learning phase, which may be viewed as ending with an individual's formal education, hopefully prepares that person for the earning phase. This is the long period—about four decades—during which an individual adds value and, in exchange, earns which is hopefully a comfortable income.

The returning phase starts with formal retirement from work. During this third and last phase, which could last for two or more decades, an individual could participate in various combinations of activities such as relaxation, travel, volunteer work, compensated part-time work, and possibly even a new career. However, experience suggests that for many, regardless of their chosen combination of “retirement” activities, this final phase includes some volunteer or giving back activities and, therefore, the label “returning,” as in returning something to society, is appropriate.

Estimating the Necessary Net Worth at the End of Your Earning Phase

If you connect with this learn-earn-return life model, then you might be receptive to some thoughts about how you, as a student or young technical person, could use the “earning” phase to be able to afford a financially comfortable “returning” phase. That is, to use an expression introduced in this chapter, what net worth will you need to earn during your earning phase to enjoy a vibrant returning phase and how can you earn it? “You can be young without money,” according to playwright Tennessee Williams, “but you can't be old without it.”

Accumulating the Necessary Net Worth by the End of Your Earning Phase

How might you accumulate the required net worth by the end of your earning phase? The short answer is to first commit to investing at least ten percent of all of your income beginning with the first pay check you receive when you begin your first full-time employment as an engineer or other technical professional.

The suggested minimum ten percent of income might be invested in a variety of ways such as employer-sponsored retirement programs, which are often matched by the employer; self-funded retirement programs such as when you have your own business; stocks and bonds; and real estate, all of which could gradually grow your net worth. This habit, and it must become a habit, when combined with the power of compounding, will assure accumulation of substantial assets—millions—during your earning phase. “You can create far more wealth by how you use the money you already earn,” according to financial advisor Charles Givens, “then you can by earning more.”

4.5 The Impact of Time Utilization Rate and Expense Ratio on Profitability in the Consulting Business

Although providing service is the primary reason for their existence, consulting firms must generate a profit. This profit-oriented discussion is targeted primarily at aspiring and entry-level engineers and other technical personnel who want to be or are on the staff of consulting engineering, architecture, and similar firms. The ideas and information that follow are applicable to businesses that generate most of their revenue by selling time as opposed to selling products—offering services rather than producing goods. The factors determining profitability should be of interest to consulting firm employees, as well as government personnel, private sector personnel, and others who retain consultants so they are in a better position to understand how consulting firms operate.

Utilization Rate and Expense Ratio

Consulting firm profitability may be stated as Profitability = f (U, R, other factors) where, for a specified time period:

U = Utilization Rate (or Chargeable Rate or Billable Rate): Consider all the hours worked by salaried and hourly personnel at all levels for a specific time period such as a week, month, or year. Recognize that some of the hours are devoted to contract projects and, therefore, are charged to and eventually paid for by clients. Then, for that time period, $U = (\text{charged time in hours}) / (\text{total time in hours})$. U is always less than 1.0 for an organization because not everyone can be working directly on client projects all the time. At any time, various employees will be doing non-project administrative work, completing marketing tasks, participating in education and training, and enjoying a vacation or holiday.

R = Expense Ratio: Let S = non-salary costs of a business that are not billed directly to clients (e.g., Social Security, professional liability insurance, unemployment insurance, rent, utilities, and entertainment). Let P = total payroll cost, that is, the money paid to employees, excluding benefits, for all the hours they worked as described under the description of U. Then $R = \text{Expense Ratio} = S/P$.

4.6 Analysis of a Consulting Firm's Income Statement

As a further introduction to the importance of the time utilization rate and the expense ratio, consider Table 4.5, which is a year-to-date income statement for a hypothetical consulting firm.

Table 4.5 Hypothetical year-to-date income statement for a consulting firm shows how various indicators are calculated.

	Ksh
Total revenues	180,000,000.00
Less reimbursable expenses	10,000,000.00
Less outside consultants	50,000,000.00
Net revenues	120,000,000.00
Less direct labor (P – P')	40,000,000.00
Less non-reimbursable	1,000,000.00
Gross income	79,000,000.00
Less overhead (S + P')	60,000,000.00
Net income before taxes	19,000,000.00

Note that the table uses the accrual method of accounting. Review of each line item:

- Total revenues: Money paid to or due to the consulting firm.
- Less reimbursable expenses: Expenses (e.g., travel, copying) billed to clients and paid to or due to the consulting firm (excludes “markup,” overhead, etc.). This revenue “comes in,” but is “immediately” used by the firm to reimburse expenses—no gain here for the firm. Therefore, reimbursable expenses are subtracted from the total revenues.
- Less outside consultants: Similar to the preceding item. The consulting firm may mark up invoices from outside consultants partly to cover the consultant’s costs of administering the process. The mark up amount is not included in outside consultants because it is income.

- Net revenues: Revenues generated by in-house labor. As indicated below, this revenue has to cover many items.
- Less direct Labor: Raw labor cost—money paid to or due to employees while they worked on projects—excludes fringe benefits. This amount is subtracted from net revenues.
- Less non-reimbursable: Expenses incurred as a result of projects, but not billable to client (e.g., unexpected lab test needed and not covered in contract or acceptable to client as a contract change). Also includes invoices that were not paid and are written off. Non-reimbursable are subtracted from net revenues.
- Gross Income: Income after project expenses are accounted for, but before overhead. That is, all of the preceding are income and expenses directly related to projects.
- Less overhead: While projects were underway, many and various expenses were being incurred within the firm which were not directly billed to the clients. Overhead = S + P' where P' is the sum of salaries and hourly pay not billable to client such as vacation, illness, holidays, bonuses, office staff, and business development. Recall that S is non-salary costs not billed to client and that P is total payroll. Then P - P' = payroll paid by project income. The overhead ratio is $O = (\text{overhead}) / (\text{direct labor cost}) = (S + P') / (P + P')$. The overhead ratio, which is usually greater than 1.0, is “burden” on direct labor—direct labor has to be “marked up” to recoup overhead and to generate profit. For the hypothetical income statement shown in Table 4.5, $O = 1.5$. Overhead is subtracted from gross income.
- Net income before taxes: Note how overhead takes a “big cut” in that gross income is reduced from 79,000,000 to 19,000,000, because of overhead, to become net income or pre-tax profit. As noted in Table 4.5, net income or profit before taxes is 15.8 percent of net revenues.

Profitability is sensitive to overhead in that an increase in overhead goes directly to the “bottom line,” that is, pre-tax profit is decreased by the same amount.

4.7 The Multiplier

Multiplier, a common term in the consulting business, is one measure of a firm’s efficiency. Refer again to Table 4.5, which is a hypothetical year-to-date income statement for a consulting engineering firm. The multiplier (M), a dimensionless parameter, is defined as net revenues divided by the direct cost of labor used to produce the revenues. In other words, the hours of labor

that cost the firm 40,000,000 must generate total net revenues of 120,000,000 so that $M = 3.0$. Therefore, the multiplier is a factor that the salary chargeable to projects must be “marked up” to cover the raw salary itself, non-reimbursable, overhead, taxes, and profit.

Another way of viewing the situation is that the employer (the consulting firm) buys labor wholesale at the raw labor rate and sells it to clients, owners, and/or customers retail, at the marked up or multiplied rate. Consider a young engineer employed by the hypothetical consulting firm and receiving an annual salary of 6,000,000. The young engineer’s raw labor rate is 2,885 per hour—6,000,000 divided by 52 weeks and 40 hours per week. For each hour the young engineer works on a contract project, the client or owner will be billed at a charge-out rate determined by the product of the multiplier and the engineer’s hourly rate or $3.0 * 2,885 = 8654$.

4.8 Project Overruns: Implications for Profitability and Personnel

Budgets for planning, design, and other projects typically performed by consulting firms, for construction projects carried out by contractors, and for design and production projects performed by manufacturing organizations are usually prepared as part of the process of negotiation between the firm and the client, owner, or customer. The contract or agreement between the consulting firm, contractor, or manufacturer and the client, owner, or customer typically “locks in” a total fee. An exception to this is successful use of the formal change of scope provision usually included in the contract or agreement.

Consider what happens if the budget is exceeded. An examination of a typical annual income statement (e.g., Table 4.5) for a consulting engineering firm indicates that the net revenue will not increase as a result of the troubled project (unless a change of scope is negotiated with an additional fee). All expenses and labor costs incurred as a result of continued effort on the project may not be billed to the client and, therefore, will go into the company’s overhead, with the appropriate overhead factor applied to the raw labor costs. Increases in overhead as a result of the project will go directly to and subtract from the company’s bottom line.

Concluding Thoughts

You, as a student or young practitioner, should understand accounting basics. Accounting knowledge and skills will enable you to be a more effective employee. Those basics will also help you plan your personal financial future and you could draw on them if you establish your own business.