Business Management, Business Failures, and Problem Solving

Business Failures in the Construction Industry

Introduction

The project management team of the construction firm is faced with the never-ending task of making decisions which will have short- and long-range impact on the operations of the firm. Financially speaking, these decisions may impact one or more of the following:

- The revenue required to yield the desired return-on-investment by affecting either the price or quantity of *work done*
- The cost of completing a project by affecting the purchase and use of job resources (labor, material, equipment, subcontracts, etc.)
- The cost of operating the business by affecting the use of company resources (plant, personnel, cash, etc.)

The dollar equivalent to the use of these resources and the revenue they generate is summarized on an income statement. The bottom line of the income statement is *profit*. Thus, all personnel and especially project managers should have an understanding of what is an income statement, what information it contains, how profits are calculated, and how to use these statements to make good decisions.

An analysis of past income statements, and the preparation of a budgeted income statement for the coming year, will provide input data to answer the question, *What if*?

- What if we decrease price to obtain more work?
- What if we spend more time and money in planning?
- What if we hire another project manager to help with the overload?

Given a knowledge of the firm's cost structure as shown on the income statement, the project manager can forecast the impact these and other decisions may have on revenues, costs and, subsequently, profit. By applying cost-volume-profit analysis, the project manager can estimate the impact of a decision on profits. The project manager will then implement those *What ifs?* that will increase profits, and avoid those that don't!

What will you learn from this exercise?

Upon completion of the activities in this article, you should be able to:

1. Identify those factors which cause a company to fail or not generate required profit
2. Comprehend what is found on an income statement
3. Explain the difference between a variable and fixed cost
4. Classify a cost or expense as either variable or fixed
5. Estimate the cost structure of a firm as shown by the income statement
6. Apply cost-volume-profit analysis to note the impact of a change in operating policy on profit

The Case of RUSTY'S PLUMBING GOES DOWN THE DRAIN

Rusty's Plumbing started business on January 1, 20X1. Not including his time as an apprentice, Rusty had been a plumber for 12 years. He had the reputation of being a top hand. Rusty knew how to install plumbing materials in a quality fashion. The type of work that Rusty did was

repair work. He had a service truck which was equipped with common fittings for water supply and drain systems for residential and light commercial construction. With his 12 years of experience, he had a pretty good idea of the things he needed to have on hand. If he needed a part that he did not stock in his service truck, he would go to the local plumbing supply to purchase the part.

When Rusty first began his business, he ran it out of his home. Rusty did everything himself, including *keeping the books* which was simply a checkbook that listed checks as they were written and deposits as they were made. Rusty purchased all his materials from one supplier and paid for each item at the time of purchase. Most of the work was completed in a day or two. At the end of the job, Rusty would fill out an invoice and give it to the client who would in most instances pay at that time. Rusty would list his time on the job, and extend it times the hourly charge-out rate to determine labor cost. When Rusty had worked for another company, he had made $20.00 per hour. Now that he is self-employed, he has decided to charge $25.00 per hour to help pay for tools and gas for the truck. He then added another $5.00 per hour for profit which gave a charge-out rate of $30.00. He would list the materials used and price them based on his knowledge of what the going rate was for the material. Items purchased uniquely for the job and not taken from his stock in his service truck were listed at cost. Rusty kept track *in his head* of inventory in his truck as well as time spent on the job and materials used. This wasn't too hard to do because he basically worked on one job at a time.

Once a project was completed and the check was received, Rusty would deposit the check at the bank. Whenever Rusty needed to pay personal bills or needed cash for living expenses, Rusty would take money from this account.

At the end of the first year of operations, Rusty went to a tax accountant to prepare an income tax return. The accountant gave Rusty a form to fill out which listed all the financial data required to complete a tax return. At that time, Rusty asked the accountant to prepare an income statement so that he could see how profitable he was the first year. Rusty knew that he was profitable because his checking balance was a lot higher at the end of the year than at the beginning. (See Period Ending 20X1 in Table 1.1. Rusty's Plumbing Income Statements, Periods Ending 20X1 Through 20X5**.**)

Because of Rusty's good work and reasonable prices, his business grew. Time passed. Five years later, Rusty's Plumbing had grown from the small *one-horse* outfit to a firm which employs 25 people. Because of the workload, Rusty has hired craftspersons as well as management staff. Rusty no longer does the work himself but spends most of his time finding work to keep his people busy. In addition to repair work (he now owns 4 trucks), Rusty is doing new construction on residences and light commercial structures. Rusty has also branched into installing and servicing heating, ventilating, and air-conditioning (HVAC) systems.

Rusty is very interested in the estimating process for the new construction jobs. He has two full-time estimators--one for plumbing and one for HVAC. Rusty reviews all bids and places the final price on the bid before it is submitted to the general contractor. Rusty has learned that, unlike repair work which had short duration and was done *time and materials*, new construction takes longer to complete and must be competitively bid. Rusty competes against several other plumbing-heating-cooling contractors for the work that is available and feels his price must be low to obtain the job.

Though Rusty feels good about the amount of work he does (more than anybody in town), he does not like what he sees happening financially. Even though sales have increased dramatically, profit has not kept pace. An examination of Rusty's financial statements indicates that, though he is making money, each year's growth does not produce the profits that Rusty wants. In fact, Rusty feels that if a downturn occurs in the market, no profits will be earned, and there will be a shortage of cash to pay off the debt incurred in the growth years. (see Table.1)

Table.1.1

Rusty's Plumbing Income Statements, Periods Ending 20X1 Through 20X5

	20X1		20X2		20X3		20X4		20X5	
ACCOUNT	$	%	$	%	$	%	$	%	$	%
SALES	250,000	100	700,000	100	1,800,000	100	3,200,000	100	5,000,000	100
COST OF SALES										
LABOR*	0	0	140000	20	540000	30	1088000	34	1750000	35
MATERIALS	150,000	60	350,000	50	810000	45	1408000	44	2200000	44
EQUIPMENT**	0	0	21000	3	108000	6	192000	6	350000	7
SUBCONTRACTS***	0	0	0	0	36000	2	96000	3	200000	4
ODC****	0	0	7000	1	18000	1	28800	0.9	50000	1
TOTAL DIRECT COST	150,000	60	518,000	74	1,512,000	84	2,812,800	88	4,550,000	91
GROSS PROFIT	100,000	40	182,000	26	288,000	16	387,200	12	450,000	9
OPERATING EXPENSE										
ADVERTISING	0	0	1000	0.1	1000	0.1	2000	0.1	3000	0.1
AUTO AND TRUCK	5000	2	7600	1.1	10000	0.6	17000	0.5	26000	0.5
CONTRIBUTIONS	100	0	500	0.1	600	0	600	0	600	0
COMMUNICATIONS	600	0.2	1000	0.1	1200	0.1	1800	0.1	2800	0.1
DEPRECIATION	0	0	3000	0.4	3000	0.2	3000	0.1	3000	0.1
DUES & SUBSCRIPT	0	0	275	0	300	0	300	0	300	0
INSURANCE	1500	0.6	3500	0.5	7000	0.4	12000	0.4	18000	0.4
INTEREST	0	0	1500	0.2	4000	0.2	7500	0.2	10500	0.2
LEGAL/PROF.	300	0.1	575	0.1	625	0	675	0	700	0
MISCELLANEOUS	7000	2.8	8000	1.1	9500	0.5	9000	0.3	10000	0.2
OFFICE EXPENSE	500	0.2	1200	0.2	1500	0.1	2200	0.1	2400	0
PENSION/WELFARE	0	0	0	0	1000	0.1	2000	0.1	3000	0.1
RENT	0	0	2400	0.3	2400	0.1	2800	0.1	3200	0.1
REPAIRS	800	0.3	1500	0.2	2700	0.2	3400	0.1	3800	0.1
SALARIES	0	0	35000	5	45000	2.5	52000	1.6	65000	1.3
SHOP SUP/TOOL	500	0.2	2500	0.4	3500	0.2	4300	0.1	5600	0.1
TAXES - PAYROLL	0	0	14000	2	54000	3	108800	3.4	175000	3.5
TAXES - OTHER	0	0	0	0	700	0	1200	0	2700	0.1
TRAVEL/ENTERTAIN	0	0	700	0.1	1000	0.1	1500	0	2200	0
UTILITIES	1000	0.4	1400	0.2	1650	0.1	2200	0.1	2500	0.1
TOTAL OP. EXPENSE	17300	6.9	85650	12	150675	8.4	234275	7.3	340300	6.8
NET PROFIT	82,700	33	96,350	14	137,325	7.6	152,925	4.8	109,700	2.2
* IN 20X1 RUSTY'S LABOR WAS NOT LISTED AS HE WAS THE SOLE PROPRIETOR										
** IN 20X2 RUSTY PURCHASED A BACKHOE AND DUMPTRUCK FOR UTILITY WORK										
*** IN 20X3 RUSTY HAD TO SUBCONTRACT TO MEET SCHEDULE										
**** OTHER DIRECT COSTS INCLUDE PERMITS, BONDS, AND OTHER JOB OVERHEAD										

Identifying Failure Factors Activity

Try to list 4 potential causes for Rusty's poor profit performance. In a brief fashion, explain why each cause would impact profits. Use the case as a springboard to generate ideas, but don't limit your thinking to just the case. Use your experiences in the industry to create your list.

For example, Rusty feels good about the amount of work as indicated by sales volume that the company does. But the question arises, how was the increase in sales generated? Was it generated because Rusty provides a quality product or timely service, or because he was the low bidder? If it was because of low bid, is it possible that the bids were too low and, thus, profits declined?

Cause	Explanation
1.	
2	
3.	
4.	

Common elements of contractor failure

In the book, *A Contractor's Survival Guide*, by Thomas Schleifer, the author concludes that after ten years of examining distressed and failing construction firms, a finite number of causes are repeated as the reason for profit loss or failure. These 10 common elements include:

1. An increase in project size from that normally handled
2. Doing work in an unfamiliar geographic location
3. Taking on new types of work or moving between the public and private sectors
4. Losing key personnel in one of three primary areas of operation--estimating and sales (obtaining the work), construction operations (doing the work), and administration and accounting (managing the business)
5. Lack of managerial maturity in expanding operations--the qualities of a manager to *start a business* are not necessarily the same qualities required to *manage growth of the business*
6. Use of poor accounting systems which yield inadequate information for decision making
7. Failure to evaluate project profitability
8. Lack of equipment cost control
9. Poor billing and collection procedures which yield a negative cash flow
10. Transition to computerized accounting from a manual one causing contractors to lose control of their recordkeeping altogether

Do you suppose Rusty's Plumbing could be experiencing any one or more of these situations? Review the list above and compare it to the growth of Rusty's Plumbing over the last five years. Do you see potentials for problems?

Table 1.2

Causes of Construction Company Failure, 1988 Through 1993, from the Dun and Bradstreet Corporation

CAUSES	1988	1989	1990	1991	1992	1993
NEGLECT CAUSES	**2.50%**	**3.70%**	**3.30%**	**2.90%**	**3.90%**	**6.20%**
DISASTER CAUSES	**0.00%**	**1.20%**	**1.40%**	**2.10%**	**4.30%**	**4.90%**
FRAUD CAUSES	**1.10%**	**0.50%**	**0.60%**	**0.60%**	**1.20%**	**1.40%**
ECONOMIC FACTORS CAUSES	**62.50%**	**37.30%**	**46.10%**	**66.80%**	**70.20%**	**36.60%**
HIGH INTEREST RATES	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
INADEQUATE SALES	4.0%	2.3%	1.9%	1.9%	2.5%	2.2%
INDUSTRY WEAKNESS	12.3%	17.7%	21.8%	27.9%	23.7%	19.5%
INSUFFICIENT PROFITS	22.0%	15.9%	21.2%	36.6%	43.7%	14.6%
INVENTORY DIFFICULTIES	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
NOT COMPETITIVE	1.6%	0.9%	0.8%	0.0%	1.0%	0.3%
POOR GROWTH PROSPECTS	22.5%	0.4%	0.3%	0.4%	0.1%	0.0%
POOR LOCATION	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
EXPERIENCE CAUSES	**9.80%**	**17.80%**	**9.90%**	**1.30%**	**1.60%**	**0.50%**
LACK OF BUSINESS KNOWLEDGE	5.7%	12.0%	8.4%	0.0%	0.3%	0.0%
LACK OF LINE EXPERIENCE	1.2%	2.9%	0.8%	0.2%	0.2%	0.0%
LACK OF MANAGERIAL EXP.	2.9%	2.9%	0.7%	1.1%	0.2%	0.5%
FINANCE CAUSES	**22.40%**	**37.90%**	**37.30%**	**24.50%**	**18.80%**	**47.40%**
BURDENSOME DEBT	4.5%	5.9%	6.7%	10.6%	3.6%	0.3%
HEAVY OPERATING EXPENSES	9.2%	12.6%	9.8%	11.1%	13.4%	41.1%
INSUFFICIENT CAPITAL	8.7%	19.4%	20.8%	2.8%	1.8%	3.3%
STRATEGY CAUSES	**1.70%**	**1.60%**	**1.40%**	**1.70%**	**0.90%**	**3.00%**

The data from Table 1.2 serves as an *indication only* of possible problem areas on an industry-wide basis. Variations are due to the overall economic climate of the country as well as to the quality of data returned by failing businesses.

An analysis of the data, in general, indicates that the failure causes in the industry are economic and financial ones. Insufficient profits can be a result of insufficient sales (quantity of work done, or price received for work done), high job expenses (poorly managed construction operations) as compared to contract price, and high operating expenses (poorly managed business operations) as compared to total company sales.

With this in mind, it is imperative that the project manager know how profits are generated. A detailed understanding of the factors affecting profits will allow the project manager to not only focus his or her limited time on those areas, but also to make decisions which increase the opportunities for profits to occur.

The Income Statement

The *income statement* is a summary of a firm's financial operations for a given period of time. For Rusty's Plumbing, the *annual* income statements are presented in Table 1.1, but the income statements could be broken down *by month* or *by quarter* as well. The data reflects the revenues generated in that time period and the cost to generate those revenues. Profit is determined as follows:

Profit = Revenues - Expenses (Cost)

Recognizing revenues

Revenues represent the flow of cash into the business now or in the future depending on the way revenue is recognized. Revenues can be determined several ways and for various purposes such as for reporting taxable income, but the method selected for reporting the *true* summary of the firm's financial operations should apply the *revenue recognition principle* which states ***recognize revenue as it is earned*** as follows: When revenues are recognized when the sale is made, then the term *Sales* is used to indicate revenues on the income statement. When revenue is recognized based on the *percentage of completion* of the project, then the term *Earnings* is used to indicate revenues on the income statement. When revenue is recognized when the project is substantially complete, then the term *Contracts* is used to indicate revenues on the income statement. When revenue is recognized based on the cash received, then the phrase *Cash Receipts* is used to indicate revenues on the income statement. When revenue is recognized when the bill for work done is prepared, then the term *Billings* is used to indicate revenues on the income statement. These terms are summarized in Figure 1.1: The terms used for indicating revenues on the income statement.

Reporting the true summary of a firm's financial operations requires using a method which applies the revenue recognition principle which states RECOGNIZE REVENUE AS IT IS EARNED:	the term used to indicate revenues on the income statement IS
When revenues are recognized when the sale is made . . .	Sales
When revenue is recognized based on the percentage of completion of the project . . .	Earnings
When revenue is recognized when the project is substantially complete . . .	Contracts
When revenue is recognized based on the cash received . . .	Cash Receipts
When revenue is recognized when the bill for work done is prepared . . .	Billings

Figure 1.1: The terms used for indicating revenues on the income statement.

The *percentage of completion* method is the *best* method for construction contractors with projects that are long term in nature because this method attempts to determine the revenues earned in a given time period and the matching expenses. If the revenue recognition principle is violated when preparing the income statement, then its usefulness in forecasting and controlling cost, setting price, and managing cash flow is severely limited.

When Rusty first started business, all his projects were very short in duration. His accountant had him recognize revenue at the point of sale; thus, the term *Sales* was used to recognize revenue, as indicated in *Figure 1.1*

Calculating Gross Profit

The terms *Cost* and *Expenses* are used to account for the outflow of cash now or in the future. *Cost* is used to denote *project costs* on the income statement, while *Expense* is used to denote *company expenses*. Those costs and expenses which are shown on the income statement apply the *matching principle*; that is, **costs or expenses are matched to the revenues they generate**.

Project costs are caused by and are directly traceable to a specific construction project. These costs are matched to the revenues they generate; thus, the phrase *Cost of Sales* is used on Rusty's income statement. Typical project costs shown on the income statement include *Labor, Materials, Subcontracts, Equipment, and Other Direct Cost* (job overhead). Simply stated,

Labor Cost = Hours worked x Labor hourly cost

Material Cost = Quantity used x Price paid

Subcontracts Cost = Subcontract amount

Equipment Cost = Hours operated x Hourly rate

Other Direct Cost (Job Overhead) = Project duration (months) x Monthly cost

The summary of the Cost of Sales items is shown on the income statement as *Total Direct Cost.* The Cost of Sales items are the expenses that are *directly* traceable to a specific project.

The *Gross Profit* is found by subtracting the direct cost of construction from the revenues that the direct costs generate. Thus, for Rusty's Plumbing,

Gross Profit = Sales - Total Direct Cost

Calculating net profit

Company expenses are typically referred to as *Operating Expenses* on the income statement. Operating expenses are in most instances caused by the passing of time and do not reflect the cost needs of an individual project. Some examples from Rusty's income statement include Advertising, Contributions, Communications, Dues and Subscriptions, Salaries, etc.

Sometimes a cost is caused by several projects and cannot be separated among these projects in a timely and cost-effective fashion. This cost would be listed as an *operating expense* on the income statement rather than as a *cost of sales* item. An example from Rusty's income statement (see Table 1.1) would be Interest, if the Interest was used to fund work-in-progress on many short-duration projects.

Operating expenses are typically summarized on the income statement and referred to as *Total Operating Expense.* Then, *Net Profit* is found by subtracting total operating expense from gross profit. Simply stated,

Net Profit = Gross profit - Total Operating Expense

As stated before, the income statement is a summary of the firm's financial operations for a given period of time. An analysis of an income statement (or better still, a series of income statements over several periods of time) can yield valuable information to help the project manager make decisions that will increase the firm's profit-producing potential.

Cost-Volume-Profit Analysis: A decision-making tool

One simple, yet powerful, analysis technique used for making decisions is called *Cost-Volume-Profit Analysis*. The analysis technique relies on the fact that all costs or expenses can be classified as either a *variable cost* (or variable expense) or a *fixed cost* (or fixed expense).

Variable cost

A *variable cost* is a cost that has a direct relationship to revenue. As revenue increases, the cost increases. As revenue decreases, the cost decreases. In theory, this relationship is graphically represented in

Figure 1.2

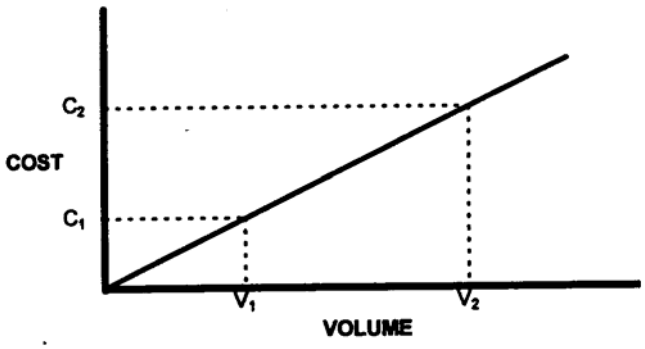

Figure 1.2. Variable cost graph.

Note in
Figure 1.2 that as volume increases (expressed as Sales on the Income Statement) from V_1 to V_2, variable costs increase from C_1 to C_2. The slope of the line represents the relationship of variable costs to Sales, and is expressed as a percent of Sales. For example, the Cost of Sales item called Labor on Rusty's income statement is a variable cost, because as Sales increases, so does Labor Cost. For 20X5, the relationship of Labor Cost to Sales is 36 percent. That is, for every dollar of Sales, there is 36 cents of Labor Cost on average.

Fixed cost

A *fixed cost* is a cost that does not change as volume changes. In theory, this relationship is graphically represented as follows in

Figure1.3.

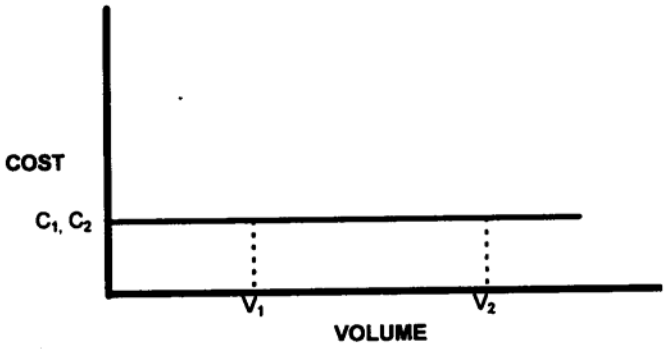

Figure1.3. Fixed cost graph.

Note in

Figure1.3 that as volume increases (expressed as Sales on the Income Statement) from V1 to V2, fixed costs remain constant at C1 to C2. For example, the operating expense item called Salaries is not related to Sales. If the Sales were $5,100,000 for 20X5 rather than $5,000,000, Salaries would remain fixed at $65,000.

(In reality, no fixed cost is truly fixed, and no variable cost will maintain the same relationship from year to year. This issue will be addressed later in this discussion.)

Classifying Costs Activity

Look over each cost or expense as listed on Rusty's Plumbing Income Statement in Table 1.1. Determine whether the cost or expense should be classified as a fixed cost or a variable cost. For example, the expense called *Miscellaneous* remains relatively constant from year to year, and, though *Miscellaneous* increases as revenues increase, the relationship between *Miscellaneous* and *Sales* is decreasing (20X1 = 2.8%, 20X2 = 1.1%, 20X3 = .5%, 20X4 = .3%, and 20X5 = .2%). Thus, the *Misc.* expense would be more appropriately classified as *fixed*.

ACCOUNT	FIXED (F)	VARIABLE (V)
COST OF SALES		
LABOR*		
MATERIALS		
EQUIPMENT**		
SUBCONTRACTS***		
ODC****		
OPERATING EXPENSE		
ADVERTISING		
AUTO AND TRUCK		
CONTRIBUTIONS		
COMMUNICATIONS		
DEPRECIATION		
DUES & SUBSCRIPT		
INSURANCE		
INTEREST		
LEGAL/PROF.		
MISCELLANEOUS		
OFFICE EXPENSE		
PENSION/WELFARE		
RENT		
REPAIRS		
SALARIES		
SHOP SUP/TOOL		
TAXES - PAYROLL		
TAXES - OTHER		
TRAVEL/ENTERTAIN		
UTILITIES		

Classifying Costs Activity (Continued)

Classifying Costs Activity (continued): Assume that Rusty classified his cost in the following fashion. Some accounts were hard to classify and seemed to be more semi-fixed than fixed, but he had to force the issue and either make it fixed or variable. This is not a problem, because the only costs that will be hard to classify are the operating expenses, which are a small percentage of total costs. Any inaccuracies in classification of operating expenses will have negligible impact on the outcome of the cost-volume-profit technique.

ACCOUNT	FIXED (F)	VARIABLE (V)
COST OF SALES		
LABOR*		variable
MATERIALS		variable
EQUIPMENT**		variable
SUBCONTRACTS***		variable
ODC****		variable
OPERATING EXPENSE		
ADVERTISING	fixed	
AUTO AND TRUCK		variable
CONTRIBUTIONS	fixed	
COMMUNICATIONS		variable
DEPRECIATION	fixed	
DUES & SUBSCRIPT	fixed	
INSURANCE		variable
INTEREST		variable
LEGAL/PROF.	fixed	
MISCELLANEOUS	fixed	
OFFICE EXPENSE	fixed	
PENSION/WELFARE		variable
RENT	fixed	
REPAIRS		variable
SALARIES	fixed	
SHOP SUP/TOOL		variable
TAXES - PAYROLL		variable
TAXES - OTHER		variable
TRAVEL/ENTERTAIN	fixed	
UTILITIES	fixed	

The income statements from Table 1.1 could be rearranged into the classifications as illustrated in Table 1.3.

Table 1.3
Rearrangement of Rusty's Plumbing Income Statements that Were Presented in Table 1.1

	20X1		20X2		20X3		20X4		20X5	
ACCOUNT	$	%	$	%	$	%	$	%	$	%
SALES	250,000	100	700,000	100	1,800,000	100	3,200,000	100	5,000,000	100
COST OF SALES										
LABOR*	0	0	140000	20	540000	30	1088000	34	1750000	35
MATERIALS	150,000	60	350,000	50	810000	45	1408000	44	2200000	44
EQUIPMENT**	0	0	21000	3	108000	6	192000	6	350000	7
SUBCONTRACTS***	0	0	0	0	36000	2	96000	3	200000	4
ODC****	0	0	7000	1	18000	1	28800	0.9	50000	1
TOTAL DIRECT COST	150,000	60	518,000	74	1,512,000	84	2,812,800	88	4,550,000	91
GROSS PROFIT	100,000	40	182,000	26	288,000	16	387,200	12	450,000	9
OPERATING EXPENSE										
VARIABLE										
AUTO AND TRUCK	5000	2	7600	1.1	10000	0.6	17000	0.5	26000	0.5
COMMUNICATIONS	600	0.2	1000	0.1	1200	0.1	1800	0.1	2800	0.1
INSURANCE	1500	0.6	3500	0.5	7000	0.4	12000	0.4	18000	0.4
INTEREST	0	0	1500	0.2	4000	0.2	7500	0.2	10500	0.2
PENSION/WELFARE	0	0	0	0	1000	0.1	2000	0.1	3000	0.1
REPAIRS	800	0.3	1500	0.2	2700	0.2	3400	0.1	3800	0.1
SHOP SUP/TOOL	500	0.2	2500	0.4	3500	0.2	4300	0.1	5600	0.1
TAXES - PAYROLL	0	0	14000	2	54000	3	108800	3.4	175000	3.5
TAXES - OTHER	0	0	0	0	700	0	1200	0	2700	0.1
TOTAL VARIABLE	8400	3.4	31600	4.5	84100	4.7	158000	4.9	247400	4.9
FIXED										
ADVERTISING	0	0	1000	0.1	1000	0.1	2000	0.1	3000	0.1
CONTRIBUTIONS	100	0	500	0.1	600	0	600	0	600	0
DEPRECIATION	0	0	3000	0.4	3000	0.2	3000	0.1	3000	0.1
DUES & SUBSCRIPT	0	0	275	0	300	0	300	0	300	0
LEGAL/PROF.	300	0.1	575	0.1	625	0	675	0	700	0
MISCELLANEOUS	7000	2.8	8000	1.1	9500	0.5	9000	0.3	10000	0.2
OFFICE EXPENSE	500	0.2	1200	0.2	1500	0.1	2200	0.1	2400	0
RENT	0	0	2400	0.3	2400	0.1	2800	0.1	3200	0.1
SALARIES	0	0	35000	5	45000	2.5	52000	1.6	65000	1.3
TRAVEL/ENTERTAIN	0	0	700	0.1	1000	0.1	1500	0	2200	0
UTILITIES	1000	0.4	1400	0.2	1650	0.1	2200	0.1	2500	0.1
TOTAL FIXED	8900	3.6	54050	7.7	66575	3.7	76275	2.4	92900	1.9
TOTAL OP. EXPENSE	17300	6.9	85650	12	150675	8.4	234275	7.3	340300	6.8
NET PROFIT	82,700	33	96,350	14	137,325	7.6	152,925	4.8	109,700	2.2
* IN 20X1 RUSTY'S LABOR WAS NOT LISTED AS HE WAS THE SOLE PROPRIETOR										
** IN 20X2 RUSTY PURCHASED A BACKHOE AND DUMPTRUCK FOR UTILITY WORK										
*** IN 20X3 RUSTY HAD TO SUBCONTRACT TO MEET SCHEDULE										
**** OTHER DIRECT COSTS INCLUDE PERMITS, BONDS, AND OTHER JOB OVERHEAD										

An examination of the reorganized statement indicates that Direct Cost accounts are variable as well as are some of the operating expenses, while other operating expenses are fixed. But, an examination of the 5 years' income statements for Rusty reveals that no cost is truly fixed nor is a cost likely to maintain the same relationship to Sales year after year. Thus, a variable cost will maintain a constant relationship with

Sales, and a fixed cost will remain a constant dollar amount only within a given range of sales volumes, and only within one year. This range is known as the Relevant Range, that is, the range of sales volume where the firm's cost structure remains constant. The cost structure is defined as the total fixed cost in dollars, and the relationship of variable costs to sales as a percentage. Thus, for Rusty's Plumbing for 20X5, the cost structure is defined as follows:

Fixed Cost	= $92,900
Variable Cost(%)	= Total Direct Cost(%) + Variable Expenses(%)
	= 91% + 4.9%
	= 95.9%

Comparing revenue and costs

Once a representative cost structure for a firm's current operations is determined, a profit for a given sales volume can be determined for that cost structure. A graphical representation follows in *Figure 1.4*.

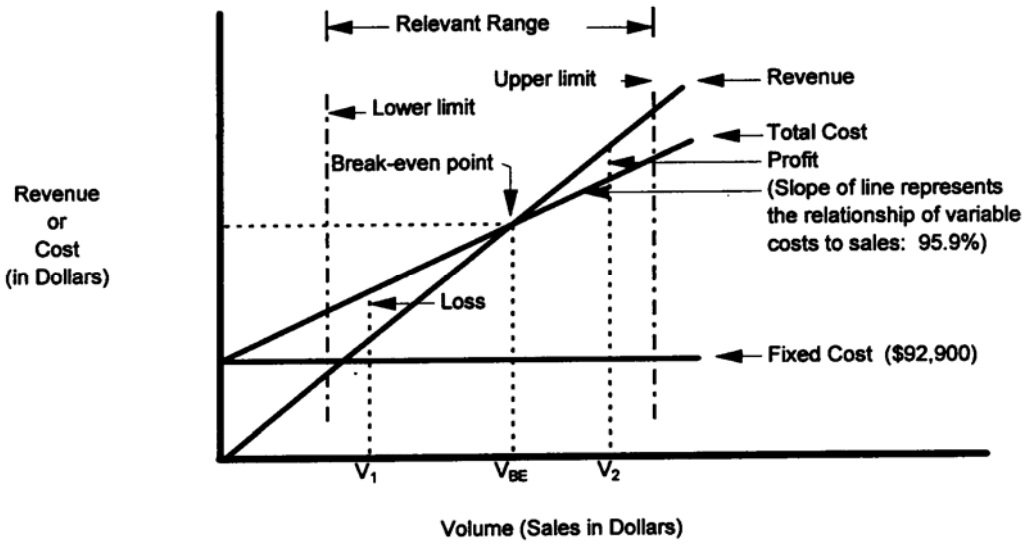

Figure 1.4. C-V-P Graph.

Note that the graph in *Figure 1.4* indicates that fixed costs are $92,900 and that the slope of the total cost line is the relationship of variable costs to Sales or 95.9 percent. That is, for every dollar's worth of Sales that Rusty's Plumbing performs, 95.9 cents covers total variable costs: 91 cents covers job costs, and 4.9 cents covers variable company expenses. Note that a revenue line is laid over the total cost line. If volume on the X-axis is represented as Sales in dollars, and if revenue on the y-axis is represented in dollars, then the slope of this line is 45 degrees: for every dollar's worth of sales, there is a dollar's worth of revenue.

An interesting point on the graph in *Figure 1.4* is where the revenue line and the total cost line intersect. At this point, there is neither profit nor loss. The firm breaks even. That is why the point of intersection (V_{BE}) is referred to as the break-even point and the graph is typically referred to as a break-even graph. From the break-even point, one can drop a line vertically to the x-axis to determine the break-even sales volume. Any sales volume above this point (V_2) will return a profit, and any sales volume below this point (V_1) will return a loss.

Note that no cost is truly fixed, and that the variable cost relationship will change as well. Thus, the two vertical dashed lines represent (1) the lower limit and (2) the upper limit of sales volumes where the cost structure remains constant. The distance between these two lines is the *relevant range.* Unfortunately, these limits cannot be calculated because in practice they depend on management decision. For example, in the case of Rusty's Plumbing, Salaries is a fixed cost.

As the firm does more work, Rusty decided that he needed more help in estimating. When he hired the two estimators, he changed the firm's cost structure by increasing salaries, and thus increased fixed costs.

Calculating sales volume

Rather than graph the break-even volume and volumes at required profit levels, one can mathematically compute these volumes. An examination and abbreviation of the 20X5 statement reveals the following:

Sales	$ 5,000,000	
Variable Cost	4,797,400	95.9%
Fixed Cost	92,900	
Net Profit	109,700	

If one were to find the break-even sales volume, let Sales equal 'X' and Net Profit = '0'. Thus, the break-even sales volume for the cost structure as defined by the 20X5 income statement would be solved as follows:

Sales	X
Variable Cost	9599
Fixed Cost	92,900
Net Profit	0

or,

$X - .9599 - 92{,}900 = 0$
$X(1 - .959) = 92{,}900$
$X = 92{,}900/(1 - .959)$
$X = 2{,}265{,}854$

Note that a generic formula can be derived from the third step in the calculation above:

$$\text{Sales Volume}_{\text{Breakeven}} = \text{Fixed Cost}/(1 - \text{Total Variable Cost})$$

when Total Variable Cost is expressed as a percent of Sales

Similarly, a formula can be derived when the profit goal before tax is a specific amount. The amount is fixed; thus, this goal is like a fixed cost.

$$\text{Sales Volume}_{\text{Breakeven}} = [\text{Fixed Cost} + \text{Net Profit (bt)}]/(1 - \text{Total Variable Cost})$$

when Total Variable Cost is expressed as a percent of Sales

And, when the profit goal is expressed as a percent of Sales, the amount is variable; thus, this goal is like a variable cost:

$$\text{Sales Volume}_{\text{Breakeven}} = \text{Fixed Cost}/[1 - (\text{Total Variable Cost} + \text{Net Profit})]$$

when Total Variable Cost and Net Profit (bt) are expressed as a percent of Sales

Calculating Sales Volume Activity

Solve the following problems by applying your knowledge of fixed and variable costs and the equations on the previous page. Refer to the reorganized income statements in Table 1.3 which were rearranged to separate fixed and variable cost.

1. Calculate the Sales volume required for 20X5 if profit goal is $ 200,000.

2. Calculate the Sales volume required for 20X5 if profit goal is 5 percent of Sales. (Is something unusual?)

3. Determine the cost structure for 20X4 for Rusty's Plumbing.

4. Calculate the break-even Sales volume for 20X4.

5. Calculate the Sales volume required for 20X4 if profit goal is $ 200,000.

6. Calculate the Sales volume required for 20X4 if profit goal is 5 percent.

7. Compare answers to questions #1 and #5. Why do the differing *sales volumes required* yield the same profit?

Decision making with Cost-Volume-Analysis

In the second year of business, Rusty's Sales almost tripled from the first year - $250,000 to $700,000. Yet, profits only increased a modest 17 percent. In 20X1, the profit was $82,700, and in 20X2, the profit was $96,350. He felt that the profit for 20X2 should have been around $200,000.

Rusty decided that profits were not keeping up with sales because of higher costs. In the first year, Rusty did everything himself. In the second year, he had to hire help to do the work, purchased equipment, and required more operating expenses to get the work done. He figured that the best way to offset these cost increases was to increase the quantity of work that the company did. He reasoned, *If I want to do more work, I should lower my price to become more competitive. By doing more work, I should make more money!*

So, for 20X3, Rusty decided to lower all his bids by 10 percent. Let's see if this was reasonable, and at the same time, demonstrate how cost-volume-profit analysis can prevent poor decisions from being implemented.

The cost structure for Rusty's Plumbing for 20X2 is as follows:

Fixed Cost = $ 54,050

Variable Cost = 74% + 4.5% = 78.5%

If Rusty lowers price by 10 percent for the coming year, what impact will this policy decision have on the existing cost structure? If,

Sales = Quantity of work done X price

and,

Total Variable Cost (%) = [Total Variable Cost($)/Sales($)] X 100%

then as price is decreased, the total variable cost to sales relationship increases and can be estimated for the coming year as follows:

Total Var. Cost (%) = [549,600/(700,000 X .90)] X 100% = 87.2%

where the Sales volume has been adjusted for a 10-percent decrease in price.

The first question that arises is, *How much more work (more competitive) must Rusty perform in order to yield the same profit as before the price decrease?*

Sales = [Fixed Cost($) + Net Profit($)]/{1 - [Total Var. Cost(dec.)]}

Sales = ($54,050 + 96,350)/(1 - .872)

Sales = $1,175,000

The work quantity change can be estimated by

Quantity Change = [Sales after price change/Sales before price change adjusted for price change -1] x 100%

Quantity Change = [$1,175,000/($700,000 X .90) - 1] X 100%

Qty Change = 86.5%

One would interpret the calculations as follows. If Rusty lowers price by 10 percent, quantity of work must increase by 86.5 percent to offset the effect of the price change.

But, the reason Rusty lowered his price at the end of 20X2 was to increase work and thereby increase profits to $200,000. Thus, the second question arises, *How much more work must Rusty perform in 20X2 to yield $200,000 profit at the lower price?* This figure can easily be calculated as follows:

Sales = [Fixed Cost($) + Net Profit($)]/{1 - [Total Variable Cost(dec.)]}

Sales = ($54,050 + 200,000)/(1 - .872)

Sales = $1,984,765

And, the increase in work quantity required is estimated by

Qty Change = [Sales after price change/Sales before price change adjusted for price change -1] x 100%

Qty Change = [$1,984,765/($700,000 X .90) - 1] X 100%

Qty Change = 215%

What does this mean? Rusty would have to increase his work quantity by 215 percent if he lowered his price by 10 percent to yield a $200,000 profit. Is this reasonable?

Apparently not! An examination of the 20X3 statement yields some startling information. Yes, the lower price allowed Rusty to become more competitive and to perform more work. However, it did not make him that much more competitive to increase his volume by 215 percent. In addition, Rusty didn't realize that the dramatic growth made him lose control of the cost side of his business. Workers were not as productive because they had to wait on materials, tools, and instructions, and Rusty had to spend more operating expense dollars to gain the additional workload.

At what point could Rusty have circumvented this downward trend? At the end of year two, Rusty could have used cost-volume-profit analysis to obtain an indication that:

A 10-percent decrease in price requires a 215-percent increase in quantity to yield the desired profit.

The additional workload will require more operating expense to support it.

The additional work will be installed less efficiently because overhead support was not planned for and so will be inadequate.

If Rusty had been aware of the facts (presented above) before he had made the price change, he probably would not have changed the price. But Rusty is like the typical contractor who got an idea, implemented it, and then waited for the impact on actual profits to see if the idea worked. Rusty saw in 20X3 that his profits went up quite a bit, but not to $200,000, and reasoned that he should lower his price even more. Basically, he jumped out of the frying pan into the fire! By lowering price, the relationship between variable costs and sales became so small (95.9 percent in 20X5) that returning a $200,000 profit became even less likely. The sales volume required to yield $200,000 profit for the 20X5 cost structure is:

Sales = [Fixed Cost($) + Net Profit($)]/{1 - [Total Variable Cost(dec.)]}

Sales = ($92,900 + 200,000)/(1 - .959)

Sales = $7,143,902

And, the increase in work quantity required as compared to 20X2 is

Qty Change = [Sales after price change/Sales before price change adjusted for price change -1] x 100%

Qty Change = [$7,143,902/($700,000 X .90) - 1] X 100%

Qty Change = 1034%

In closing this discussion of the *Cost-Volume-Profit Analysis: A decision-making technique* of the *Business Failures in the Construction Industry* section, we have learned that the cost-volume-profit *analysis technique* is a simple, yet powerful, predictive tool *to gauge* the impact of business decisions on profits, and *to gauge* the required sales volume to earn those profits. All business decisions will impact the cost structure which drives this analysis technique. Thus, it is the management team's responsibility to estimate the impact a specific policy or decision will have on the cost structure, and through cost-volume-profit analysis, to determine whether this decision is viable.

Summary

The case of *Rusty Goes Down the Drain* is typical of the construction industry. Growth is spurred by lowering price. The contractor trades on price to obtain work. Yet, because the contractor is price sensitive (small changes in price require large changes in quantity to offset the price change), the contractor can never stimulate enough sales to yield the required profit.

So, what could Rusty have changed in order to increase profit? Instead of trading on price, Rusty could have traded on benefits as perceived by the customer. Some of these benefits include but are not limited to:

Timeliness of delivery of service
Quality of service
Courtesy to customers
Quality of work completed
Production efficiency

It is important to note that the way to generate profit is not by doing more work at a lower price, rather it is by lowering costs.

By now you are probably wondering whether you are in a project management program or a company management program. It is a fact that coming from the fields of architecture, engineering, and trades, many project managers have not had the opportunity to see the overall financial picture of the contracting business nor understand how profits are generated. Yet, project managers are on the front line of cost control for their companies and thereby directly impact the company's financial health. Your understanding of the income statement will help you to determine which costs need the most control. Your ability to analyze the impact of decisions on profit will keep you from implementing poor practices on your jobs. From your study of this module, you realize that lowering price to obtain more work is dangerous. But, you say, as a project manager, *I don't bid work*. That may be true, but you do *price* change orders! You must realize that if extra work is performed and isn't identified, quantified, and payment received for it, it is the same as lowering the price of the project. Lowering price requires a large increase in volume to offset the price decrease.

Analysis Activity

At the end of 20X5, Rusty meets with his key management and production personnel to generate ideas on how the company can stay afloat and return a decent profit. Recall that for 20X5 Sales were $5,000,000; total direct costs were $4,550,000; variable operating expenses were $247,400; and fixed operating expenses were $92,900 which combined to yield a profit of $109,700.

Several people at the meeting had an opinion on how the firm could become profitable. For each opinion listed below, use cost-volume-profit analysis to determine whether the opinion is a good one or not! Assume that Rusty would be happy with a profit of $200,000.

Rusty's Opinion: Get rid of unnecessary fixed costs which would include Contributions, Dues and Subscriptions, Miscellaneous, and Travel and Entertainment. In addition, put a cap on salaries. To obtain more work, reduce price by 1%.

	20X5 Actual	%	Req'd after changes	%
Sales	$5,000,000	100.0	$9,025,807	100.0
Tot Var Cost	4,797,400	.959		.969
Fixed Cost	92,900		79,800	
Net Profit (bt)	$109,700		$200,000	
Marginal Ratio	.041		.031	
Qty Change			82%	

Thus, the quantity of work done must increase by 82% to offset the 1% price decrease even though fixed costs were reduced by 14%!

Explanation:

Get rid of contributions ($600), dues and subscriptions ($300), miscellaneous ($10,000) and travel and entertainment ($2200). Total decrease in fixed cost is $13,100. New total is $92,900 - $13,100 = $79,800.

Decrease in price increases relationship of variable cost to Sales. Quantity x Price = Sales. Thus, $5,000,000 x .99 = $4,950,000. New relationship of variable cost to sales is $4,797,400/$4,950,000 = .969. Marginal ratio is 1-.969 = .031

Sales required after change is ($79,800 + $200,000)/.031 = $9,025,807.

Change in quantity is {[9,025,807/(5,000,000 x .99)] - 1} x 100% = 82%.

Dan's Opinion (An Estimator): Increase price by 5% on all bids. The few times a bid comparison was done with other contractors, Rusty's Plumbing was appreciably lower.

	20X5 Actual	%	Req'd after change	%
Sales	$5,000,000	100.0	$3,405,814	100.0
Tot Var Cost	4,797,400	.959		.914
Fixed Cost	92,900		92,900	
Net Profit (bt)	$109,700		$200,000	
Marginal Ratio	.041		.086	
Qty Change			-35%	

Thus, a 5% increase in price allows a 35% decrease in quantity to yield the required profit. If the price increase loses more than 35% of the work to the competition, then the $200,000 profit goal will not be attained.

Explanation:

Increase in price decreases relationship of variable cost to Sales. Quantity x Price = Sales. Thus, $5,000,000 x 1.05 = $5,250,000. New relationship of variable cost to sales is $4,797,400/$5,250,000 = .914. Marginal ratio is 1-.914 = .086

Sales required after change is ($92,900 + $200,000)/.086 = $3,405,814.

Change in quantity is {[3,405,814/(5,000,000 x 1.05)] - 1} x 100% = -35%.

Joe's Opinion (A Plumber**):** Joe couldn't quantify his ideas but he said, *If you office guys would get your act together and get me information, materials, tools, and equipment so I could work without stopping all the time, maybe we could save some money*. After some thought the team said, *What if we hire two assistant project managers to help us plan the jobs and make sure materials are available when needed. This would improve productivity and lower construction costs. Suppose we pay each new hire a salary of $30,000 and give the other two salaried people (the estimators) a raise to keep them happy. Total additional cost to the company would be about $100,000*. Suppose the planning saves 5% on job costs.

	20X5 Actual	%	Req'd after changes	%
Sales	$5,000,000	100.0	$4,568,605	100.0
Tot Var Cost	4,797,400	.959		.914
Fixed Cost	92,900		192,900	
Net Profit (bt)	$109,700		$200,000	
Marginal Ratio	.041		.086	
Qty Change			-8.6%	

If the additional cost to plan the jobs and control material flow does decrease job costs by 5% through an increase in production and a decrease in material cost due to loss, waste, damage, and theft, then the $200,000 profit goal can be realized - even by performing 8.6% less work!

Explanation:

Increase in fixed cost is $92,900 + $100,000 = $192,900.

Savings in job cost is 5% or 95% of existing job costs. Thus, .95 x $4,797,400 = $4,322,500. Add the variable overhead which is unchanged to the lower job cost is $247,400 + $4,322,500 = $4,569,900. The new variable cost to sales relationship is $4,569,900/$5,000,000 = .914.

Sales required after change is ($192,900 + $200,000)/.086 = $4,568,605.

Change in quantity is [(4,568,605/5,000,000) - 1] x 100% = -8.6%.