Accounting Textbooks   Accounting

2018

Managerial Accounting (2nd edition)

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Recommended Citation

Managerial Accounting (2nd Edition)

By

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by the author of INTRODUCTION TO FINANCIAL ACCOUNTING (2nd Edition)

ABOUT THE AUTHOR

A.J. Cataldo has worked in public accounting, internal and government auditing (California Auditor General), chief financial officer/controller, and provided expert testimony in business litigation engagements involving GM, Ford, Chrysler, Toyota, Nissan and other automobile manufacturers, testifying in Nevada, California, Texas, and Arizona. His 8 books include 3 Elsevier Science, scholarly monographs, and some of his 200+ articles have appeared in *Journal of Accountancy, National Tax Journal, Research in Accounting Regulation, Journal of Forensic Accounting, Accounting Historians Journal*, and *Seeking Alpha*. The *Securities and Exchange Commission* has filed some of these publications in Court Proceedings. A very recent publication (2015) won a *Best Paper* award at a conference (2014). He has served as an external reviewer for promotion and tenure and/or dissertation candidates, both domestically and internationally (e.g., U.S., Malaysia and Australia). He continues to serve on editorial review boards for IMA association journals (and others) for 25+ years, the former, including *Management Accounting, Strategic Finance*, and *Management Accounting Quarterly,* (1990-) and the *ATA Journal of Legal Tax Research* (2010-). Presently, he teaches financial accounting, at all levels and cost accounting at the MBA level. Previously, he taught managerial and cost accounting, at all levels.

Additional information and other publications are available on **_LinkedIn_**, **_Google Scholar_**, **_Seeking Alpha_**, and **THE CANNABIS REPORT** for **_IHUB_**. Professor Cataldo is also the author of **_Introduction to Financial Accounting (2nd Edition)_** and **_Marijuana Stocks_**.

PREFACE

This text covers the material required in an <u>introductory managerial accounting</u> course and compliments my text on <u>introductory financial accounting</u>. Both are texts and courses required for all business degree undergraduates. My objective is to make this material available to students at a very low cost.

I should note that I have, also, included some appendices introducing intermediate or advanced managerial or cost accounting topics.

NOTE: If your instructor has old power points, test banks and homework problems and solutions from out of print texts, you might consider persuading him or her to develop their own, generic and reusable variations to reduce to cost of texts to you and your student peers. In both the case of <u>introductory financial accounting</u> and <u>introductory managerial accounting</u>, there have been no innovations for a few decades, so older, out-of-print editions work very nicely. Alternatively stated, these texts have a very, very long shelf life.

Your instructor cannot, of course, accept a free desk copy of a current, alternative text, and use it without adopting that text. This would represent theft, and involve interfering with the revenues associated with the publisher's intellectual property and current edition(s). This would be unfair to the publisher(s).

TABLE OF CONTENTS

A Review of Basic Financial Accounting Concepts & Introduction to Managerial Accounting

Learning Objectives
- Review the basic mechanics of debits and credits for all balance sheet and income statement classifications.
- Review (or introduce) the concept of materiality or significance and cost-benefit as it relates to the level of "accuracy" desired or reflected in financial statements.
- Review of the basic financial statements used in this course, including the basic cost of goods sold framework and the reconciliation of gross purchases to net purchases.
- Review the basic depreciation techniques and the non-cash nature of the journal entry required to record depreciation expense.
- Review the basic cost flow assumptions and/or inventory techniques.
- Review (or introduce) and distinguish between the CPA and CMA credentials.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

	External Use	Internal Use	
	IRS/GAAP	Contribution Approach	
	Absorption Costing	Direct Costing	Only
	Full Costing	Variable Costing	Product Cost

Type of Product Cost	Product Costs	Per Unit		Total		Total	Per Unit	Listed
		SP	+	SP	+	SP	SP	DM
		CGS	-	CGS	-	VC	VC	DL
Prime — DM		GM	=	GM	=	CM	CM	OH (VC)
Conversion — DL				OPER	-	FC		OH (FC)
OH				NOI	=	NOI		

Typically covered in a single chapter

NOI will be **equal** if
[1] no BI & [2] no EI

Only Non-Product Cost Listed
OPER (VC)
OPER (FC)

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

Generally, managerial or cost accounting or cost management courses and texts presume that the student has already completed introductory coursework in financial accounting. However, some of the most frequently applied financial accounting course concepts and mechanics warrant review. Therefore, this introductory chapter in managerial (or management) accounting includes a very brief review of some of the most relevant components of an introductory financial accounting course.

A Review of the Basic Mechanics of Debits and Credits

The following is a T-account review of the basic mechanics of debits (DR) and credits (CR) from your introductory financial accounting course:
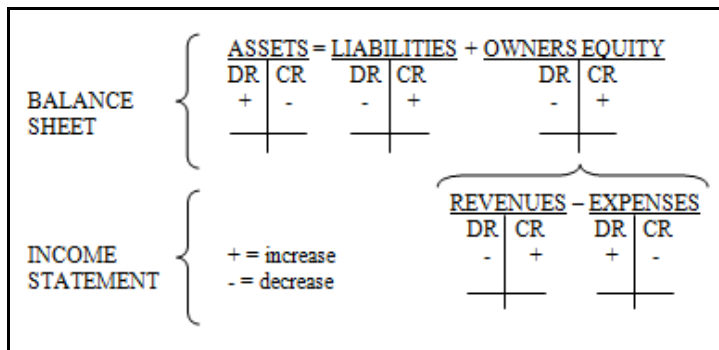
This course makes extensive use of raw materials (RM), work in process (WIP) and finished goods (FG) inventory accounts. Recall that inventory is a current asset.

Some accruals are also used in this course, including trade accounts payable (AP), salaries payable and wages payable (SP and WP, respectively) and, to a lesser extent, trade accounts receivable (AR). Recall that all payables are liabilities (L) and all receivables are assets (A).

A Review of the Concept of Materiality (Significance) and Cost-Benefit

Financial statements could be prepared with a very high degree of accuracy or precision. However, these high degrees of accuracy are achieved at great cost (e.g., additional accounting staff). For this reason, financial statements and financial information is developed within a framework of cost-benefit and/or with the objective of preparing financial statements free from material or significant error. An example follows:

Assume that a large corporation has revenues of $10,045,357,538.49. Would an investor, potential investor, potential bond holder or other stake holder care if this amount was simply reported as $10,000,000,000? In fact, what if this amount was rounded and reported as $10,000,000 (in thousands)? These reporting alternatives are presented, below:

Alternative #1	$10,045,357,538	
Alternative #2	$10,000,000,000	
Alternative #3	$ 10,000,000	(in thousands)

Alternative #3 is the preferred method of presentation to external users of financial statements and financial information as it reflects the materiality or significance associated with this revenue measure and does not produce financial statement noise or clutter (e.g., pennies) that may represent a distraction to the users of this financial information. The detailed information is maintained by the organization for internal purposes.

Assume that this same corporation has determined that the cost of producing one unit of a finished good is $1,056.93. This measure was developed by a team of five cost accounting staff members.

What if hiring two additional cost accounting staff members, at an additional cost of $80,000 (each), per year, might achieve greater precision, and lead to the development of a more precise cost of $1,057.07 per unit. These alternatives are summarized, below:

Less precise cost per unit	$1,056.93	Existing staff accountants
More precise cost per unit	$1,057.07	Requires 2 additional staff accountants

Generally, the difference between alternatives is immaterial, insignificant, and the cost of achieving the more precise cost per unit measure would exceed the benefit. Hiring two additional cost accountants would not represent a cost-beneficial decision.

A Review of Basic Financial Statements
Recall that the balance sheet (BS) reflects the *financial position* for a firm at a <u>point</u> in time and the income statement (IS) and statement of cash flows (CFs) summarize the *results of operations* for a <u>period</u> of time and the *sources and uses of cash* for a <u>period</u> of time, respectively, as follows:

IS & CFs

Beginning BS ←————————————————→ Ending BS
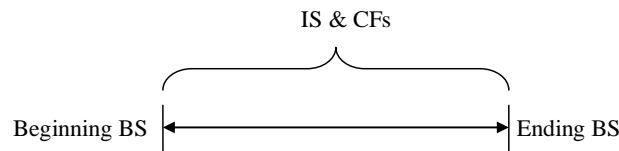
A Review of the Basic Cost of Goods Sold Framework
Your introductory financial accounting course spent time familiarizing you with revenues (R) or sales (S) and cost of goods sold (CGS or COGS). This managerial accounting course <u>does</u> <u>not</u> focus on contra revenue (i.e., sales returns, discounts or allowances) or contra expense (i.e., purchase returns, discounts or allowances) accounts, but <u>does</u> focus, frequently, on the basics of cost of goods sold framework, so a review of relevant contra accounts is provided below:

	Gross Sales (or Revenues)	Gross Purchases
less:	Sales Returns	Purchase Returns
less:	Sales Discounts	Purchase Discounts
less:	Sales Allowances	Purchase Allowances
add:		Freight In
equals:	Net Sales	Net Purchases

	Beginning inventory	$xx
add:	Purchases	xx
equals:	Available	$xx
less:	Ending inventory	xx
equals:	CGS	$xx

You should be very comfortable with the basic schedule of cost of goods sold and the cost of goods sold formula, which you will use, repeatedly, throughout this text and course.

A Review of the Basic Journal Entry and Selected Depreciation Techniques
Recall that depreciation is a non-cash charge (or expense) and credits a contra asset account – accumulated depreciation (AD), as follows:

Depreciation expense	$xx	
Accumulated depreciation (AD)		$xx

This becomes clear when recalling the basic journal entry (JE) for depreciation expense, where no cash is involved (see above). This will be important when reading the text's coverage of forecasting or cash budgeting, the statement of cash flows, and capital budgeting.

Also recall two of the basic techniques used for depreciation, as follows:

- Straight-line (SL), where salvage value is removed before depreciating the asset, and
- Double-declining balance (DDB), also known as 200% declining balance, where salvage value is <u>not</u> removed before depreciating the asset, but recall that this depreciation technique changes to SL, mid-way through the life of the asset. It is at that point when the asset's depreciable base is reduced by salvage value, before proceeding to depreciate the asset using the straight-line depreciation technique.

A review of this material will be very helpful when covering capital budgeting.

Assume that a long-lived asset has a cost of $10,000, a useful life of 5 years, and an estimated salvage value of $1,000, as follows:

	Cost	$10,000
less:	Salvage	$1,000
equals:	Depreciable Base	$9,000

The following table summarizes and provides a review of depreciation expense under the straight-line, sum-of-the-years' digits (SYD) and double-declining balance (DDB) methods, for financial accounting purposes and MACRS for tax accounting purposes:

Period	SL	SYD	DDB	MACRS
1	$1,800	$3,000	$4,000	$2,000
2	$1,800	$2,400	$2,400	$3,200
3	$1,800	$1,800	$867	$1,920
4	$1,800	$1,200	$867	$1,152
5	$1,800	$600	$866	$1,152
6	$-0-	$-0-	$-0-	$576
Total	$9,000	$9,000	$9,000	$10,000

A Review of Basic Cost Flow Assumptions and Inventory Techniques
Recall that there are 3 basic inventory techniques or cost flow assumptions:

(1) first-in, first-out (FIFO),
(2) weighted-average (WAVG), and
(3) last-in, first-out (LIFO).

A fourth basic technique might include *specific identification*, which may or may not be included in all introductory financial accounting texts or course coverage, but would be most likely applied for very costly items (e.g., real property or housing or automobiles).

For the below example, 5 units were in beginning inventory (BI) and 5 units were purchased during the period or month. Similarly, 5 units were sold and 5 units remained in ending inventory (EI). This was an inflationary period, so the 5 units in beginning inventory cost only $1.10 and the later 5 units were purchased during the period at a cost of $1.20 per unit, as follows:

		Units	Unit Cost	FIFO	WAVG	LIFO
	BI	5	$1.10	$5.50	$5.50	$5.50
add:	Purchases	5	$1.20	$6.00	$6.00	$6.00
equals:	Available	10		$11.50	$11.50	$11.50
less:	EI	5		$6.00	$5.75	$5.50
equals:	CGS	5		$5.50	$5.75	$6.00

The table, above, illustrates the difference between the 3 cost flow assumptions, but only for a first period or initial year for a firm, for simplicity and review. The important point is to note that, for a first period application, there is no difference between these 3 cost flow assumptions for beginning inventory, purchases or units available.

Effectively, these cost flow assumptions result in differences in allocations to the balance sheet for ending inventory and to the income statement for cost of goods sold. There is, however, a difference in the ending balance sheet and the income statement for the period, where the "available" unit costs are allocated between these financial statements.

Managerial and Cost Accounting

Managerial accounting and *management accounting* are synonymous terms. Managerial accounting is defined as a process to identify, accumulate, measure, and analyze costs for the preparation, interpretation and communication in a form usable by management in order to plan, evaluate and control the organization. *Cost accounting* is more narrowly focused, and typically associated with the processes used to determine the unit cost for a particular product.

Both managerial accounting and cost accounting are associated with the development of useful information for <u>internal</u> decision-making, whereas *financial accounting* focuses on information likely to be useful to <u>external</u> users.

Public and Management Accounting

Public accounting is frequently associated with the audit or attest function (generally accepted auditing standards or GAAS), where Certified Public Accountants (CPAs) in public accounting firms perform audits and related attestation engagements.

CPAs *are not employees* of the firm they are hired to audit, but are engaged by the firm to provide an independent opinion with respect to the fair presentation of the firm's financial statements.

The CPA credential is earned, in part, by completing a uniform examination administered by the American Institute of Certified Public Accountants (<u>AICPA</u>). The CPA examination focuses on all aspects of accounting, including managerial and cost, and relevant business law and regulatory topics.

Managerial or cost accounting is more frequently associated with the Certified Management Accountant (CMA) credential. The CMA is an *employee* of the profit, nonprofit firm or governmental entity. The CMA credential is earned, in part, by completing an examination administered by the Institute of Management Accountants (<u>IMA</u>).

The CMA examination tends to focus on all aspects of accounting, including managerial and cost, but is interdisciplinary. It also tests corporate finance, micro and macroeconomics, marketing, information systems, and organizational behavior.

Both CPAs and CMAs possess high levels of expertise in generally accepted accounting standards (GAAP). Both the AICPA and the IMA maintain a code of conduct for their members. The code of conduct developed by the IMA for CMAs and management accountants includes principles, standards and guidance for the resolution of ethical conflict. The following four broad categories of the IMA standards are:

1. Competence
2. Confidentiality
3. Integrity
4. Credibility

Chief Financial and Chief Information Officers

The chief financial officer (CFO), typically, is responsible for all financial functions. The chief information officer (CIO), typically, manages the firm's use of information and related technologies. The treasurer, typically, manages investor and creditor relationships.
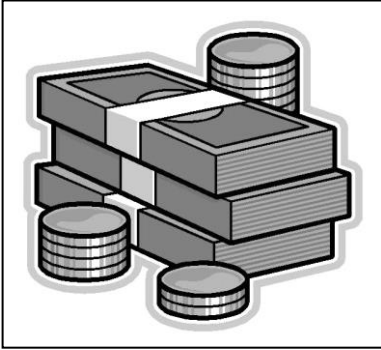
While these functions may overlap, management, managerial and cost accountants must possess some minimal level of expertise in all of the disciplines. For example, to be effective, the CFO must possess expertise for financial, information technology, investor and creditor relationships.

The CFO and CIO may, in some firms, be the same individual. The CFO may also be known as the *controller* for a firm.

Review

- Summarize the debits and credits and whether they increase or decrease account balances for all balance sheet and income statement classifications.
- Explain why financial statements are not "accurate" and why achieving "accuracy" is not cost-beneficial.
- Describe the component accounts required to arrive at cost of goods sold.
- Describe the component accounts and their impact as your reconcile gross purchases to net purchases.
- Review the basic techniques and mechanics of the journal entry used to record depreciation expense.
- Explain why depreciation expense does or does not involve cash.
- Summarize the basic cost flow assumptions for all inventory techniques.
- Describe the impact of all inventory techniques on [1] cost of goods sold, [2] gross margin, [3] net income, and [4] ending inventory.
- Explain the CPA and CMA credentials and focus, as you would to a non-business major or graduate.

True/False Questions

1. Inventory is an asset reported in the balance sheet.
2. Cost of goods sold is an expense reported in the income statement.
3. To increase inventory, debit the account; to increase cost of goods sold, debit the account.
4. For a good costing $1,000, it makes sense to hire additional staff to identify the cost, more accurately, at $999.99, as the difference is significant or material.
5. To compute cost of goods sold, beginning inventory is added to ending inventory, and gross purchases are subtracted from this amount.
6. Cost of goods sold is the same, regardless of the method of inventory valuation.
7. Depreciation expense is a period cost and matched to the period when the asset is used.
8. All depreciation methods result in the same cash outflow.
9. The straight-line method of depreciation is easy to apply and the only method acceptable under US GAAP.
10. The CPA and CMA credentials focus on the same topics of expertise.

Transition to a Globalized Business Environment

While a wide variety of views may persist, a successful effort during World War II (WWII) was probably the most influential and recent historical event leading to the wealth enjoyed by the US and Americans. Effectively, WWII was not fought on US soil and only the US retained manufacturing capabilities throughout and after the post-WWII period. Therefore, post-WWII, if someone wanted an automobile or a refrigerator or any other manufactured good, they had to buy it from a US-based firm.

As Japan, Germany and European nations worked to rebuild their manufacturing capability, US manufacturers came under increased competitive pressure. Alliances formed, primarily based on geographical location, as evidenced by the European Union (EU), the North American Free Trade Agreement (NAFTA), and, perhaps, the lesser known Central America Free Trade Agreement (CAFTA).

Standards of living rose, worldwide, and increased competitive pressures and a greater focus on the consumer and consumer satisfaction increased outsourcing to lesser developed nations, where they were achieving higher quality, and at a lower cost, when compared to their US competitors. Many of these countries enjoying dramatic increases in standard of living were previously referred to as *Third World Countries* are now referred to as "emerging markets" (EMs).

Information technology, e-commerce, the Internet, and an increased focus on consumer satisfaction and total quality management (TQM) forced more fully developed countries to continue to outsource low- or no-skilled jobs to EMs, where labor was less costly and regulation was less restrictive or even non-existent. While social, political and cultural considerations, including property rights and political and economic stability, were significant considerations, it was the desire to lower costs that led to the development of EMs from significantly low- or no-skilled, to increasingly semi-skilled, and, finally, to developmental-stage professional-level and highly-skilled labor forces.

From a manufacturing perspective, high-production and standardized facilities have transitioned to facilities producing high quality, extremely functional products, while also achieving very high levels of customer satisfaction. High volume facilities with long production runs and high inventory levels (and related storage or carrying costs) have been replaced with facilities capable of short production runs and low or no inventories, while remaining profitable. Robotics, automation, and the integration of varieties of technologies have made this possible, practical and profitable. While low- or no-skilled labor was sufficient in the past, today's facilities require higher levels of skills

and team-orientation to quickly and effectively solve problems that arise or continuously improve or streamline operations.

From a marketing and product design perspective, the world has moved from products with few variations and long product life-cycles to highly customized finished goods that may become obsolete very, very quickly. What was once a US or western market has exploded to a worldwide market, as standards of living in the EMs have improved with the skill sets and education levels of their populations.

Organizations previously managed almost entirely based on financial information learned to competitively exploit non-financial information, as, increasingly, this data became readily accessible and inexpensively stored for retrieval and analysis. Linear thinking and hierarchies have been replaced by networks and multi-dimensional thinking. Manufacturing techniques, procedures and processes have improved to a stage where innovation has taken the lead and may represent a factor more critical to an organization's long-term success.

Outsourcing Auditing to Emerging Markets

Mini-Case

The partners at the ***Let's Outsource Labor (LOL) CPA Firm*** are having a meeting on cost reduction. Auditing "through the computer" makes it possible to assign audit tasks to entry-level auditors in emerging markets, where the skill levels have evolved in recent decades. The non-US labor cost approximates one-third of the US labor cost. While all of the international CPA and/or audit firms must maintain some presence in all major cities throughout the world, this "outsourcing to emerging markets" strategy would increase the profitability for the partners at LOL.
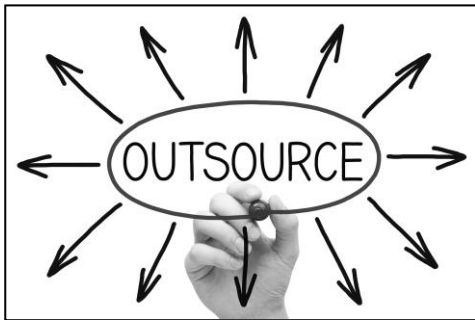
- Have other professional services been outsourced in recent decades?
- Is there any reason to expect that this will <u>not</u> occur in auditing or public accounting?
- Could this also occur in the area of US tax return preparation?
- Will it remain necessary for national and regional public accounting firms and auditors to maintain some minimum level or presence in densely populated US metropolitan areas?

Accounting for a Currency Collapse: The Cases of <u>Argentina</u> and the Former United Soviet Socialist Republic (<u>USSR</u>)

Iceland provided a more contemporary example of what occurs to businesses when a currency collapses. These firms cease operations and/or leave. <u>Zimbabwe</u> also provided an additional, contemporary example. They stop using their domestic currency and use a foreign, stable currency.

Soaring inflation and rising unemployment are consequences of hyperinflation. If the currency is no longer a "store of value," how can pre-hyper-inflation US$ be mixed with post-inflation US$, should the US experience <u>hyperinflation</u>?

> ***The utmost prudence is required in managing accounts receivable, inventory, and production at such a time***

Argentina (1999-2002)
Recall that Argentina is, presently, an emerging market, part of the G-20, is engaging in currency swaps to avoid the US$, and the Argentine peso has increased, in terms of US$, from a 1-to-1 ratio at the end of 2000 to a 1-to-3.45 ratio at the end of 2008.

USSR (1998)
Recall that Russia is, presently, a "big" emerging market (BEM), part of the G-20, has gone so far as to recommend that the US$ be "ditched" (see below), and the new Russian Ruble, in terms of US$, has enjoyed a modestly improved exchange rate from 21 in 1998 to 29 in 2008.

***PM <u>Putin</u> suggests Russia, China ditch dollar in trade deals* 15:23 28/10/2008**

Currency Failures in Emerging Markets (1980-2008)
Manufacturing and non-manufacturing firms, headquartered in the US, have outsourced many of their manufacturing and service activities to what were previously referred to as Third World

countries, but are now referred to as emerging markets. The primary reason for outsourcing has been lower direct labor (DL) and indirect labor (IL) costs. The activities outsourced may, in part, have been identified through activity-based costing (ABC) techniques. Therefore, a controller or chief financial officer (CFO) of any firm conducting business internationally would find it beneficial to hedge against any currency fluctuations for their international operations. For example, a US-based firm with a factory in Mexico would monitor fluctuations in Mexico's currency, the peso, as well as the US dollar ($).

A topic typically introduced and covered in *advanced* accounting courses is currency gains and losses. These gains and losses relate to currency fluctuations between the US$ and other currencies, and are not a function of operations, per se. It is, for this reason, that this component of any of the firm's profits are isolated and reported separately in the firm's financial statements.
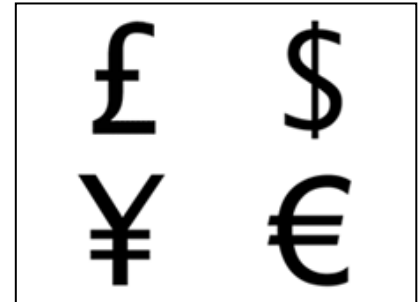
The below table summarizes currency measures through fall 2009, illustrating currency failures from many emerging markets countries. The new currency is noted with an asterisk (*) to the right of the new currency, in terms of US$.

Argentina, Brazil, Mexico, Russia and Turkey represent five of the G-20, the largest economies in the world (see "G-20" in the table). Brazil, Mexico, Russia and Turkey are perceived and classified, by some, as big emerging markets (see "BEM" in the table). The asterisks indicate a currency collapse.

	Swaps						
	G-20	G-20		G-20		G-20	G-20
		BEM		BEM		BEM	BEM
	Argentina	Brazil	Israel	Mexico	Peru	Russia	Turkey
	Peso	Real	Shekel	Pesos	Nuevo Sol	Ruble	Lira (TRL)
Year	per US$	per US$	per US$	per US$	per US$	per US$	per US$
1980	1,997.50	65.50	0.004	22.95	334.00		100.00
1981	10,400.00	127.80	0.008	24.51	495.50		100.00
1982	68,000.00	252.67	0.016	57.18	876.00		158.33
1983	*25.65* *	979.00	0.034	150.29	2,287.00		216.67
1984	205.00	3,184.00	0.019	185.19	4,743.60		350.00
1985	*0.88* *	10,490.00	*0.631* *	310.28	13,942.00		508.33
1986	1.67	*14.90* *	1.500	920.00	*13.95* *		683.33
1987	5.10	72.25	1.490	2,260.00	33.00		866.67
1988	16.41	765.00	1.540	2,330.00	1,000.00		1,416.67
1989	1,950.00	*11.33* *	1.690	2,692.00	7,662.00		2,116.67
1990	5,820.00	*169.33* *	1.950	2,959.40	547,945.21		2,608.33

1991	10,028.00	1,068.70	2.070	3,071.00	1.03 *		4,158.33
1992	0.99 *	11,213.12	2.540	3,115.40	1.53	414.50	6,858.33
1993	1.00	326.10 *	2.960	3.10 *	2.06	1,247.00	10,966.67
1994	1.00	0.85 *	3.030	5.32	2.19	3,550.00	29,791.67
1995	1.00	0.97	3.010	7.64	2.32	4,640.00	45,733.33
1996	1.00	1.04	3.190	7.85	2.61	5,560.00	81,275.00
1997	1.00	1.12	3.450	8.06	2.73	5,960.00	151,591.67
1998	1.00	1.21	3.810	9.86	3.16	20.65 *	260,475.00
1999	1.00	1.81	4.140	9.51	3.51	27.00	418,983.33
2000	1.00	1.95	4.080	9.60	3.53	28.16	624,333.33
2001	1.15	2.41	4.210	9.20	3.44	30.14	1,228,266.67
2002	3.41	3.54	4.740	10.40	3.62	31.78	1,512,341.67
2003	2.94	2.90	4.550	11.32	3.47	29.45	1,502,541.67
2004	2.98	2.66	4.490	11.15	3.31	27.80	1,425,991.67
2005	3.03	2.33	4.500	10.64	3.31	28.78	1.34 *
2006	3.06	2.14	4.460	10.80	3.31	26.33	1.43
2007	3.15	1.77	4.110	10.91	3.31	24.55	1.30
2008	3.45	2.36	3.590	13.74	2.99	29.38	1.30

Chapter 2
Introduction to the Basic Vocabulary & Mechanics of Managerial Accounting

Learning Objectives

- Identify the three classifications of product or manufacturing costs, and how these three cost components are related to prime costs and conversion costs.
- Distinguish between product costs and period costs.
- Define prime cost and conversion cost.
- Prepare a basic schedule of cost of goods manufactured, schedule of cost of goods sold, and income statement.
- Distinguish between raw materials, direct materials and indirect materials.
- Define full costing or absorption costing and how they relate to methods required by the Internal Revenue Service, US GAAP, and for external reporting.
- Distinguish between actual overhead and applied overhead and the three, most frequently taught techniques for applying overhead.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.
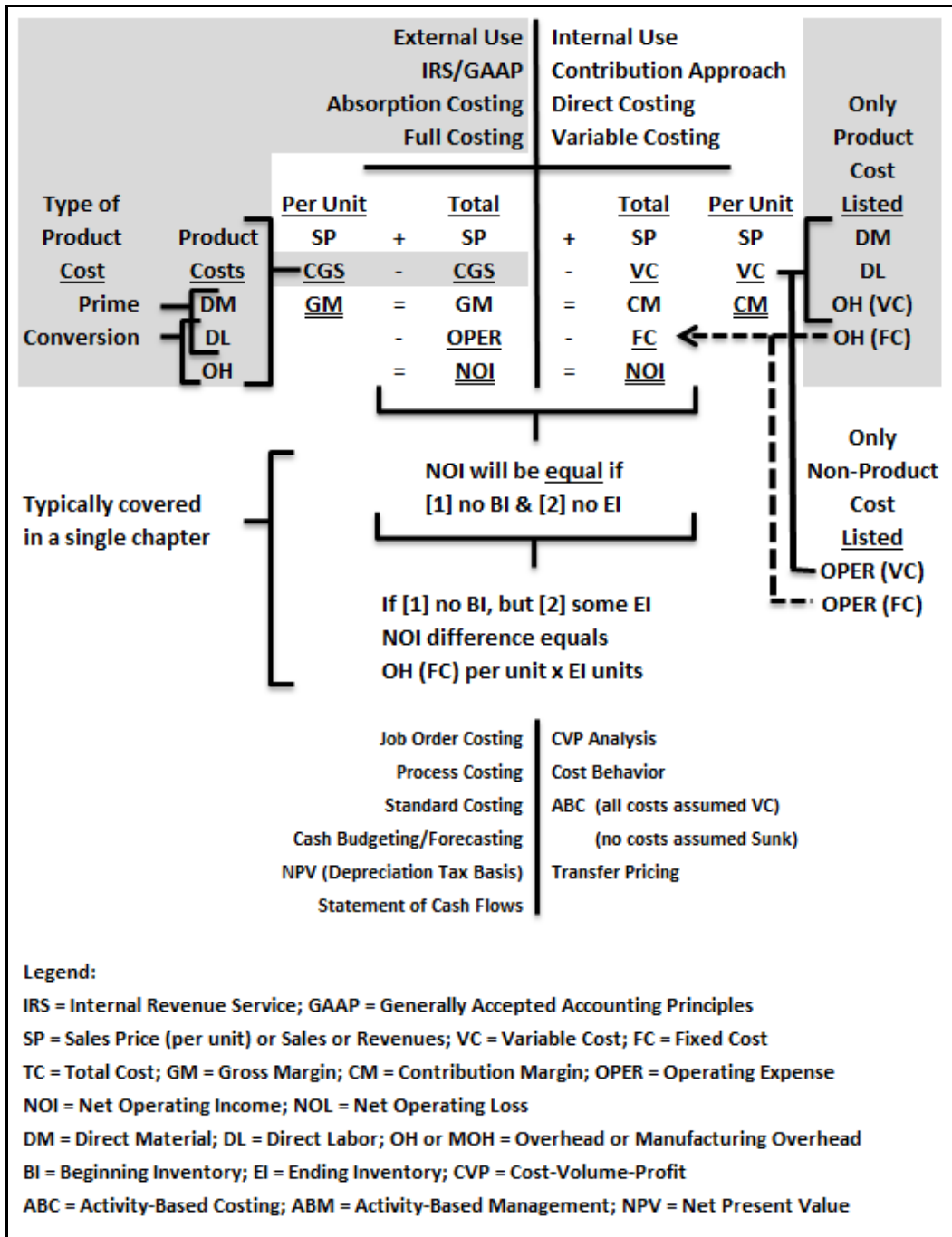
This chapter introduces a variety of terms and their context or managerial/cost accounting mechanics, primarily focusing on manufacturing firms. However, all of these concepts and mechanics may also be used to examine and cost for service and professional service firms, where direct material might be insignificant and consist only of toner and paper for laser printers and the focus might more likely be on the more significant direct labor (or *professional* labor) cost component in a law firm or a public accounting firm.

Before covering applications for these service firms and examples (e.g., CPA and public accounting firms, law firms, market research firms, engineering firms, and so on), it is likely to be helpful to, first, learn to cost the manufacture of physical products.

Product or Manufacturing Costs

There are 3 classifications of *product* or *manufacturing costs* (representing cost of goods sold):

- Direct materials (DM)
- Direct labor (DL)
- Manufacturing overhead (OH or MOH, in some texts)

Direct material might include the lumber used to manufacture a coffee table or end tables or the headboards for a bed frame. Hardware used to assemble and complete the manufacture this furniture may also be classified as direct materials, if significant or material in dollar amount and easily traced to the finished good (e.g., screws, bolts, washers, nuts, and hinges).

Occasionally, a unit of wooden furniture may require some repair or rework to correct a scratch or defect occurring in the manufacturing process, and sand paper, glue, nails, and these types of supplies might be required to complete these repairs. These items might more appropriately be classified as indirect material (IM).

Indirect materials are immaterial are relatively insignificant and the cost of "tracing" these costs to finished goods or cost of goods sold in an accounting system exceeds the benefit likely to be derived. For this reason, these relatively immaterial or insignificant indirect materials costs are "pooled" with other indirect costs and classified as manufacturing overhead.

All of these classifications of product or manufacturing costs are addressed below:

Direct Materials are those materials that are relatively significant or material in dollar amount and easily traced to the finished good. Think of <u>direct</u> material as <u>directly</u> traced to the finished good.

Indirect Materials are all materials (contained in finished goods) that are not direct materials (e.g., supplies, glue, screws, nails, sandpaper, and so on).

Direct Materials + Indirect Materials = Total Manufacturing Materials
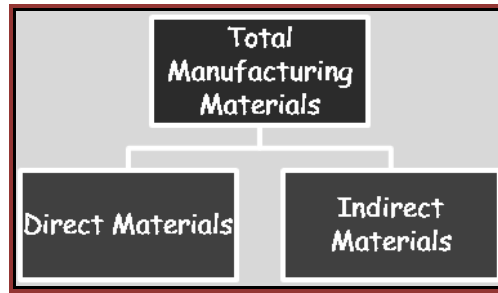
Alternatively,
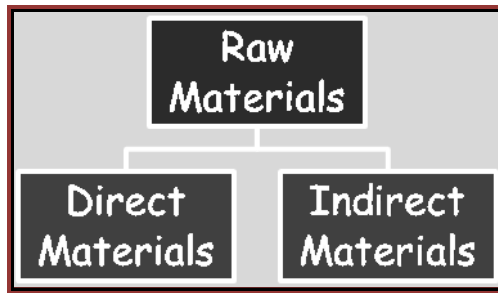
Direct Labor is that labor directly associated with the manufacture of a product.
Direct labor is that labor that is relatively significant or material in dollar amount and easily traced to the finished good. Think of <u>direct</u> labor as <u>directly</u> traced to the finished good.

Indirect Labor is all labor (used to complete a finished good) that is not direct labor (e.g., manufacturing supervisor salaries and maintenance personnel).

Direct Labor + Indirect Labor = Total Manufacturing Labor
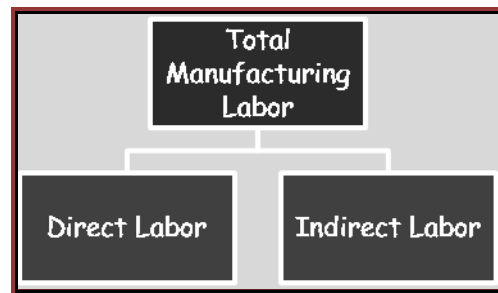
For example, an assembly line worker may spend 7 hours of an 8 hour work day on a production run and the last hour of the day cleaning up the work area and assisting others in cleaning up common areas. Seven hours would be classified as direct labor and one hour would be classified as indirect labor.

Overhead or **Manufacturing overhead** consists of

- Indirect material (see above),
- Indirect labor (see above), and
- All other non-direct product or manufacturing costs.

In addition to indirect material and indirect labor, other product or manufacturing costs might include factory utilities, factory rent, factory property taxes, factory property insurance and factory depreciation on factory real or personal property and any other expense (cost) related to running (associated with) the factory. While you have been trained to think of these costs as periodic or period costs, in a manufacturing firm, they are converted to product costs and become "inventoriable." More will be covered on this topic, later in the chapter.

Outsourcing

In recent decades, cheap, fast computers have allowed manufacturing firms to identify activities, tasks and costs that can be cost-effectively and profitably outsourced, primarily to what were previously referred to as 3rd World countries or emerging markets. This has reduced costs to American consumers, but has also resulted in the reduction of these positions available to Americans.

Outsourcing has not been restricted to manufacturing or related costs. Non-product or non-manufacturing activities, tasks and costs have also been outsourced.

Non-Product or Non-Manufacturing Costs

Non-product or non-manufacturing costs tend to consist of

[1] Selling costs and
[2] Administrative costs.

Some texts separate these operating expenses into

[1] Selling costs,
[2] General costs, and
[3] Administrative costs.

The selling, general and administrative (SG&A) costs and their presentation in the financial statements were covered in your Introductory Financial Accounting course.

Product Costs versus Period Costs

Product or manufacturing costs were addressed in the previous section. Non-product or non-manufacturing costs were also addressed. In this section, we will address the distinction between product costs and period costs.

Recall, that in accrual-based financial accounting, we "match" costs to the period benefitting. For example, rent for January is matched to and reported as rent expense in the January income statement. If both January and February rent expense of $1,000 per month was paid in January, only January rent expense of $1,000 would be "matched" to the January "period." The remainder of the $2,000 paid in January would be classified as an asset, prepaid rent expense, in the January 31 balance sheet and expensed in February.

Product costs include direct material, direct labor and overhead. Period costs represent everything else.

However, what you have been trained to treat as a period cost can be a product cost, and become <u>inventoriable</u>. This can be a difficult transition for students, and will be covered in greater detail in the next chapter, but consider the following:

Depreciation expense is a non-cash charge or debit expensed during a period as we attempt to match this expense to the period benefitting. When depreciation is part of overhead and a product cost, however, it is not simply expensed and matched to a period. It is "pooled" to an account for later "allocation."

For example, the building and equipment used to manufacture a product must be distinguished from the building and equipment used for non-manufacturing operations. The former is "pooled" as part of manufacturing overhead, and, as raw materials inventory goes into production, these and other costs "flow" into work-in-process inventory and finished goods inventory, to be sold, and, eventually expensed as part of cost of goods sold. This depreciation expense, therefore, becomes "inventoriable." The latter, of course, is simply building- and equipment-related depreciation that is expensed the period.

This, again, is covered in greater detail in the next chapter.

Prime Costs and Conversion Costs

Both prime costs and conversion costs include direct material cost:

- *Prime costs* are defined as direct material and direct labor. Direct material and direct labor are frequently presumed to represent significant or material costs and, so, prime costs are the *primary* costs. Direct material and direct labor, because they are significant or material in dollar amount, are easily and cost-effectively *traced* to the finished goods.

- *Conversion costs* (CC) are defined as direct labor and overhead. This is because a raw material is *converted* to a finished good by adding direct labor and overhead. Overhead consists of costs that are not separately significant or material in dollar amount and not easily

and cost-effectively *traced* to the finished good. For this reason, overhead costs are *pooled* and *allocated* to the fished goods.

Product costs include direct material (DM), direct labor (DL), and manufacturing overhead (OH):

DM + DL + OH = Product Costs = Manufacturing Costs = Cost of Goods Sold
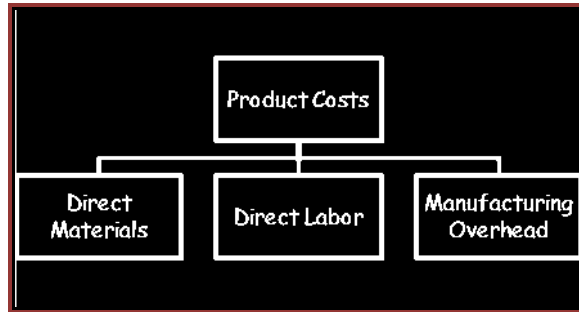
Product costs and their components can be viewed as prime costs and conversion costs, which overlap and/or are not mutually exclusive, since direct labor is included in both, as follows:
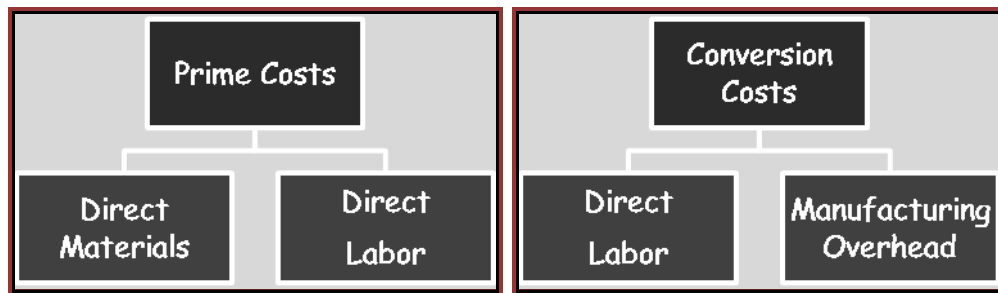
Think of direct labor and manufacturing overhead as those costs added to direct materials or raw materials to "convert" them into finished goods.

Just as cost of goods sold or manufacturing costs or product costs consist of direct material, direct labor and overhead, there are operating or non-manufacturing costs. *Non-manufacturing costs* or *non-product costs* or *period costs* consist of general, selling and administrative (GS&A) costs.

Non-manufacturing Costs = Non-product Costs = Period Costs = Operating Costs

Basic Income Statement Format

There are a variety of ways to present income statement material, depending on the instructor, the course and/or the text. You should become comfortable with all of them. Several are presented below:

	Revenues or Sales			R of S			R or S
less	Cost of Goods Sold		*less*	CGS		*less*	Product Costs
equals	Gross Profit		*equals*	GP		*equals*	GP
less	Operating Expense		*less*	GS&A		*less*	Period Costs
equals	Net Operating Income		*equals*	NOI		*equals*	NOI

A manufacturing firm has three classifications of inventory:

[1] Raw material,
[2] Work in process and
[3] Finished good.

Raw material is <u>not</u> equal to direct material. Most textbooks do not make this point, overtly, and it is an important one. Raw material includes both *direct* materials and *indirect* materials, as follows:

$$RM = DM + IM$$

and/or

$$RM \neq DM$$

This concept and mechanics are illustrated in the below T-account. Beginning inventory (BI) and ending inventory (EI) for raw materials (RM) inventory, and the direct materials (DM) and indirect materials (IM) being transferred out of raw materials inventory can be "traced" to work in process (WIP) and "applied" to overhead (OH) accounts. The "application" of overhead is addressed later in this chapter.

	Raw Materials		
BI RM	$10		
RM Purchases	$5	$11	DM (cost TRACED to WIP)
		$1	IM (cost APPLIED to OH)
EI RM	$3		

Below are two sets of columns used in the below example. One does and one does not provide actual numbers. None of the numbers are very large and none are repeated. This will simplify the illustration and minimize the risk of confusion, where raw material = direct material + indirect material.

The outflows from the inventory account occur and should be thought of as occurring in two separate components, one for direct material and one for indirect material. Note that direct material is "traced" to work in process (WIP), and, eventually, to finished good. However, indirect

materials are not "traced" to the finished good. They are "applied" along with other costs "pooled" in the overhead account. This topic is addressed in greater detail later in the chapter, where the below schedule of cost of goods manufactured will, again, be presented. For now, take a first look at the format.

DM		BI RM	xx	10
	Add	RM Purchases	xx	5
	Equals	RM Available	xx	15
	Less	EI RM	xx	3
	Equals	RM Used	xx	12
	Less	IM included in OH	xx	1
	Equals	DM Used	xx	11
DL			xx	14
OH		IM	xx	1
		IL	xx	2
		Rent*	xx	4
		Utilities*	xx	6
		Property Taxes*	xx	7
		Property Insurance*	xx	8
		Supplies*	xx	9
		Depreciation*	xx	13
		Total OH	xx	50
		Total Manufacturing Costs	xx	75
		*Amounts for the factory		

Note that $47 is bracketed alongside Rent through Depreciation.

Note that indirect materials (IM @ $1) and indirect labor (IL @ $2) equal $3 and all other overhead items equal $47, for total overhead (OH) of $50.

More on Manufacturing Overhead
Direct material, direct labor and overhead are all product or manufacturing costs and are included in the computation of cost of goods sold. However, some of these product costs may, at first, appear to be period costs (e.g., rent and depreciation, from above). They are not.

If a cost that appears to be "periodic" is also a product cost, you must think of that cost as a product or manufacturing cost that is stored, temporarily, in the overhead account for eventual "application" to jobs or production runs. **These overhead costs flow into work in process, then, to finished good, and, finally, to cost of goods sold.** It is for this reason, the fact that these costs flow through the balance sheet's work in process and finished good inventory accounts, that these costs are said to be "inventoriable."

Product Cost or Period Cost?
Is rent a product cost or a period cost? If it is factory rent or factory machine rent, it is a product cost. If it is rent associated with general, selling and administrative (GS&A) or non-manufacturing or non-product activities, it is a period cost like other operating expenses.

This illustration focuses on rent, but it could just as easily have been focused on any of the other overhead items. It illustrates that factory rent, an overhead item, is a product cost and, therefore, "inventoriable." The inventoriable nature of these product costs will become more apparent when viewed in the form of the *Schedule of Cost of Goods Manufactured*.

DM			xx	11
DL			xx	14
OH	IM	xx		1
	IL	xx		2
	Rent	xx		4
	Utilities	xx		6
	Property Taxes	xx		7
	Property Insurance	xx		8
	Supplies	xx		9
	Depreciation	xx		13
	Total OH		xx	50
	Total Manufacturing Costs		xx	75

Schedule of Cost of Goods Manufactured

The *Schedule of Cost of Goods Manufactured* (CGM) illustrates how costs flow and are traced or allocated through work in process and finished goods inventory accounts in the balance sheet. Overhead items become "inventoriable" in the work in process inventory account and, eventually, the finished goods inventory account. The cost of goods sold section of the income statement is provided to illustrate how these costs "flow" through the manufacturing process.

This flow of costs through inventory balance sheet accounts is also referred to as *full costing* or *absorption costing*, as all costs are "absorbed" or "stored" as they "flow" into work in process (on the firm's balance sheet) and, then, finished goods inventory (on the firm's balance sheet) until sold, and flow into cost of goods sold, where they are matched to revenues or sales in the firm's income statement.

Full costing or absorption costing is, generally, used for external reporting and is required by the Internal Revenue Service (IRS) and also required under generally accepted accounting principles (GAAP).

	DM		xx	11
	DL		xx	14
	OH		xx	50
	Total Manufacturing Costs		xx	75
add	BI WIP		xx	20
equals	Total manufacturing cost to account for		xx	95
less	EI WIP		xx	30
equals	CGM		xx	65
	CGS:			
	BI FG		xx	25
add	CGM		xx	65
equals	FG Available		xx	90
less	EI FG		xx	35
equals	CGS		xx	55

T-Accounts illustrate the flow of costs or cost flows, using the same data used in this chapter. Notice the *flow of costs* through the work in process and finished goods inventory accounts, until matched with revenues, upon sale, in the cost of goods sold account.
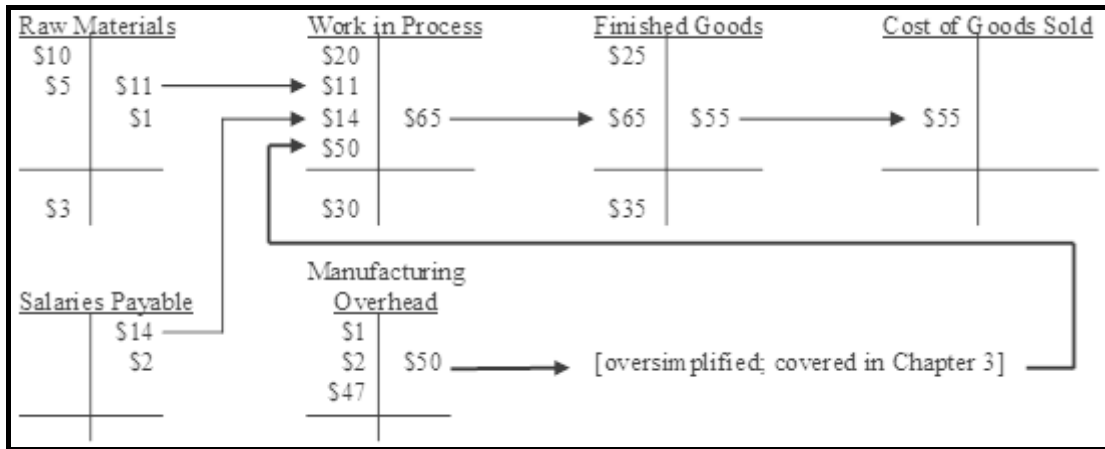
Take note of the $47 dollar amount in the manufacturing overhead T-account, above. This $47 includes $4 in rent. Rent is typically thought to be a period cost, but this amount, along with others, is applied to jobs and flows into work in process (see above).

When the manufacturing process is completed, work in process costs flow into finished goods. When these finished goods are sold, these costs flow out of the finished goods inventory account, from the balance sheet, into the cost of goods sold account, into the income statement.
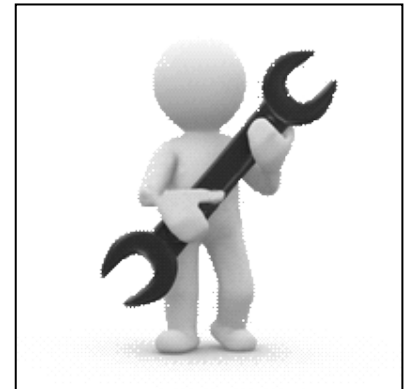
Actual Overhead versus Overhead Applied

Actual direct material and direct labor costs are "traced" to the finished good. This is cost-beneficial, as these product costs are presumed to be easily or cost-beneficially traced to the finished good and are material or significant in dollar amount.

Overhead has, historically, been very costly to trace to the finished good, so a *cost pool* is often established. Cost pools are groupings or aggregations of individual costs for later allocation, typically involving a single allocation base.

Overhead costs are, then, "applied" to products, based on a pre-determined overhead application rate. The allocation base for the application of overhead costs is, typically, causally linked to some activity or cost driver.

This pre-determined overhead application rate is an estimated, budgeted, forecasted, projected, standard, or pro forma amount. These terms are equivalent or sufficiently comparable for the purpose of this course, as follows:

Estimated = Budgeted = Forecasted = Projected = Standard = Pro Forma

The estimated overhead cost is applied using, as a numerator, an estimate of manufacturing overhead costs and, as a denominator (or denominator activity level), an estimated **cost driver**. A cost driver is typically a measure of physical activity most highly associated or correlated with cost variation. It "drives" the cost through the manufacturing process, as follows:

- RM cost   Preferred when CC is relatively immaterial
- DL hours (DLH)   Preferred when manufacturing is DL intensive
- Machine hours (MH)   Preferred when manufacturing is highly automated

**Estimated OH ÷ Estimated cost driver or activity level
= Predetermined OH application rate**

Note that the numerator, estimated overhead, is *matched* to estimated denominator activity level. Stated alternatively, both the numerator and denominator are *consistent*, in that both are *estimated* measures. It may be helpful to think of the *consistency* or *comparability* secondary qualities from your introductory financial accounting course.

You are estimating overhead expenses and estimating the cost driver to arrive at a predetermined overhead application rate to be used to apply actual costs incurred during a future accounting period. There should be a cause-and-effect relationship or causal linkage between these overhead costs and the cost driver. Cost may be allocated on a variety of bases: the ability to bear costs, equity, or relative benefits present themselves as alternatives.

A Comprehensive Example, *in Good Form*

Below is a comprehensive example, using the same information covered in the body of the chapter, but *in good form*. Notice that all three inventory accounts (raw material, work in process and finished good) used by a manufacturing firm are presented in these statements, which further

illustrates the flow of costs through these inventory accounts and, eventually, into the firm's cost of goods sold section in the income statement.

XYZ Corporation Schedule of Cost of Goods Manufactured For the Month Ended January 31, 20XX		
Direct Materials:		
Raw materials inventory, January 1	$ 10	
Add: Purchases of raw materials	$ 5	
Raw materials available for use	$ 15	
Deduct: Raw materials inventory, January 31	$ 3	
Raw materials used in production	$ 12	
Deduct: Indirect materials included in overhead	$ 1	
Direct materials used in production		$ 11
Direct Labor		$ 14
Manufacturing Overhead:		
Indirect materials	$ 1	
Indirect labor	$ 2	
Factory rent	$ 4	
Factory utilities	$ 6	
Factory property taxes	$ 7	
Factory property insurance	$ 8	
Factory supplies	$ 9	
Factory depreciation	$ 13	
Total manufacturing overhead cost		$ 50
Total manufacturing cost		$ 75
Add: Work in process inventory, January 1		$ 20
Equals: Total manufacturing cost to account for		$ 95
Deduct: Work in process inventory, January 31		$ 30
Cost of goods manufactured		$ 65

XYZ Corporation Cost of Goods Sold - Income Statement For the Month Ended January 31, 20XX	
Finished goods inventory, January 1	$ 25
Cost of goods manufactured	$ 65
Finished goods available for sale	$ 90
Finished goods inventory, January 31	$ 35
Cost of goods sold	$ 55

The Service or Non-manufacturing Firm

The professional services or non-manufacturing firm would use the same, basic concepts and mechanics presented in this chapter, but direct material would be likely to prove to be insignificant or immaterial in dollar amount and, therefore, not cost-effectively traced to the finished good.

For example, a CPA or law firm preparing tax returns would not be likely to attempt to count and charge clients for the number of sheets of paper used to prepare their tax return or trace the amount of toner from a laser printer toner cartridge to each client. (This is not to say that some firms do not prefer to charge clients for photocopies.) Instead, the firm is likely to add these

immaterial or insignificant supplies costs to other overhead items, for application (or allocation), based on direct labor (or professional labor) hours, and at some pre-determined rate (e.g., $5 per direct labor hour).

Review

- List and define the 3 classifications for product costs.
- Define prime cost.
- Define conversion cost.
- Identify the cost common to both prime cost and conversion cost and explain why.
- Explain how depreciation can be both a product cost and a period cost.
- List the 3 classifications of inventory in a manufacturing firm.
- Define full or absorption costing.
- Describe how actual overhead differs from applied overhead.
- List the methods might be used to apply overhead.

True/False Questions

1. Mixed costs are costs that are confused.
2. The 3 classifications of inventory in a manufacturing firm are direct materials, work-in-process, and finished goods.
3. Indirect materials are those requiring redirection.
4. Depreciation can be a period cost, but cannot be a product cost.
5. Full costing results in a higher cost of goods sold, when compared to absorption costing.
6. Actual overhead is always applied using direct material cost.
7. Actual overhead is applied using a pre-determined overhead application rate.
8. Rent expense for a manufacturing facility becomes inventoriable.
9. Overhead is, frequently, applied based on raw material cost, direct labor hours, and manufacturing overhead.
10. Overhead is capitalized and depreciated using straight-line depreciation.

Chapter 3
Job Order Costing

Learning Objectives

- Distinguish between job order costing and process costing and when each GAAP method is appropriately applied.
- Identify documents likely to be used in a job order costing system.
- Compute the predetermined manufacturing overhead rate.
- Apply manufacturing overhead costs to jobs using a predetermined manufacturing overhead rate.
- Compute the total cost and average cost per unit for a job using a predetermined manufacturing overhead rate.
- Compute and explain why the use of estimated rather than actual overhead cost is used in the cost accounting process.
- Use T-accounts and journal entries to illustrate your understanding of the flow of costs in a job order costing system.
- Apply overhead cost to work-in-process and finished goods inventory, and cost of goods sold.
- Prepare a schedule of cost of goods sold.
- Compute under- and over-applied overhead and prepare related journal entries to close these balances in manufacturing overhead and other costs to cost of goods sold.
- Define and explain spoilage, rework and scrap.
- Define and explain what is meant by normal and abnormal, specific normal and common normal, all in the context of spoilage and rework.
- Understand why it might be desirable to isolate overtime and exclude it from the job cost sheet for a particular job or production run.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

		External Use IRS/GAAP Absorption Costing Full Costing		Internal Use Contribution Approach Direct Costing Variable Costing		Only Product Cost Listed
Type of Product Cost	**Product Costs**	**Per Unit** SP CGS GM	**Total** + SP − CGS = GM	**Total** + SP − VC = CM	**Per Unit** SP VC CM	DM DL OH (VC)
Prime	DM					
Conversion	DL		− OPER	− FC	←	OH (FC)
	OH		= NOI	= NOI		

Typically covered in a single chapter

NOI will be *equal* if
[1] no BI & [2] no EI

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Only
Non-Product
Cost
Listed
OPER (VC)
OPER (FC)

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

This chapter illustrates how **job order costing** is used. Job order costing is a generally accepted accounting principle (GAAP). It is **absorption costing**, as all manufacturing costs, both fixed and variable, and some that you might otherwise view a periodic, are **absorbed** and become **inventoriable**. Generally, this method is also required for external reporting, tax purposes and by the Internal Revenue Service (IRS), since it provides for the "matching" principle where costs are "matched" to revenues for a "period," providing for a "clear reflection of income."

This chapter develops the T-accounts and journal entries (JEs), using the same data introduced in chapter 2 to produce a *Schedule of Cost of Goods Manufactured*. Review the *flow of costs* through the work in process and finished goods inventory accounts until the sale of the goods are matched with revenues, upon sale, in the cost of goods sold account.

Examples of a Materials Requisition Form
& Employee Time Ticket for Direct Material & Direct Labor

A simple Google search will reveal many images and examples of a materials requisition form. Two examples from a key word Google search follow:
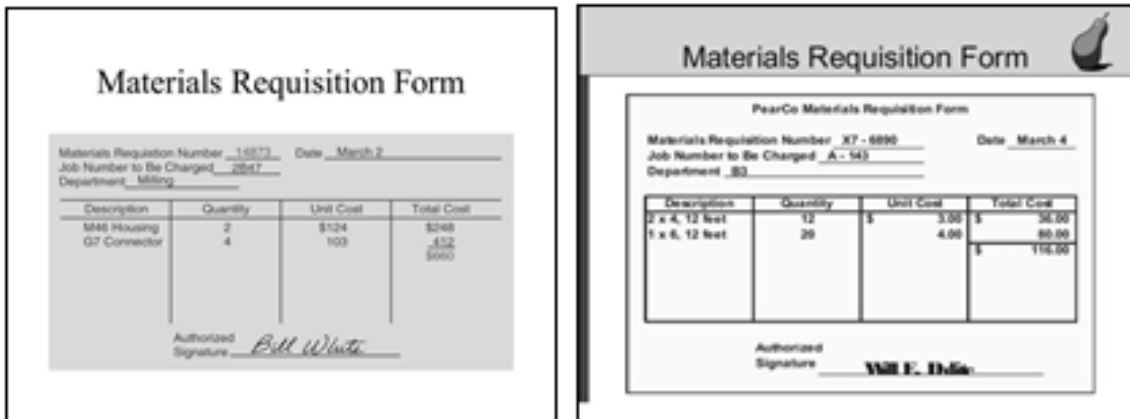
Whether this source document is stored in a filing cabinet or electronically, material requisition forms are numbered and all material requisition forms would be accounted for. Any missing material requisition forms would be investigated by internal audit staff.

A missing material requisition form might, for example, suggest that some direct materials or indirect materials left the facility for an employee's personal use or consumption. Alternatively, a missing material requisition form might merely suggest that the transfer of these raw materials to work-in-process were not properly recorded.

A Comprehensive Example

Assume that job number 20XX-005 is the 5th job started in calendar year 20XX. This job was in progress at the end of the prior period, as is represented by the $20 [see below boxed measure] beginning balance in work-in-process.
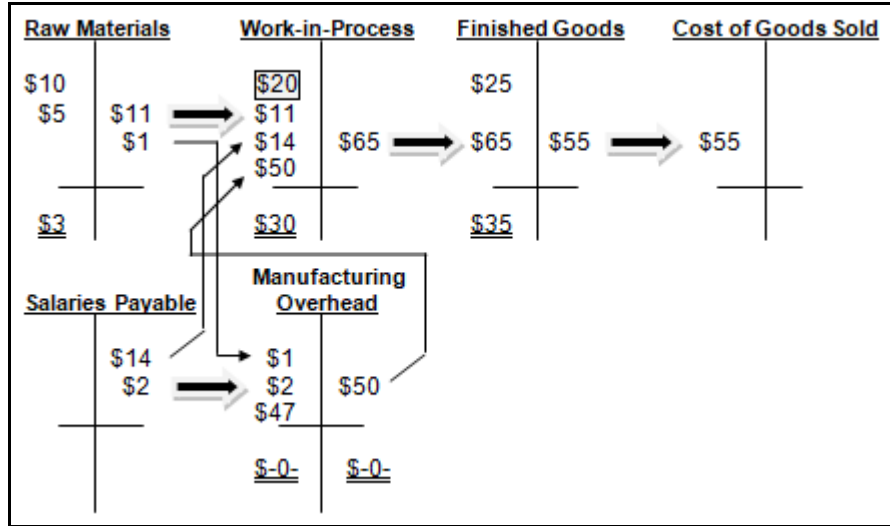
Source documents, like material requisition forms and employee time are numbered, sequentially, also to provide internal control over the appropriate assignment of direct labor and indirect labor costs to the appropriate job, production run and/or time period.

Both of these source documents may be stored physically, electronically, or both, and would be controlled and accounted for. A missing employee time ticket might, for example, be the result of personal use of employee time, but billed to the firm. Alternatively, a missing employee time ticket might merely suggest that this direct labor cost was not recorded and/or assigned and billed to the correct job.

The next few pages provide summary data for job cost sheets for 2 jobs: Job A and Job B. Job A was started during the prior month or period. Job B was started during the current month or period.

The next few pages do not focus on the journal entries, per se, but provide the job cost sheets for Job A and Job B and T-accounts for you to become comfortable with the "flow" of costs as they are added to the production or manufacturing process.

Job Cost Sheets – Direct Materials

Below are the job cost sheets for two separate jobs. They are Job A and Job B, as follows:

Job Cost Sheet - Job A		Job Cost Sheet - Job B	
Beginning balance	$20	Beginning balance	$0
Direct Materials	$2	Direct Materials	$9

The $11 of direct materials [see below boxed measure] went into Job A ($2) and Job B ($9). Note that Job A was already a work in process, with **inventoriable** costs of $20, carried forward from the prior month.

The $1 that went into manufacturing overhead is "pooled" with other costs, and will be allocated based on a predetermined manufacturing overhead application rate.
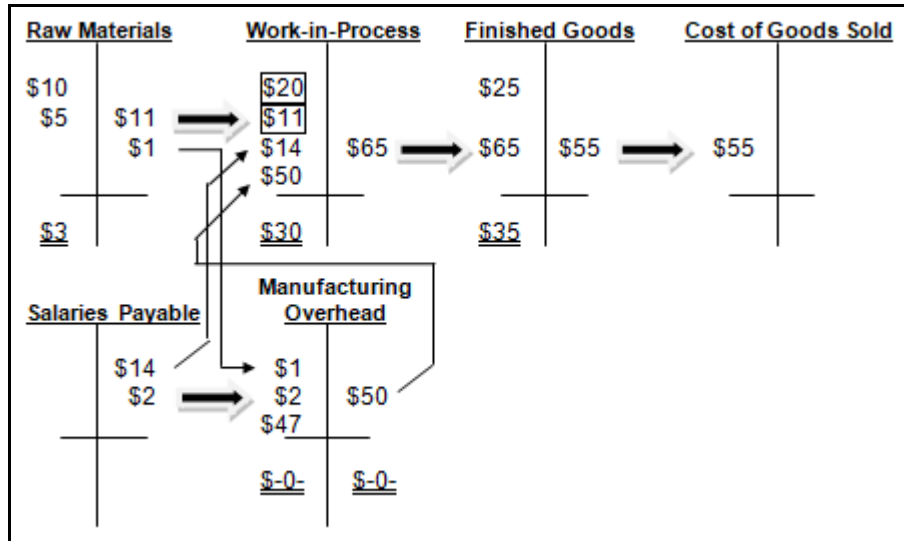
Job Cost Sheets – Direct Materials & Direct Labor

Below, again, are the job cost sheets for Job A and Job B:

Job Cost Sheet - Job A		Job Cost Sheet - Job B	
Beginning balance	$20	Beginning balance	$0
Direct Materials	$2	Direct Materials	$9
Direct Labor	$4	Direct Labor	$10

The $14 of direct labor [see below boxed measure] went into Job A ($4) and Job B ($10). Again, recall that Job A was already a work in process, with **inventoriable** costs of $20, carried forward from the prior month.

The $2 that went into manufacturing overhead is "pooled" with other costs, and will be allocated based on a predetermined manufacturing overhead application rate.

Raw Materials	Work-in-Process	Finished Goods	Cost of Goods Sold
$10	$20	$25	
$5 $11 →	$11		
$1	$14 $65 →	$65 $55 →	$55
	$50		
$3	$30	$35	

Salaries Payable | Manufacturing Overhead
$14 → $1
$2 → $2 $50 →
$47

$-0- $-0-
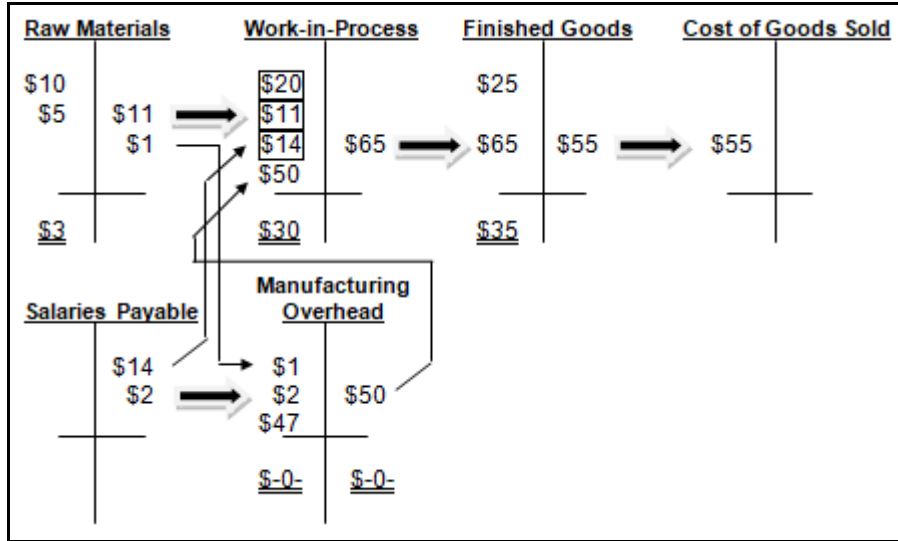
Job Cost Sheets – Direct Material, Direct Labor & Manufacturing Overhead

Below, again, are the job cost sheets for Job A and Job B, where it has been determined that $39 of manufacturing overhead was applied to Job A and the remaining $11 was applied to Job B:

Job Cost Sheet - Job A		Job Cost Sheet - Job B	
Beginning balance	$20	Beginning balance	$0
Direct Materials	$2	Direct Materials	$9
Direct Labor	$4	Direct Labor	$10
Manufacturing Overhead	$39	Manufacturing Overhead	$11
Total	$65	Total	$30

Again, recall that Job A was already a work in process, with **inventoriable** costs of $20, carried forward from the prior month. At the end of the month or period, Job A has been completed, but Job B has not been completed. Therefore, the $30 of costs incurred, so far, for Job B, will be **inventoriable** and carried forward as the beginning work in process balance for the next month or period.

The $50 of manufacturing overhead [see below boxed measure] was applied to Job A ($39) and Job B ($11).

A Comprehensive Example – The Journal Entries

The pages that follow focus on the journal entries represented in the T-accounts, presented, again, below:

Purchasing Raw Materials

Assume that a firm purchased raw materials for $5 during the period. The below journal entry (JE) is used to record the purchase of raw materials on account.

Journal Entry - 1		
Raw materials	$5	
Accounts payable		$5

Further assume that beginning inventory for raw materials was $10. Therefore, the beginning raw materials at $10 plus the raw materials purchased during the period at $5 (see above) are represented on the left side of the below T-account, increasing the balance of raw materials inventory [see below boxed measures].

Raw Materials		Work-in-Process		Finished Goods		Cost of Goods Sold	
$10		$20		$25			
$5	$11 →	$11					
	$1	$14	$65 →	$65	$55 →	$55	
		$50					
$3		$30		$35			

		Manufacturing Overhead			
Salaries Payable					
	$14	$1			
	$2 →	$2	$50		
		$47			
		$-0-	$-0-		

Transferring Direct Materials and Indirect Materials into Production

Focusing on the beginning raw material inventory of $10 and the additional purchase of raw materials inventory of $5, we have $15 of raw materials inventory available. Assume that $11 of direct materials and $1 of indirect materials were issued from the raw materials inventory stores and into the production process.

Journal Entry - 2		
Work in process	$11	
Overhead	$1	
Raw materials		$12

Recall that $11 of direct material was transferred out of raw material inventory to work-in-process inventory. In addition to the $11 of direct material transferred from raw material inventory to work-in-process inventory, there was a $1 transfer of indirect material transferred from raw material inventory to manufacturing overhead.

Notice how these costs flow out of raw material inventory into the work-in-process inventory and manufacturing overhead accounts [see below boxed measures for both $11 and $1 transfers].

Direct Labor & Indirect Labor Consumed for Production

Focusing, now, on the below journal entry and salaries payable T-account, note that $14 of direct labor and $2 of indirect labor was consumed during the manufacturing process.

Journal Entry - 3		
Work in process	$14	
Overhead	2	
Salaries payable		$16

Recall that $14 of direct labor was consumed for jobs and $2 of indirect labor was consumed, but not assigned to any job. Notice how these costs flow out of salaries payable into the work-in-process inventory and manufacturing overhead accounts [see below boxed measures for both $14 and $2 transfers].

Manufacturing Overhead "Pooled" for Application

In addition to indirect material and indirect labor, other indirect costs that are immaterial, insignificant, and/or difficult to cost-effectively trace to the finished good are included in the manufacturing overhead cost "pool," to be allocated based on a predetermined manufacturing overhead application rate. These costs total $47 and are detail in the below journal entry and illustrated in the T-accounts that follow:

Journal Entry - 4		
Overhead	$47	
Rent		$4
Utilities		6
Property taxes		7
Property insurance		8
Supplies		9
Accumulated depreciation		13

The amounts for indirect materials ($1) and indirect labor ($2) are already represented in the manufacturing overhead account.
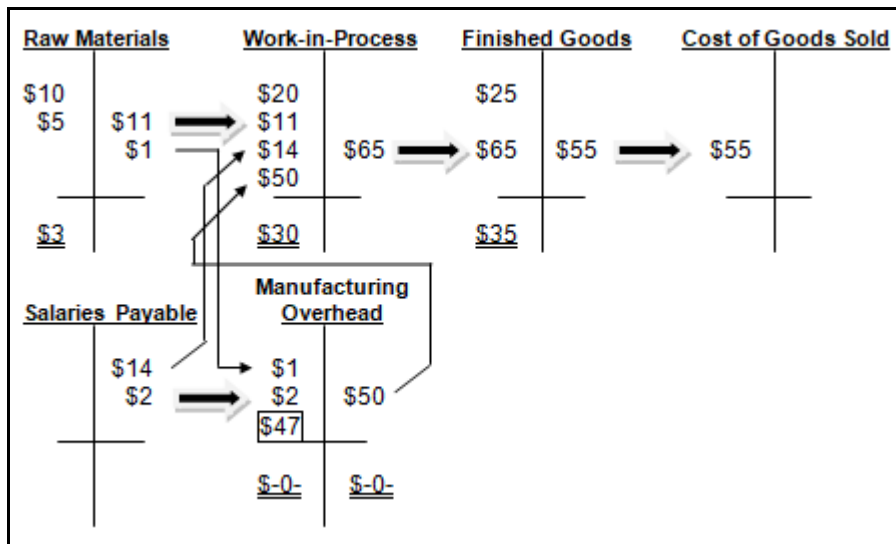
Note that rent, utilities, property taxes, property insurance, supplies and accumulated depreciation are all **absorbed** into the manufacturing overhead account. Many of these costs are **periodic**, but they become **inventoriable**.

Applying Manufacturing Overhead Costs to Jobs

Manufacturing overhead costs are, first, accumulated or "pooled" in this "control" account. Then, these "pooled" costs are "applied" to jobs, using a predetermined manufacturing overhead application rate. This "flow" of costs is presented in the below T-account, as follows:

Manufacturing Overhead

ACTUAL Costs are "Pooled"

Costs are **APPLIED** to jobs in work-in-process using a pre-determined manufacturing overhead application rate

In the below example, we will assume that the **ACTUAL** and **APPLIED** manufacturing overhead for the period were equal. This will rarely (or never) happen, in practice, but this first example will be simplified.

The predetermined manufacturing overhead application rate is budgeted or the result of a forecast and computed, as follows:

Estimated Total Amount of Manufacturing Overhead Cost for the Year
Estimated Total Amount of the Allocation Base

The denominator could be machine-hours (MH), direct labor hours (DLH), or some other appropriate application base (e.g., $10 per MH or $15 per DLH).

For now, do not be concerned with the manufacturing overhead application base or rate. Assume that some base or rate other than MH or DLH was used, and it was determined that 78% of the manufacturing overhead should be applied to Job A and 22% of the manufacturing overhead should be applied to Job B.

Focus on the below journal entry and the complete application of the manufacturing overhead balance of $50 ($1+$2+$47) to work-in-process.

Journal Entry - 5		
Work in process	$50	
Overhead		$50

Work in Process Completed & Transferred to Finished Goods

Raw material is an inventory account. Work in process is an inventory account. Finished good is an inventory account.

Job A, started during the prior period, has been completed at a cost of $65:

Job Cost Sheet - Job A	
Beginning balance	$20
Direct Materials	$2
Direct Labor	$4
Manufacturing Overhead	$39
Total	$65

Job A is transferred from work in process inventory to finished goods inventory, as shown in the below journal entry and T-account.

Journal Entry - 6		
Finished goods	$65	
Work in process		$65

Finished Goods Sold

Finished goods included $25 in beginning inventory and $65 of additional inventory was completed during the period, making the total amount of finished goods available during the period $90. Of this amount, $55 of finished goods was sold during the period.

The journal entry and T-accounts for this sale is provided, below:

Journal Entry - 7		
Cost of goods sold	$55	
Finished goods		$55
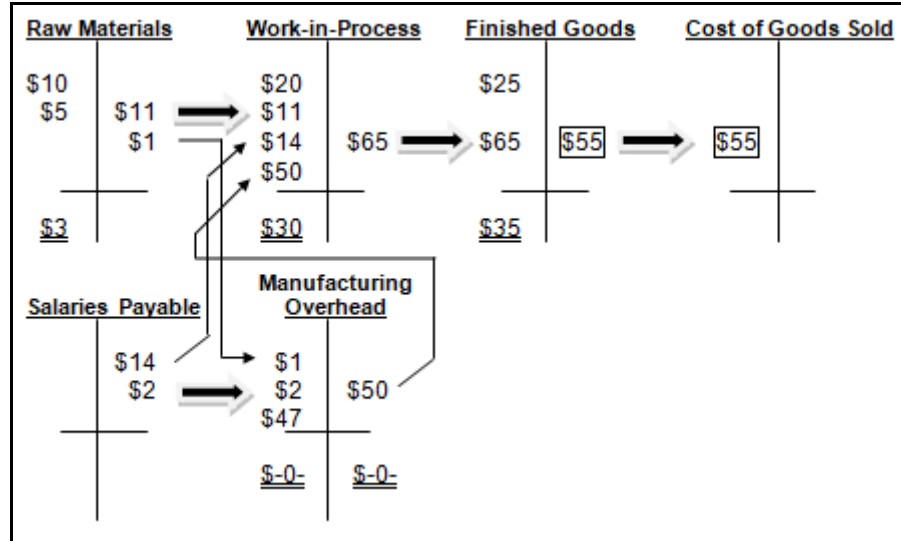
Assume that this inventory was sold for $90, as follows:

Journal Entry - 8		
Accounts receivable	$90	
Sales		$90

We can compute the gross profit for Job A:

Job A	
Sales	$90
Cost of goods sold	$55
Gross profit	$35

The above data for Job A is not only useful for costing and accounting, but provides a data base for future production runs. For example, let's assume that some time passes before another job comparable to Job A is completed. As long as this historical data is preserved in the firm's data base, it is retrievable for consideration when accepting another job or contract or deciding whether or not to continue to produce this product.

Additional Journal Entries for Revenues and Operating Expenses

Additional journal entries for operating expenses follow. These are not manufacturing or product cost-related, but are included for completeness, so that an income statement might be produced:

Journal Entry - 9		
Advertising	$1	
Other operating expenses	2	
Depreciation expense	4	
Salaries expense	5	
Accumulated depreciation		$4
Accounts payable		3
Salaries payable		5

Below is the basic schedule of cost of goods sold and income statement that would be developed from the above fact pattern:

Cost of Goods Sold:	
Cost of goods manufactured	$ 65
Finished goods available for sale	$ 90
Finished goods inventory, January 31	$ 35
Unadjusted Cost of goods sold	$ 55
Add/(Deduct) under-applied/(over-applied) overhead	-0-
Adjusted cost of goods sold	$ 55

The T-accounts are produced, again, below, just as a convenient reminder.

Below is the income statement:

Income Statement:		
Sales		$ 90
Cost of goods sold		$ 55
Gross margin		$ 35
Operating expenses:		
Advertising expense -	$1	
Depreciation expense -	$4	
Salaries expense -	$5	
Other operating expense -	$2	$ 12
Net operating income		$ 23
Other income/(expense)		-0-
Net income before tax		$ 23
Tax		$ 10
Net income		$ 13

Over- and Under-Applied Manufacturing Overhead (MOH)

The above example provides an oversimplification, where *actual* manufacturing overhead and *applied* manufacturing overhead are both, precisely equal, at $50. It is, however, a rare situation for actual expenses to precisely equal the budgeted or forecasted measure. Consider two additional alternatives:

- Alternative #1 (as previously shown): Actual MOH = $50; Applied MOH = $50
  This is the example provided above. In this case, the nominal or temporary manufacturing overhead account need not be closed out at the end of the period, as there is no balance in the account at the end of the period.

- Alternative #2: Actual MOH = $51; Applied MOH = $50
  In this case, actual expenses exceeded those budgeted (applied). The nominal or temporary manufacturing overhead account must be closed out at the end of the accounting period. The simplest closing journal entry is to close the balance to cost of goods sold, in this case *increasing* cost of goods sold, as follows:

Closing Journal Entry - 1A	
Cost of goods sold	$1
Overhead	$1

- Alternative #3: Actual MOH = $49; Applied MOH = $50
  In this case, actual expenses fell below those budgeted (applied). Again, the nominal or temporary manufacturing overhead account must be closed out at the end of the accounting period. The simplest closing journal entry, again, is to close the balance to cost of goods sold, in this case *reducing* cost of goods sold, as follows:

Closing Journal Entry - 1B		
Overhead	$1	
Cost of goods sold		$1

All three of the above alternatives are now presented in a schedule of cost of goods sold form. All three of the above alternatives are also presented in income statement form, where items below net operating income are added only for completeness:

	As Illustrated Alternative #1	Alternative #2 Journal Entry - 1A	Alternative #3 Journal Entry - 1B
Cost of goods manufactured	$ 65	$ 65	$ 65
Finished goods available for sale	$ 90	$ 90	$ 90
Finished goods inventory, January 31	$ 35	$ 35	$ 35
Unadjusted Cost of goods sold	$ 55	$ 55	$ 55
Add/(Deduct) under-applied/(over-applied) overhead	-0-	1	(1)
Adjusted cost of goods sold	$ 55	$ 56	$ 54

		As Illustrated Alternative #1	Alternative #2 Journal Entry - 1A	Alternative #3 Journal Entry - 1B
Sales		$ 90	$ 90	$ 90
Cost of goods sold		$ 55	$ 56	$ 54
Gross margin		$ 35	$ 34	$ 36
Operating expenses:				
Advertising expense -	$1 per unit			
Depreciation expense -	$4 per unit			
Salaries expense -	$5 per unit			
Other operating expense -	$2 per unit	$ 12	$ 12	$ 12
Net operating income		$ 23	$ 22	$ 24
Other income/(expense)		-0-	-0-	-0-
Net income before tax		$ 23	$ 22	$ 24
Tax		$ 10	$ 10	$ 10
Net income		$ 13	$ 12	$ 14

Job Order Costing for Service Firms Job order costing is also used for professional and service firms (e.g., law firms, public accounting firms, architectural firms, engineering consulting firms, and so on). In the case of professional or service firms, direct materials is likely to be insignificant and/or immaterial in dollar amount, and not cost-beneficially traced to the finished job, project or assignment. Instead, these costs are likely to be included in overhead.

For example, the direct materials for a public accounting firm preparing income tax returns is likely to consist of immaterial or insignificant (e.g., paper and toner for the printing of tax returns). While direct labor (or professional labor) is likely to remain quite significant and/or material in dollar amount and easily traced to the finished job, direct materials (e.g., paper and toner) are likely to simply be added to overhead.

Therefore, all of the job order costing techniques applied to manufacturing firms apply to professional or service firms, but the value is added through professional or direct labor and little or no value is added or originates from the raw materials or direct materials.

Review

- List the 3 classifications of inventory used in a manufacturing firm.
- Explain when and how period costs can become product costs and inventoriable.
- Produce a figure, using T-accounts, to completely describe the flow of costs in a job order manufacturing firm.
- Explain how under-applied or over-applied manufacturing overhead is dealt with at the end of an accounting period.
- Prepare a schedule of cost of goods manufactured.

True/False Questions

1. Raw materials inventory includes "inventoriable" costs like depreciation.
2. Work in process inventory includes "inventoriable" costs like depreciation.
3. Finished goods inventory includes "inventoriable" costs like depreciation.
4. Cost of goods sold includes "inventoriable" costs like depreciation.
5. Under-applied overhead during one period must be over-applied during the following period to correct the early period error.
6. Raw material and direct material are equivalent or the same thing.
7. Raw material and indirect material are equivalent or the same thing.
8. Direct material and indirect material both come out of raw material inventory.
9. Job order costing is most likely to be used in an oil refinery.
10. Process costing is most likely to be used in an oil refinery.

Appendix A

Intermittent or Atypical Production Costs

Intermittent or atypical production costs may include spoilage, rework or scrap.

In a service-oriented firm (e.g., law, public accounting or consulting), this might include that portion of direct labor (or professional labor or services) expended to develop expertise in a new area – effectively, a capital asset and anticipated the benefit the practice with respect to the acquisition of new clients as opposed to an expense.

In a public accounting or service firm, scrap, spoilage or rework might include what are referred to as "write-downs" to billings, below some standard or budgeted amount anticipated for a job or project. This might occur with a new or inexperienced staff accountant, where the same might occur with a new factory employee producing more spoilage or direct and indirect materials and require more direct and indirect labor hours when compared to a more experienced factory employee.

Classifications likely to be used for spoilage follow:

- *Spoilage* would consist of items failing to pass quality control standards.
  - o *Normal* spoilage would not be accounted for separately, but would be that portion of spoilage anticipated. Treated as part of the cost of the job or production run, typically as a charge to manufacturing overhead.
    - o *Specific* normal spoilage is that associated with a particular job or production run (e.g., inferior raw material input).
    - o *Common* normal spoilage is that associated with more than one job or production run (e.g., equipment failure or machinery breakdown).
  - o *Abnormal* spoilage is that amount of spoilage in excess of the normal amount anticipated. This amount would probably be accounted for separately to avoid including these amounts in historical job order cost documents that might be used in the future to bid on future production jobs.
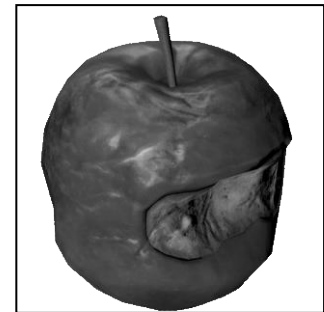
    Precisely the same pattern and classifications are repeated for rework, as follows:

- *Rework* would consist of items not beyond repair to meet quality control standards.
  - o *Normal* rework, just as is the case for normal spoilage, would not be accounted for separately, and would, again, include
    - ▪ *Specific* normal rework and
    - ▪ *Common* normal rework.

- o **Abnormal** rework, just as is the case for abnormal spoilage, is that amount of rework in excess of the normal amount anticipated.

- **Scrap** would consist of materials remaining, with little or no value. There really is no classification of scrap as abnormal, though a firm might refer to spoilage or rework as scrap. Like spoilage and rework, scrap would be classified as and include
  - o **Specific** (to a particular job or production run) scrap or
  - o **Common** (to more than one job or production run) scrap.

The following framework summarizes the above, where <u>specific</u> refers to a specific job or production run, <u>common</u> is associated with two or more projects, jobs or production runs:

> **Spoilage=(Specific + Common) Normal + Abnormal**
> **Rework=(Specific + Common) Normal + Abnormal**
> **Scrap=(Specific + Common) Normal**

Overtime
Overtime should also be viewed as an intermittent or atypical cost, and accounted for separately. Again, the purpose is to avoid permitting an unusual cost component from distorting measures in the historical job order costing data base, which might be used for forecasting or to bid in future jobs or projects.

Chapter 4
Process Costing

Learning Objectives
- Compare and contrast job order and process costing.
- Define conversion cost.
- Describe the flow of direct materials and conversion costs through a process costing system and how it differs from process costing.
- Compute equivalents units of production and allocate costs between the relevant balance sheet and income statement accounts under both weighted average and first-in, first-out cost flow assumptions.
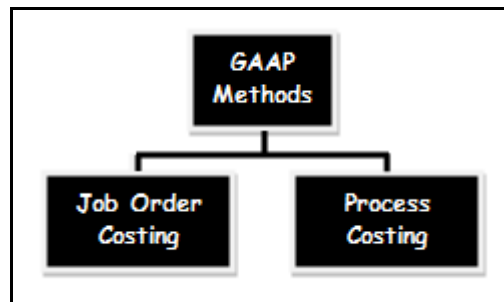
A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.
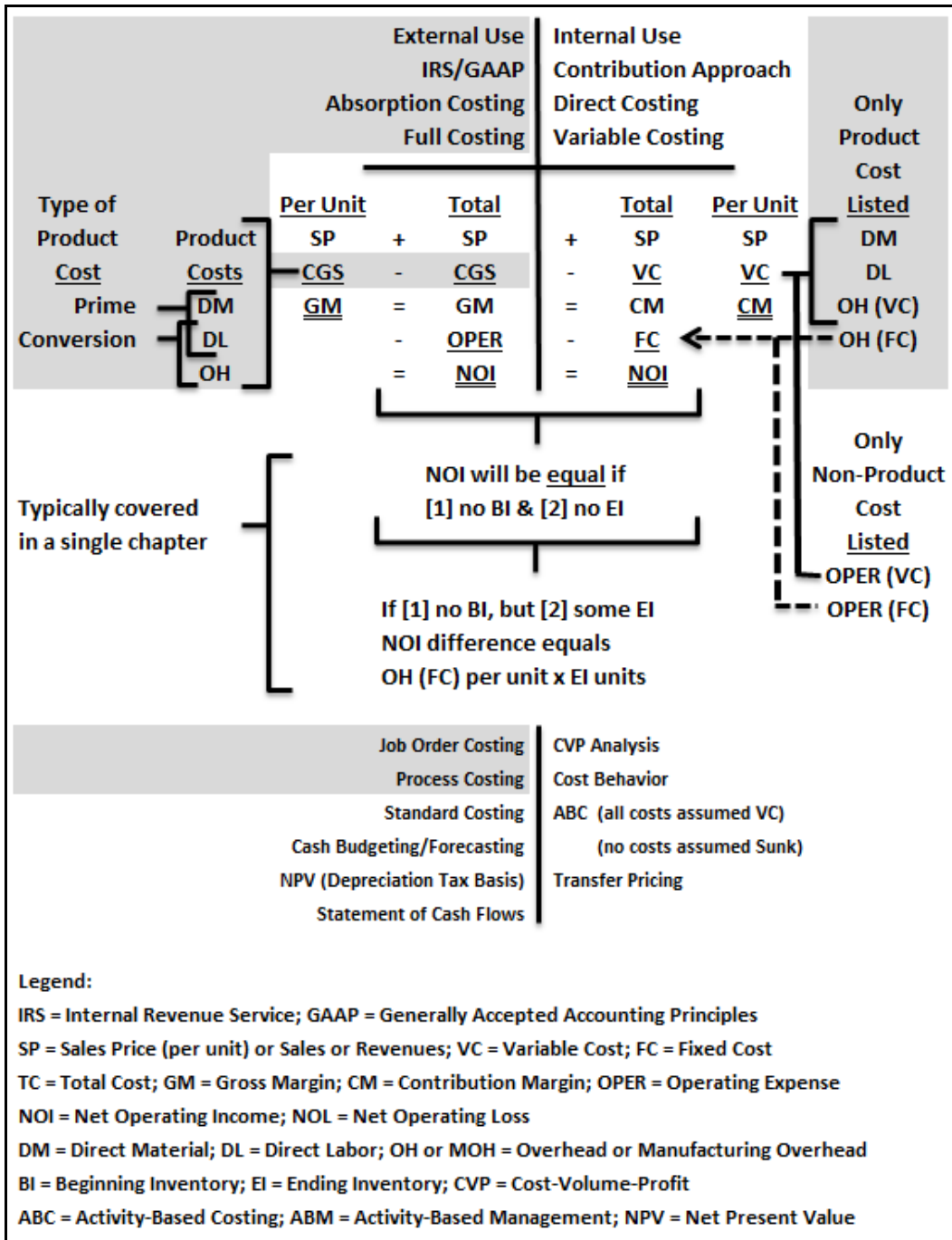
Job order costing is useful for furniture, automobiles, and even housing, but process costing is more appropriate for liquids or gases or "processes" where cost tracing must be accomplished by computing costs in terms of gallons or cubic feet or measures for non-solids.

A Review of the Mechanics of Job Order Costing
The following T-accounts represent a review of the basic mechanics of cost flows in a job order costing system:

An Introduction to Process Costing
In a process costing system, the finished good (output) from one department become the raw material (input) for a second (or later) department, where additional direct material, direct labor and manufacturing overhead may be added in the second department to complete the finished good. However, in most processes, the majority of the direct material is likely to be placed into work in process at the beginning of the process in the first department (e.g., crude oil for the production of and processing into gasoline).

Recall that DM + DL + OH = CGS and that DL + OH = CC, as follows:

DM + DL + OH = Product Costs = Manufacturing Costs = CGS

While value is added to a raw material to convert it into a finished good in both job order and process costing, it is common to combine the conversion costs (comprised of direct labor or DL and manufacturing overhead or OH) that add value or convert the raw material to the finished good in a process costing system.

Process costing uses *estimates* to determine the level of completion with respect to direct material and conversion costs (DL + OH) at the end of each accounting period and for each department. This is similar to the "percentage of completion method" taught in financial accounting at the intermediate level and, typically, used in the construction industry. The manufacturing firm, like a construction company, is constructing a finished good from a raw material. Like job order costing, process costing is GAAP.
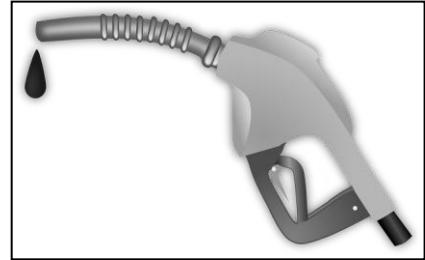
The following illustration is a simple process costing system with only 2 departments. The solid bold line is precisely the same as the T-accounts for job order costing, in substance. The flow of indirect material or IM and indirect labor or IL to manufacturing overhead or OH is not illustrated.
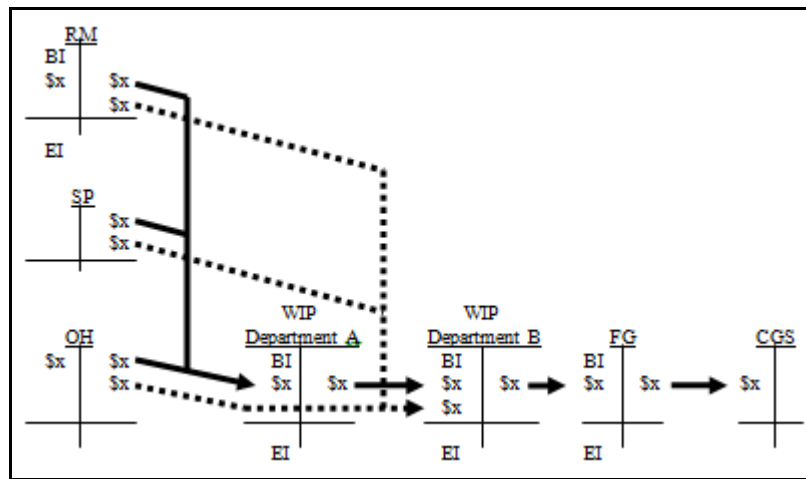
The difference is the dashed line, where additional direct material or DM and conversion costs (direct labor or DL and manufacturing overhead or OH) may be added as Department A finished goods or FG are transferred out of Department A and into Department B as Department B raw materials or RM.

Recall the basic cost of goods sold framework, but with some unique measures. The below format may be applied to units and/or costs. The lower portion allocates costs between the balance sheet or BS (units in ending inventory or EI) and the income statement or IS (units completed). This latter point is critical to your understanding of process costing. Just as the FIFO, LIFO and weighted average inventory cost flow assumptions and techniques in your introductory financial accounting course allocated costs between the balance sheet and income statement. This same concept and the same mechanics are also applied to process costing. In fact, you can apply the same logic to alternative depreciation techniques and many other alternative techniques in financial accounting.

	Beginning Inventory (BI)	2
add:	Purchases	3
equals:	Available	5
less:	Ending Inventory (EI)	1
equals:	CGS	4

Alter the format, but not the substance of the above, as follows:

Units in BI	2
Units started (similar to Purchases)	3
Units to account for (similar to Available)	5
Units completed (similar to CGS)	1
Units in EI	4
Units accounted for (similar to Available)	5

Equivalent Units

Process costing allocates costs based on equivalent units (EUs). The number of EUs will be different, depending on the cost flow assumption.

Recall, from your introductory financial accounting course, that there are alternative methods of accounting for inventory. Unlike a retailer like WalMart, our concern in this course is heavily weighted towards manufacturing. WalMart might use one of several cost flow assumptions:

(1) Specific identification,
(2) Weighted average (WAVG),
(3) First-in, first out (FIFO) and/or
(4) Last-in, first out (LIFO).

In process costing, specific identification is usually nothing less than impossible and LIFO is impractical. LIFO is not practical, because if any inventory "pool" drops to zero, the pool is eroded and all deferred gross margin from all prior periods is immediately realized. This eliminates any value associated with the use and application of LIFO, the purpose of which is the deferral of tax on inflationary profits.

We are left with 2 methods, and these techniques are, typically, the only cost flow assumptions covered in an introductory managerial accounting course. They are the WAVG and FIFO cost flow assumptions.

Equivalent Units – Weighted Average Cost Flow Assumption

The weighted average or WAVG cost flow assumption requires fewer computations, when compared to the first in, first out or FIFO cost flow assumption. Consider the same measures used in the above table, but increased and in 100 unit measures, as follows:

Units in BI	200
Units started (similar to Purchases)	300
Units to account for (similar to Available)	500
Units completed (similar to CGS)	400
Units in EI	100
Units accounted for (similar to Available)	500

We could just as easily view this information in the format used in your introductory financial accounting course, as follows:

	BI	$200
add:	Purchases	300
equals:	Available	$500
less:	EI	100
equals:	CGS	$400

The table that follows more fully develops the format used in a process costing system, where we will assume that the first step in the process (or department) began the period (or month) with 200 units that were 60% complete with respect to direct material or DM and 25% complete with respect to conversion cost or CC. At the end of the period, the same 500 units consisted of 400 units that were (100%) completed and transferred to the next step in the manufacturing process (i.e., the next department), but 100 of these units were, at the end of the period, only 20% complete with respect to direct material or DM and only 10% complete with respect to conversion cost or CC.

The below table summarizes these results, using the weighted average or WAVG cost flow assumption, where you might assume that the completion estimates are made by production managers or those outside of the accounting department. The work completed during the period is reflected by the equivalent units or EUs, separately computed for direct material or DM and conversion cost or CC, as follows:

WAVG	Units	Percent Complete DM	CC	Equivalent Units DM	CC
BI WIP (60%/25%)	200				
Units started	300				
Units to account for	500				
Units completed	400	100%	100%	400	400
EI WIP	100	20%	10%	20	10
Units accounted for	500				
Equivalent Units (EU)				420	410

Equivalent Units – First-In, First-Out Cost Flow Assumption

The first in, first out or FIFO cost flow assumption requires some addition computations, due to the separate components for the "units completed" component. FIFO assumes that the units completed first were the units in beginning inventory or BI. Any additional units completed were both started and completed during the period or month.

Consider the same measures used in the above table, but using the FIFO cost flow assumption. Focus on the separation of the "units completed" component into two components: (1) those units in BI that were completed during the period and (2) those units both started and completed during the period or month, as follows:

FIFO		Percent Complete		Equivalent Units	
	Units	DM	CC	DM	CC
BI WIP (60%/25%)	200				
Units started	300				
Units to account for	500				
To complete BI	200	40%	75%	80	150
Started & completed	200	100%	100%	200	200
EI WIP	100	20%	10%	20	10
Units accounted for	500				
Equivalent Units (EU)				300	360

The 400 units completed during the period are discussed below:

- The beginning inventory or BI was 60% completed at the beginning of the period or month with respect to direct material or DM. This means that, under FIFO, these units required an additional 40% of DM to complete them and send them to the next process or department.

- The beginning inventory or BI was 25% completed at the beginning of the period or month with respect to conversion cost or CC. This means that, under FIFO, these units required an additional 75% of CC to complete them and send them to the next process or department.

- The 200 units both "started & completed" during the period or month must, necessarily, have required 100% of both direct material or DM and conversion cost or CC to complete these units and send them to the next process or department.

Reconciliation of the weighted average or WAVG and first in, first out or FIFO equivalent units or EUs follows:

	Units		
WAVG EUs		420	410
FIFO EUs		300	360
Difference to Account for		120	50
DM difference	200		
200 units x (100% - 40%)		120	
CC difference	200		
200 units x (100% - 75%)			50
Difference Accounted for		120	50

A Combined Weighted-Average and FIFO Format for Equivalent Units
The following table combines the above WAVG and FIFO tables for the computation of EUs:

	Units	WAVG Pct Complete DM	CC	WAVG EUs DM	CC	FIFO Pct Complete DM	CC	FIFO EUs DM	CC
BI WIP (60%/25%)	200								
Units started	300								
Units to account for	500								
To complete BI	200					40%	75%	80	150
Started & completed	200					100%	100%	200	200
Units completed	400	100%	100%	400	400				
EI WIP	100	20%	10%	20	10	20%	10%	20	10
Units accounted for	500								
WAVG EUs				420	410				
FIFO EUs								300	360

Why Compute Equivalent Units?

Equivalent units or EUs are computed and represent the vehicle used for the purpose of allocating product costs (direct material or DM and conversion cost or CC) incurred during a period (or month) to ending inventory or EI in the balance sheet or BS and cost of goods sold or CGS in the income statement or IS. Recall the review of weighted average or WAVG and first in, first out or FIFO cost flow assumptions, where alternative cost flow assumptions result in different financial measures for ending inventory or EI in the balance sheet or BS and cost of goods sold or CGS in the income statement or IS, as follows:
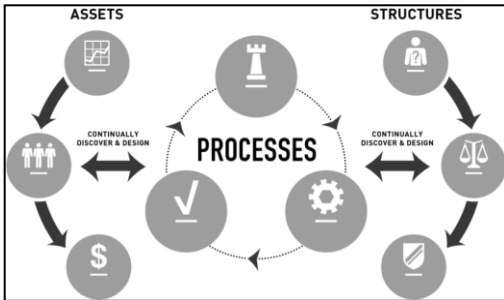
- 5 units were in BI at $1.10 per unit,
- 5 units were purchased during the period or month at $1.20 per unit,
- 5 units were sold (CGS in the IS for the period), and
- 5 units remained in EI (in the ending BS).

		Units	Unit Cost	FIFO	WAVG
	BI	5	$1.10	$5.50	$5.50
add:	Purchases	5	$1.20	$6.00	$6.00
equals:	Available	10		$11.50	$11.50
less:	EI	5		$6.00	$5.75
equals:	CGS	5		$5.50	$5.75

- There is no difference between these 2 cost flow assumptions for BI, purchases or units available, in this first period or start-up illustration.
- These different cost flow assumptions result in differences in allocations to the BS for EI and to the IS for CGS.

In process costing, the computation of EUs is a necessary first step to, then, compute the cost per EU and, based on this cost per EU, to use EUs to allocate costs between the BS to EI and the IS to CGS.

Cost per Equivalent Unit
Having computed EUs, under both WAVG and FIFO, we turn our attention to costs or expenses associated with production. The beginning inventory and "costs added this period" or purchases of direct materials and conversion costs have been developed for simplicity and to illustrate the differences between the WAVG- and FIFO-based costs per EU, as follows:

	Units	WAVG DM	CC	FIFO DM	CC
BI WIP (60%/25%)	200				
Units started	300				
Units to account for	500				
To complete BI	200	200	200	80	150
Started & completed	200	200	200	200	200
Units completed	400	400	400	280	350
EI WIP	100	20	10	20	10
Units accounted for	500				
WAVG EUs		420	410		
FIFO EUs				300	360
Cost of BI WIP		$6,000	$2,500		
add: Costs Added this Period		$36,000	$38,500	$36,000	$38,500
equals: TC		$42,000	$41,000	$36,000	$38,500
divided by: EUs		420	410	300	360
equals: Cost per EU		$100.00	$100.00	$120.00	$106.94

Note that the beginning inventory work in process cost is <u>not</u> included for the computation of FIFO-based EUs. The WAVG cost flow assumption includes and "averages" prior period costs with current period costs. The FIFO cost flow assumption does not average prior and current period costs, but isolates these costs, by period.

Alternatively, the WAVG- and FIFO-based cost flow assumptions both "match" (1) units to (2) costs. WAVG EUs for both direct materials and conversion costs include and match combined beginning inventory and current period work, or total costs to total EUs. FIFO EUs for both direct materials and conversion costs isolate and match the EUs work performed for the current period <u>only</u> to the costs added during the current period.

Focus on this "matching principle," which was introduced in your introductory financial accounting course, as the above, GAAP-based process costing approach and table is more fully developed, and these costs per EU are used to allocate costs between the balance sheet (ending inventory) and income statement (cost of goods sold).

Allocating Costs to the Balance Sheet and Income Statement
Weighted-Average
The following table illustrates how the EU measures and the costs per EU are used to allocate costs between the balance sheet (ending inventory) and the income statement (cost of goods sold), using the WAVG cost flow assumption:

WAVG		DM	CC	TC
	To complete BI			
	Started & completed			
	Units completed	400	400	
	EI WIP	20	10	
	Cost of BI WIP	$6,000	$2,500	
add:	Costs Added this Period	$36,000	$38,500	
equals:	TC	$42,000	$41,000	$83,000
divided by:	EUs	420	410	
equals:	Cost per EU	$100	$100	
	BS-:EI WIP:			
	EUs	20	10	
	Cost per EU	$100	$100	
	Cost of EI WIP	$2,000	$1,000	$3,000
	IS-Units completed			
	EUs	400	400	
	Cost per EU	$100	$100	
	Cost of units completed	$40,000	$40,000	$80,000
	TC allocated to BS & IS	$42,000	$41,000	$83,000

The ending inventory for work in process is $2,000 for direct materials and $1,000 for conversion costs. The ending inventory work in process measures for the current period or month will be carried forward as beginning inventory measures for the beginning inventory work in process for the next period or month.

The cost of goods sold (or cost of units transferred to the next department) is $40,000 for direct materials and $40,000 for conversion costs.

The entire $83,000 in product costs have been allocated between the balance sheet ($3,000) and the income statement ($80,000), under the WAVG cost flow assumption.

Allocating Costs to the Balance Sheet and Income Statement
First-In, First-Out
The following table illustrates how the EU measures and the costs per EU are used to allocate costs between the balance sheet (ending inventory) and the income statement (cost of goods sold), using the more complex, FIFO cost flow assumption.

The ending inventory balance for work in process is $2,400 for direct materials and $1,069.44 for conversion costs. These ending inventory measures for work in process for the current period or month will be carried forward as beginning inventory measures for work in process for the next period or month.

FIFO		DM	CC	TC
	To complete BI	80	150	
	Started & completed	200	200	
	EI WIP	20	10	
	Cost of BI WIP	$6,000.00	$2,500.00	$8,500.00
add:	Costs Added this Period	$36,000.00	$38,500.00	$74,500.00
equals:	TC	$42,000.00	$41,000.00	$83,000.00
divided by:	EUs	300	360	
equals:	Cost per EU	$120.00	$106.94	
	BS-EI WIP:			
	EUs	20	10	
	Cost per EU	$120.00	$106.94	
	Cost of EU WIP	$2,400.00	$1,069.44	$3,469.44
	IS-Units completed:			
	Cost of BI WIP	$6,000.00	$2,500.00	$8,500.00
	IS-Units completed:			
	To complete BI			
	EUs	80	150	
	Cost per EU	$120.00	$106.94	
	Cost of units completed	$9,600.00	$16,041.67	$25,641.67
	IS-Units completed:			
	Started & completed			
	EUs	200	200	
	Cost per EU	$120.00	$106.94	
	Cost of units completed	$24,000.00	$21,388.89	$45,388.89
	Units completed	$33,600.00	$37,430.56	$71,030.56
	TC allocated to BS & IS	$42,000.00	$41,000.00	$83,000.00

The cost of goods sold (or cost of units transferred to the next department) is, under the FIFO cost flow assumption, unlike the WAVG cost flow assumption, separated into 3 components:

1. The "cost of BI WIP," which was not used to compute the cost of EUs for the current period, is $6,000 for direct materials and $2,500 for conversion costs.
2. The cost allocated "to complete BI" is $9,600 for direct materials and $16,041.67 for conversion costs.
3. The cost allocated to the units "started & completed" during the current period or month is $24,000 for direct materials and $21,388.89 for conversion costs.

Combined, the cost to complete units for the period or month is $42,000 for direct materials and $41,000, just as it is under the WAVG cost flow assumption.

Cost Reconciliation - Weighted-Average & First-In, First-Out Cost Flow Assumptions
The following table summarizes the costs allocated between the balance sheet (ending inventory) and income statement (cost of goods sold or transferred out), under both WAVG and FIFO cost flow assumptions:

	WAVG	FIFO
Costs to be accounted for:		
BI WIP	$8,500.00	$8,500.00
Units started	$74,500.00	$74,500.00
TC to be accounted for	$83,000.00	$83,000.00
Costs accounted for:		
EI WIP	$3,000.00	$3,469.44
CGS or transferred out:		
Cost of BI WIP		$8,500
BI WIP completed		$25,641.67
Started & completed		$45,388.89
Above 3 Combined	$80,000.00	$79,530.56
TC accounted for	$83,000.00	$83,000.00

To reiterate, the FIFO cost flow assumption breaks cost of goods sold or transferred out into 3 separate components, because it "matches" current period or month EUs to current period costs. Therefore, the $8,500, in the above table, was not included in the FIFO method costs or EUs, but must be included when cost of goods sold or transferred out is computed.

Review

- List and identify process costing techniques.
- Describe conditions when job order costing and process costing are best used and distinguish between the 2 methods.
- List the 4 basic inventory cost flow assumptions and describe which 2 are most likely to be used in process costing.
- Explain why equivalent units are required in a process costing system.

True/False Questions

1. The easiest inventory valuation method under process costing is specific identification.
2. The easiest inventory valuation method under process costing is LIFO.
3. The easiest inventory valuation method under process costing is FIFO.
4. The easiest inventory valuation method under process costing is weighted-average.
5. Process costing is GAAP.
6. Process costing and job order costing both use equivalent units as a means of pooling costs for allocation.
7. Only job order costing uses equivalent units to pool costs and allocate them.
8. Only process costing uses equivalent units to pool costs and allocate them.
9. Process costing would represent an ideal technique useful to a contractor to assign costs to homes in a housing development.
10. Process costing would represent an ideal technique useful to an oil refinery with several departments or stages of production as crude oil is refined into gasoline.

Appendix A

Should a Public Accounting or CPA Firm Use <u>Job</u> <u>Order</u> Costing or <u>Process</u> Costing for Internal Management Purposes?

Mini-Case 1

At a meeting at your public accounting firm, one partner has proposed that those in the firm viewed the billable hours and revenue generation process as just that, a process. He used, as an analogy, the distinction between job order costing and process costing in a manufacturing firm.

Question for discussion: Is a public accounting firm more likely to be viewed as a <u>job</u> <u>order</u> costing or <u>process</u> costing environment? Support your position.

Mini-Case 2

In a later conversation, the partner taking the position that the public accounting firm is a ***process costing*** environment makes the following points:

- Process costing does not focus on direct materials, direct labor and manufacturing overhead, except within a department or stage of production.
- Process costing does not focus on raw materials, work-in-process, finished goods or cost of goods sold, as a job order costing system would.
- Like a process costing environment, an audit or tax return engagement moves through different departments or stages of production within the firm.

Chapter 5
Cost Behavior

Learning Objectives

- Understand how fixed and variable costs behave and might be used for forecasting the break-even point.
- Understand how the scatter plot, high-low and regression techniques are used to separate total and mixed costs into their fixed and variable components in the form of a cost equation.
- Understand that mixed costs are also referred to as semi-fixed and semi-variable costs, as they represent costs that contain both fixed cost and variable cost components.
- Distinguish between fixed cost and variable cost.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

		External Use IRS/GAAP Absorption Costing Full Costing		Internal Use Contribution Approach Direct Costing Variable Costing		Only Product Cost Listed
		Per Unit	Total	Total	Per Unit	
Type of	Product	SP +	SP	+ SP	SP	DM
Product Cost	Costs	CGS −	CGS	− VC	VC	DL
Prime — DM		GM =	GM	= CM	CM	OH (VC)
Conversion — DL		−	OPER	− FC	←	OH (FC)
OH		=	NOI	= NOI		

Typically covered in a single chapter

NOI will be equal if
[1] no BI & [2] no EI

Only Non-Product Cost Listed
OPER (VC)
OPER (FC)

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

Costs behave based on activity levels. The ability to forecast cost behavior based on some range or variety of activity levels assist the firm in planning.

The material covered in this chapter is most useful for internal decision-making, may be referred to by some authors as the *contribution approach*, but is usually referred to as *direct costing* or *variable costing*.

Cost behavior is examined to assist with forecasts. Forecasts may take the form of a cost equation, where total cost equals the fixed cost plus the variable cost, but all costs are not purely fixed or purely variable – they are mixed.

This chapter focuses on a few techniques used to separate total costs, presumed to be mixed, into fixed and variable components. This material should look familiar, even if you have not had a college-level statistics courses, and the fixed cost (or intercept) and variable cost (or slope) should be reminiscent of grade, junior high, and high school algebra course content.
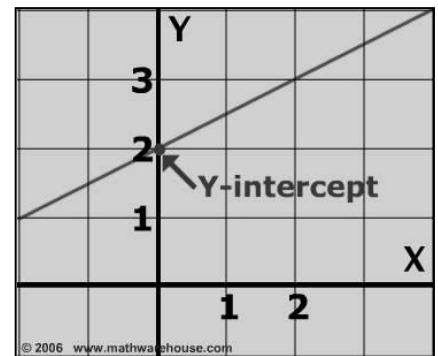
Introduction to Fixed and Variable Costs
A fixed cost (FC) is a cost that <u>does</u> <u>not</u> vary with a level of activity, within the relevant range (RR) of activity. A variable cost (VC) is a cost that <u>does</u> vary directly with a level of activity, within the RR of activity. A mixed cost (MC) is nothing more than a cost with both VC and FC components. Therefore, MC equal FC plus VC and/or total cost (TC) equals FC plus VC, as follows:

MC = FC + VC

and/or

TC = FC + VC

NOTE: Step costs may be viewed as variable, over very long relevant ranges, or fixed, where each step represents a separate fixed cost and relevant range.

Is total cost and mixed cost equivalent terms? Sometimes. Clearly, the total cost for a firm contains both fixed and variable components. Mixed costs also contain both fixed and variable cost components, but by definition.

A firm's total cost for rent may be a purely fixed cost and not a mixed cost. Alternatively, a firm's total cost for sales commissions may be a purely variable cost and not a mixed cost.

It really depends on just how narrow the focus is on cost behavior. The main point is that total cost may contain both fixed cost and variable cost components and mixed cost, by definition, contain both fixed cost and variable components.

An Illustration

The data below illustrates total cost (TC), fixed cost (FC) and variable cost (VC), in precisely the same hierarchy as the legend (e.g., the top line is the TC and the bottom line, with the same slope, is the VC).

Units	TC or MC	FC	VC
0	$5,000	$5,000	$0
1	$5,100	$5,000	$100
2	$5,200	$5,000	$200
3	$5,300	$5,000	$300
4	$5,400	$5,000	$400
5	$5,500	$5,000	$500
6	$5,600	$5,000	$600
7	$5,700	$5,000	$700
8	$5,800	$5,000	$800
9	$5,900	$5,000	$900
10	$6,000	$5,000	$1,000
11	$6,100	$5,000	$1,100
12	$6,200	$5,000	$1,200

An extended version of the above table was used to generate the Excel-based figure that follows:
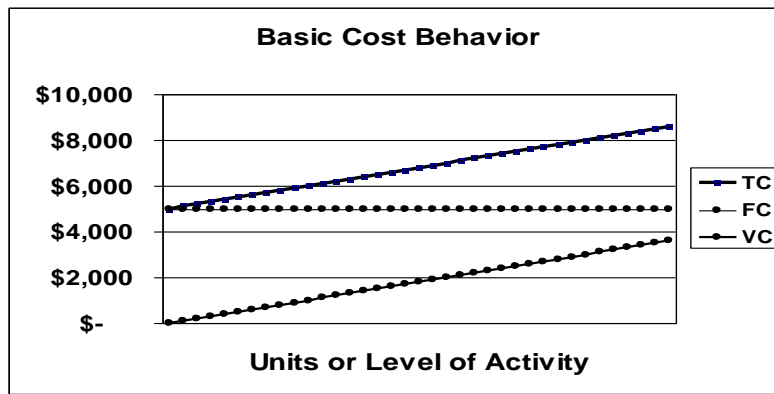
If you rent an apartment, your rent is probably both a periodic and a fixed cost. Your utilities are probably mixed costs with both fixed and variable components, as the utility company would probably charge you some form of minimum or fixed cost component even if you left town for a month or two and did not consume any electricity, natural gas, or watch any cable television programs. The same is true for firms, where minimal cost or expense levels represent the fixed cost component of a mixed cost. All of these cost behaviors change once outside of the range over which they hold constant or are relevant, where relevance only applies within the relevant range.

The fixed cost rent for a two bedroom apartment might be higher than that for a one bedroom apartment, but the fixed cost associated with the two bedroom apartment would represent a new relevant range. Similarly, the existing factory has a certain fixed cost that will increase, if the factory is expanded or if an addition to the factory were added, providing for a new or different relevant range.

Generally, direct material (DM) and direct labor (DL) are purely variable costs (VC) and manufacturing overhead (OH) is a mixed cost (MC), as follows:

Direct Materials (DM)	xx	$11	VC
Direct Labor (DL)	xx	14	VC
Manufacturing Overhead (OH)	xx	50	MC
Total Manufacturing Costs	xx	$75	

Again, it is noted that step costs may be viewed as variable, over very long relevant ranges, or fixed, where each step represents a separate fixed cost and relevant range

Cost Behavioral Analysis Includes Non-Product Costs
When examining cost behavior, we include product costs, but we also include non-product or operating costs (OPER). Therefore, keep in mind that product costs can be separated into variable cost (VC) components and fixed cost (FC) components.

Product Costs = Fixed Costs + Variable Costs

Operating Costs = Fixed Costs + Variable Costs

Total Costs = Fixed Costs + Variable Costs

Techniques for Separating Costs
Texts vary in their listing of techniques useful for separating mixed costs into fixed and variable components. Some recommend an "engineering approach" or an "account analysis" approach (e.g., scan the general ledger activity for an account and subjectively decide what the cost equation for FC and VC is for that particular general ledger cost or expense account). Generally, these are subjective techniques where different individuals are likely to reach different conclusions with respect to fixed cost, variable costs, and, therefore, the cost equation. These are not objective techniques and not further developed in this text. We are left, therefore, with three techniques, or even the latter two, as follows:
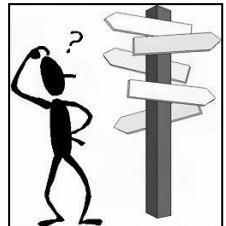
- Scatter plotGraph X,Y coordinates and draw a trend line
- High-LowUse the high and low points to draw a trend line
- RegressionUse Excel or other software to create an equation

Scatter Plots are useful and provide an opportunity to visualize cost behavior for reasonableness. For example, CPA auditors might generate scatter plots as part of an "analytical review" procedure to see if any atypical patterns or relations exist. This might assist them in development of the audit program and/or in providing assistance to the firm in preparing "reviewed" or "audited" financial statements.
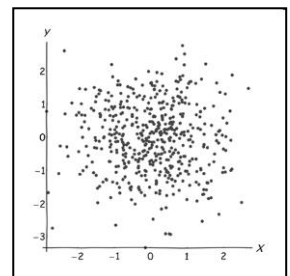
Statisticians might refer to these atypical observations as "outliers" or "extreme values." Sometimes these outliers or extreme values are "insignificant" or "significant"

(in statistics jargon) or "immaterial" or "material" (in accounting jargon). In any event, the existence of an outlier or extreme value is likely to have some impact on any cost equations, and should be investigated and corrected, if representative of an error, before a cost equation is developed for use or application for forecasting.

Using the same data introduced above, the below table illustrates just how a line graph developed from a scatter plot might be used to detect an "error" (unintentional mistake) or "irregularity" (intentional or fraudulent event) or an outlier.

Month	Units	Uncorrected TC or MC	Corrected TC or MC
Jan	1	$5,100	$5,100
Feb	2	$5,200	$5,200
Mar	3	$5,300	$5,300
Apr	4	$5,400	$5,400
May	5	$5,550	$5,500
Jun	6	$5,550	$5,600
Jul	7	$5,700	$5,700
Aug	8	$5,800	$5,800
Sep	9	$5,900	$5,900
Oct	10	$6,000	$6,000
Nov	11	$6,100	$6,100
Dec	12	$6,200	$6,200
	TTL	$67,800	$67,800

The focus is on a 12-month period or a full seasonal cycle, where you are asked to assume that this is monthly data (note that a month column has been added to the table). The scatter plot might lead the accountant or auditor to investigate the 5th (May) and 6th (June) months to correct the error on the firm's internal, monthly financial statements.

Assume that this financial information has been downloaded to an Excel file, a self-correcting error detected, and the auditor or firm's accounting staff merely corrects the errors for May and June in the Excel spreadsheet before developing any cost equations for internal forecasts or alternative uses.

Assume that some expense was overstated by $50 for May (i.e., uncorrected at $5,550 and corrected at $5,500) and understated by $50 for June (i.e., uncorrected at $5,550 and corrected at $5,600).

Note that the 12 month totals are the same at $67,800, so this error or irregularity would not come to the attention of an accountant or auditor if reviewing only *annual* measures.

Three different views are provided in the figures that follow:

> The first narrowly focuses on the 4 month period of April through July. It appears as though some form of self-correcting error occurred, where the error occurred in May and was corrected (or compensated for) in June. **4 months**, surrounding the May/June deviation from the trend
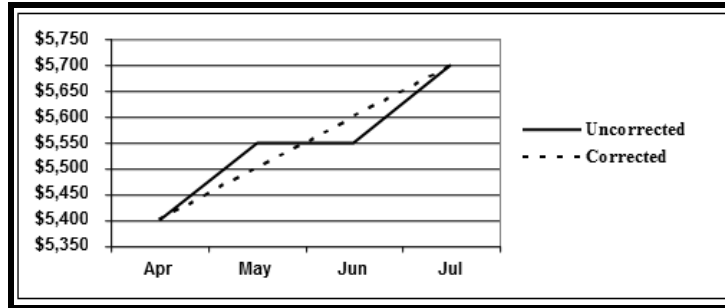
The second focuses on a broader period, ranging from March through August. The self-correcting May/June error remains visible on the line graph. **6 months**, surrounding the May/June deviation from the trend
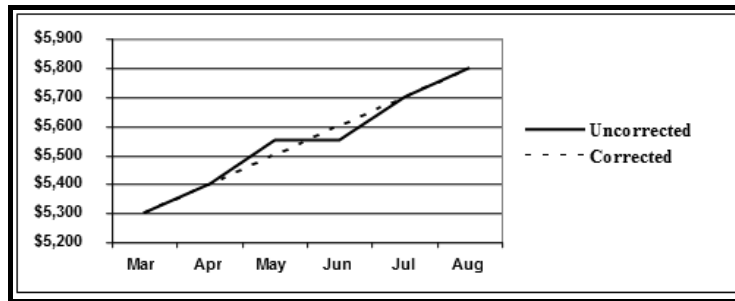
The third examines the 12 month period, where it is more difficult to visually detect the May/June error, irregularity or deviation from an otherwise perfectly linear trend, unless you know where to look or how to look for it. **12 months**, including the May/June deviation from the trend
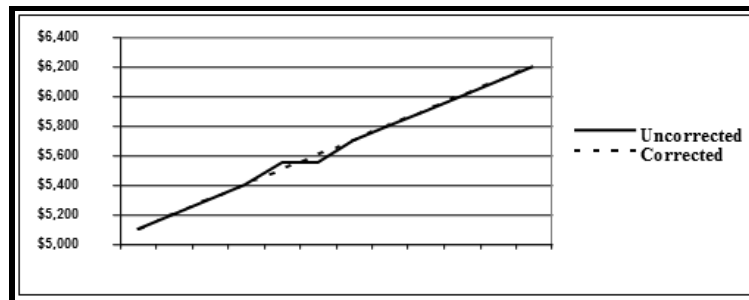
Scatter plots and line graphs will assist the accountant or auditor, internal or external to the firm, in detecting deviations that must be corrected before developing a cost equation for the firm's future use. While it is not likely that internal, historical financial statements would be restated, the correction would take place, perhaps in an Excel spreadsheet, prior to developing the cost equation for forecasting.

High-Low techniques use only the high and low measures (as the name suggests), and develops a cost equation or formula that may be used to forecast costs. Therefore, if there is an error or irregularity present in the high or the low measures, the cost equation or formula is fundamentally flawed. All non-high-low measures are irrelevant, as they are not used to develop the cost equation or formula under the high-low technique or method. Therefore, a firm with twelve months

of data, only uses n=2 observations to develop the cost equation. In the below case, the low month is January and the high month is December.

Month	x Units	Uncorrected y1 TC or MC	Corrected y2 TC or MC	y3 FC	y4 VC
Jan	1	$5,100	$5,100	$5,000	$100
Feb	2	$5,200	$5,200	$5,000	$200
Mar	3	$5,300	$5,300	$5,000	$300
Apr	4	$5,400	$5,400	$5,000	$400
May	5	$5,550	$5,500	$5,000	$500
Jun	6	$5,550	$5,600	$5,000	$600
Jul	7	$5,700	$5,700	$5,000	$700
Aug	8	$5,800	$5,800	$5,000	$800
Sep	9	$5,900	$5,900	$5,000	$900
Oct	10	$6,000	$6,000	$5,000	$1,000
Nov	11	$6,100	$6,100	$5,000	$1,100
Dec	12	$6,200	$6,200	$5,000	$1,200
	TTL	$67,800	$67,800	$60,000	$7,800

Again, using the same data introduced at the beginning of this chapter, the table above illustrates just what happens when the high-low technique is used.

The high-low technique uses only the high and low measures or matched pairs. High dollar amount ($H) less low dollar amount ($L) in the numerator, divided by the high unit or activity level (#H) less the low unit or activity level (#L) in the denominator are used to arrive at the variable cost per unit: ($H-$L)/(#H-#L)=VC, as follows:

$H	-	$L		
#H	-	#L	=	VC
$6,200	-	$5,100		
$12	-	$1	=	$100
TC	=	FC	+	VC
MC	=	FC	+	VC
Y	=	a	+	bX
		y-axis		
Y	=	intercept	+	Slope

A variety of formats, all representing the same, basic cost formula or equation, have been provided above.

Application of the high-low technique provides a solution of $100 per unit for the VC, but fails to detect the May/June error, irregularity or deviation from the cost behavioral pattern. Furthermore,

if the high or low measures contained errors or irregularities, the cost formula or equation would certainly be severely flawed and, if used for forecasting, would prove to be a very poor and misleading forecasting tool.

The FC must be equal under both high and low months or periods. In this case, the cost equation, for forecasting, as developed using the high-low technique or method, is TC or MC = $5,000 + $100X. Again, this same answer would result from using the uncorrected or corrected measures (see table, above), and the May/June error, irregularity or deviation from the pattern would simply go undetected.

Using the solution of $100 per unit for variable costs (VC), we can back into the fixed costs (FC) of $5,000 per month, as follows:

	High	Low
TC or MC	$6,200	$5,100
subtract VC per unit	$ 100	$ 100
multiply by units	x 12	x 1
equals VC (total)	$1,200	$ 100

Therefore,

TC or MC	$6,200	$5,100
less VC (total)	$1,200	$ 100
equals FC	$5,000	$5,000

Therefore, using the High, TC or MC = $5,000 + $100 (12) = $6,200 and, using the Low, TC or MC = $5,000 + $100 (1) = $5,100.

Accrual Accounting and the Matching Principle
In the above example, the high month was December and the low month was January. The high dollar amount and units or level of activity matched ($H = #H) and/or the low dollar amount and units or level of activity matched ($L = #L). However, there are cases where the high dollar amount and units or level of activity do not match ($H ≠ #H) and/or the low dollar amount and units or level of activity do not match ($L ≠ #L).

If the amount is immaterial or insignificant, some textbook authors recommend using the next closest measure to develop the cost equation or formula. However, if the highs and lows do not match and the differences are material or significant, the firm may not be using accrual basis accounting and/or their monthly financials are seriously flawed. If this is the case, no technique or method will achieve a useful cost equation or formula unless or until the underlying periodic measures are corrected to accrual accounting, using the matching principle.

Alternatively stated, use of the cash basis or any other method of accounting other than accrual will prevent the development of a useful cost equation or formula. Similar problems might appear in cases where TC, MC, FC or VC is unstable within the period under review (e.g., utility costs significantly rise or fall, and price levels reflect these changes within a period under review).

Ordinary Least Squares Regression

Ordinary least squares (OLS) regression provides a cost equation or formula, complete with a measure of *goodness-of-fit*. This measure is r-squared (R^2), which is also known as the *coefficient of variation*. As this latter name suggests, the R^2 measure quantifies the "amount of variation explained" by the cost equation, formula or model. Using the same data introduced at the beginning of this chapter, Excel was used to produce a cost equation and R^2 measure for both the uncorrected and corrected 12 month period, as follows:

| | | Uncorrected | Corrected | | |
| | x | y1 | y2 | y3 | y4 |
Month	Units	TC or MC	TC or MC	FC	VC
Jan	1	$5,100	$5,100	$5,000	$100
Feb	2	$5,200	$5,200	$5,000	$200
Mar	3	$5,300	$5,300	$5,000	$300
Apr	4	$5,400	$5,400	$5,000	$400
May	5	$5,550	$5,500	$5,000	$500
Jun	6	$5,550	$5,600	$5,000	$600
Jul	7	$5,700	$5,700	$5,000	$700
Aug	8	$5,800	$5,800	$5,000	$800
Sep	9	$5,900	$5,900	$5,000	$900
Oct	10	$6,000	$6,000	$5,000	$1,000
Nov	11	$6,100	$6,100	$5,000	$1,100
Dec	12	$6,200	$6,200	$5,000	$1,200
R-sq		0.997	1.000	-0-	1.000
Intercept		$5,002.27	$5,000.00	$5,000.00	$ -0-
Slope		$99.65	$100.00	$ -0-	$100.00

 (This introductory text does not illustrate the mechanics of the computation of the r-squared measure. However, *r-squared* or *coefficient of variation* might be searched or Googled and a variety of sources will provide insights into the mechanics involved in the computation of this *goodness-of-fit* measure. Alternatively, this material is covered in an introductory statistics course.)

The table, above, includes a new row, where y1, y2, y3, and y4 are the dependent variables and x is the independent variable. Reading from left to right or y1 to y4:

- The R^2 measure for the uncorrected data is 0.997 or 99.7 percent. This means that the cost equation explains 99.7 percent of the variation in y1, which is dependent on x. The y-axis intercept or FC for this cost equation is $5,002.27 and the slope or VC is $99.65. Recall that this uncorrected data has an error or irregularity for the May/June months.

  o The cost equation is TC or MC or **y1 = $5,002.27 + $99.65x**.

- The R^2 measure for the corrected data is 1.000 or 100 percent. This means that the cost equation explains 100 percent of the variation in y2, which is dependent on x. The y-axis intercept or FC for this cost equation is $5,000 and the slope is $100. Recall that this is the correct or corrected data.

- o The cost equation is TC or MC or **y2 = $5,000 + $100x**.

- What if we used a purely FC? The R^2 measure for FC is 0.000 or 0 percent. This means that the cost equation explains 0 percent of the variation in y3, which is dependent on x. The y-axis intercept or FC for this cost equation is $5,000 and the slope is $0. This is exactly the result that would make sense if we were checking on the variability of a pure FC.

  - o The cost equation is TC or MC or **y3 = $5,000 + $0x**.

- What if we used a purely VC? The R^2 measure for FC is 1.000 or 100 percent. This means that the cost equation explains 100 percent of the variation in y4, which is dependent on x. The y-axis intercept or FC for this cost equation is $0 and the slope is $100. This is exactly the result that would make sense if we were checking on the variability of a pure VC.

  - o The cost equation is TC or MC or **y4 = $0 + $100x**.

Other Cost Behavioral Considerations
FC is actually a *net* measure. For example, a fixed cost may be $1,000 per month, but fixed revenues of $100 may also be present (e.g., lease revenues for some portion of a building owned by a firm where it operates its business), where the *net* FC is actually $900 per month (i.e., *gross* fixed costs at $1,000 less *gross* fixed revenues of $100 equals *net* FC or FC of $900 per month). Therefore, just as CM is the net result of SP less VC, FC is actually the net result of FC and, if applicable, fixed revenues.

Other Regression Considerations
This introductory course chapter does not explore or address t-statistics and p-values for the independent variable or the overall F-statistic and p-value for the OLS regression-based model. It also does not address the use of multiple independent variables (which results in a multidimensional model) and/or the use of transforms (used to convert curvilinear models to a linear form). While these technical, statistical considerations represent an important part of your business education, they are best covered in your statistics courses and are not terribly useful in the day to day operations of the firm, where a very simple cost equation and the use of a single independent variable is desirable. However, some additional, very basic considerations warrant review.

Seasonality: The Use of 12, 24, 30 or 36 Months?
Generally, your statistics courses will recommend the use of a sample size of at least n=30. This is to satisfy the requirement for the presumption of a normal or Gaussian distribution under the central limit theorem. The use of 12 or 24 months would capture 1 or 2 complete seasonal cycles, respectively, but would not satisfy the required minimum number of 30 observations. The use of 30 months or observations would satisfy this statistical requirement, but would capture 3 six month periods (e.g., January through June) and 2 six month

periods (e.g., July through December). Therefore, for the purpose of statistically analyzing financial information, a minimum of 36 months would be desirable to both satisfy the minimum sample size requirement for the application of OLS regression, and the capture of a minimum of 3 complete seasonal cycles.

Review

- Define fixed cost and variable cost.
- Describe the methods used to separate mixed cost or total cost into fixed cost and variable cost components.
- In addition to the above, describe the strengths and weaknesses for method used.

True/False Questions

1. Fixed costs cannot be increased without Government approval.
2. Variable costs vary too much to be properly accounted for.
3. Regression is a technique used in psychology to develop information about past lives.
4. The high-low method is only applied when the accountant experiences severe mood swings.
5. The high-low method uses 2 observations to generate a cost equation.
6. Regression uses 2 observations to statistically generate a cost equation.
7. Regression uses all observations to statistically generate a cost equation.
8. A very high r-squared measure usually suggests that the cost equation developed via regression is reliable and can be used for forecasting future cost behavior within the relevant range.
9. A very high p-value measure usually suggests that the cost equation developed via regression is reliable and can be used for forecasting future cost behavior within the relevant range.
10. A very high overall F-statistic measure usually suggests that the cost equation developed via regression is reliable and can be used for forecasting future cost behavior within the relevant range.

Appendix A

Coverage of the High-Low Method in 15 Selected Texts

Complete citations are not included, but the table below contains page numbers in parentheses and the initials of the last names of authors (indicated in the "Text" column), from fifteen (15) cost/managerial accounting texts that were examined.

Five of the 15 texts (1/3rd) use 12 months in their comprehensive examples from the body of the relevant chapter, *providing for a single, complete seasonal cycle*. Therefore, the other 10 texts (2/3rds) must necessarily be assuming that they are not examining data from a business with any seasonality and/or fail to consider this possibility in their coverage. Of course, any presumption of the lack of seasonality suggests a low level of variance, and variance is necessary to generate the cost formula (e.g., no variance = no variable costs = completely fixed costs).
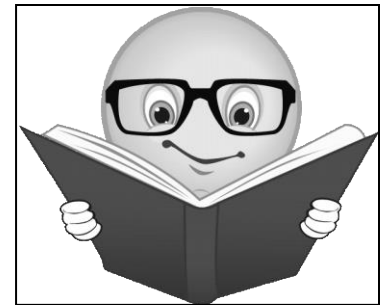
High-Low Example	Text
7-yrs (195)	BCCL
2-mos (220)	BGN
7-mos (204)	GN
12-mos (330)	HDF
12-mos (269)	H
10-mos (73)	HM
15-mos (438)	HMS
12-mos (99)	HSS
12-mos (118)	J
15-mos (351)	M
4-mos (45)	MDH
12-mos (221)	NC
7-obs (M131)	WJ
4-mos (193)	WKK
5-mos (94)	WRF

Texts using the 12 months examples represent small samples (e.g., n<30 and, therefore, central limit theorem problems may persist), where a minimum of n=36 is likely to be preferable (e.g., n>30, but increased to n=36 to capture 3 full seasonal cycles).

The 7 years example text (BCCL) is, in this respect, superior, though inflation, even at very modest levels, would suggest that any analyses based on "annual" measures might require adjustment for inflation (e.g., deflate (or inflate) measures from nominal to real terms before use to generate the basic cost formula of $y = a + bX$).

Note: years = yrs; months = mos; and observations = obs.

Appendix B

Supply Chain Management Techniques, Computing Storage Cost Reduction, and the Outsourcing of "Activities" to Emerging Markets

The vast majority of the content in this supplemental appendix was developed pre-2010. Simply Google key words or go to Wikipedia to get background or citations or additional information on any of the topics contained in this appendix.

Inventory includes raw material (both direct material and indirect material components), work in process and finished goods. While SCM represents a discipline quite separable from management accounting, it would be difficult to become a competent management accountant without some level of SCM expertise, and the reverse would also be true. SCM innovations and mechanics in their infancy, typically, preceded the cost-beneficial technological improvements (e.g., low cost computing speed and storage, as discussed below) that later provided for the application of the technique.

These software packages dealt, heavily, with inventory management (i.e., direct materials and indirect materials) and the reduction of carrying costs associated with raw materials and finished goods inventory storage. What might have been referred to as **production** or **operations** or **factory management** through the 1980s, came to be referred to as **supply chain management**, a growing field or discipline and degree program at some institutions, beginning in the early 1990s.

> **Production management = Operations management**
> **= Factory management = Supply chain management**

The cost of varying activities may be computed, cost-effectively, and non-value added activities may be identified and eliminated, while costly activities in one area of the world might be outsourced to lower cost providers, now referred to as emerging markets (EMs).

EOQ	Economic Order Quantity
ROP	Reorder Point
MRP	Material Requirements Planning/Manufacturing Resources Planning
MRP II	Material Requirements Planning/Manufacturing Resources Planning II
DRP	Distribution Requirements Planning/Distribution Resources Planning
FAX	Facsimile Transmission
EDI	Electronic Data Interchange
JIT	Just-in-Time
QR	Quick Response
CPR	Continuous Product Replenishment
ECR	Efficient Consumer Response
TOC	Theory of Constraints
VMI	Vendor Managed Inventory
ARP	Automatic Replenishment Programs
RF	Radio Frequency Systems
MES	Manufacturing Execution Systems
ERP	Enterprise Resources Planning
APS	Advanced Planning Systems
XDM	Extended Decision Management
CPFR	Collaborative Planning Forecasting and Replenishment
CRM	Customer Relationship Management
RFID	Radio Frequency Identification
ERP II	Enterprise Resources Planning (more of a supply chain/external focus)
ECM	Enterprise Commerce Management (same concept as ERP II)
6σ	Six Sigma
ABC	Activity-Based Costing & Activity-Based Management

The Evolution of Supply Chain Management Innovations

The above was adapted, modified and extended from Davis and Spekman, *The Extended Enterprise*. Supply chain management (SCM) techniques focus on the reduction or elimination of non-value added activities, streamlining processes, and reducing inventory and inventory holding or carrying costs. SCM techniques include the following:

(*Reengineering* was the term that preceded the separation of activities into value added and non-valued added classifications, where the firm was reorganized, including the modification, combination or elimination of jobs to achieve comparative or competitive advantage. Value chain analysis, a more contemporary term, where a careful study is made for each step in a process to determine just how each activity contributes to a firm's short- and long-term profitability.)
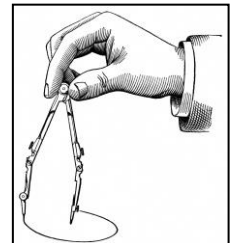
Each of the SCM techniques from the above table is discussed in greater detail, below:

Economic order quantity (EOQ) is an order quantity calculated to minimize the combined costs of acquiring and carrying inventory. It is also recognized as the Wilson EOQ Model or the Wilson Formula. The model was developed by F. W. Harris in 1913 but R.H Wilson contributed to its development in 1934. Oracle manages its inventory based on the EOQ for minimum and maximum quantities. The formula is:

$$EOQ = \sqrt{\frac{2(\text{Annual Usage in Units})(\text{Order Cost})}{(\text{Annual Carrying Cost per Unit})}}$$

Oracle corporation supply computes annual demand as the existing demand rate annualized by multiplying the present period demand estimate by the number of periods per year. The order cost is the purchase cost and the carrying cost is the holding cost per unit or the cost associated with having inventory on hand.

Oracle was founded in 1977 and has been using EOQ. However, EOQ predates Oracle's formation. EOQ is linked to SCM through the process of ordering the quantity of inventory necessary at the lowest cost possible in the production of a finished product for the customers.

Reorder point (ROP) planning is an automated system that allows managers to control when to reorder quantities without using reserved stocks. ROP uses demand forecasting to determine when to reorder by using quantities on hand, predicted sales, and receipts. It is designed to make managing inventory easier without time delays by sending an alert when inventory reaches the restock point. It may be used as an alternative to material resource planning (MRP) or Min/Max planning. Oracle's *ROP Planning* was launched in the 1960's.

Material requirements planning (MRP) is a software-based production planning and inventory control system used to manage manufacturing processes. The objective was to make sure that the appropriate levels of products/materials were available to satisfy the demands of production and customer delivery while maintaining the lowest possible level of inventory and related costs.

This was achieved through business forecasting and the thorough planning of manufacturing/purchasing activities and delivery schedules. MRP was discussed in the early 1970s and even the 1960s, while the date of establishment/recognition of MRP was 1976.

PeopleSoft was the first to start using the **distribution requirements planning (DRP)** on May 13, 1996. This began with a software development and distribution agreement that PeopleSoft signed with Red Pepper on June 19, 1995.

Facsimile transmission (FAX) is used to transmit images via telephone lines. While not common in American businesses until the late 1980s, the technology dates back to the nineteenth century. In 1843 in England, Alexander Bain (1818-1903) devised an apparatus comprised of two pens connected to two pendulums, which in turn were joined to a wire that reproduced writing on an electrically conductive surface. Many inventors after Alexander Bain improved fax devices. In 1850, a London inventor named F. C. Blakewell received a patent for the "copying telegraph." In 1860, a fax machine called the Pantelegraph (invented by Giovanni Caselli) sent the first fax from Paris. In 1895, Ernest Hummel a watchmaker from St. Paul, Minnesota invented his competing device called the Telediagraph. In 1902, Dr Arthur Korn invented an improved and practical photoelectric system fax. In 1914, Edouard Belin established the concept of the remote fax for photo and news reporting. In 1924, the telephotography machine (a type of fax machine) was used to send political convention photos long distance for newspaper publication. It was developed by the

American Telephone & Telegraph Company (AT&T). By 1926, RCA invented the Radiophoto that faxed by using radio broadcasting technology. In 1947, Alexander Muirhead invented a very successful fax machine. On March 4, 1955, the first radio fax transmission was sent across the continent.

The primary, initial users of the fax were newspapers that transmitted and received photographs from around the world. Weather services faxed weather charts around the world. Leading up to World War II, fax services were also used by the military to transmit maps, orders and weather charts. For many years fax machines were expensive, large and difficult to operate. Their use was primarily limited to large business and government. By the 1980s fax machines were designed to be smaller, faster and easier to hook up to existing telephone lines. The use of fax machines by small to medium enterprises (SME's) increased significantly during this period.

It has been estimated that there were approximately 50 thousand fax machines in the US in 1970 and 4 million by the end of the 1980's. Introduced to industry in the year 1985, and in an adaptive move, Oracle began using electronic documents with greater frequency. They teamed up with Xerox, the world's leading FAX maker, using *Oracle Premier Support* software. This helped Xerox maximize availability and lower operating costs.

Oracle created electronic software to transmit information. This reduced paper consumption from FAX transmissions. Oracle's *Siebel Mobile Solutions* connected mobile service professionals with accurate, up-to-date information.

Deployed over wireless phones, pagers, laptops, and handheld computers, it gave companies complete access to information. Oracle also created radio frequency identification (RFID) **s**oftware to send data to PDA's to eliminate paper.

Electronic data interchange (EDI) is the computer-to-computer exchange of business documents, such as purchase orders and invoices, between business partners and in a common format. This permits businesses to trade information electronically more inexpensively, accurately, and much faster, than is possible using a paper-based system. EDI replaces the faxing and mailing of paper documents, and has been under development in the US, in one form or another, since the mid-1960s.

The first to use EDI were the automotive and transportation industry in 1968, and the first set of EDI standards were developed by the transportation data coordinating committee (TDCC) in 1973. ANSI (American national Standards Institute) X12 standards (electronic numbers and formats) were developed later and based upon the TDCC format. Ocean, motor, air, rail carrier, and the associated shippers, brokers, customs, freight forwarders, and bankers put EDI into practice in 1975. Private sector companies in the US included Federal Express, Wal-Mart, General Motors, American Airlines, Nike, Staples, Nations Bank, JC Penney, and others are among the approximate 300,000 firms using EDI. Manufacturing, shipping, warehousing, utilities, pharmaceuticals, construction, petroleum, food processing, and health care are industries using EDI to streamline distribution and improve efficiency.

EDI recognizes when inventory is low and orders more with a reorder system without any human initiation, coordinates the transaction, prepares deliveries, and procures the invoices, using a form similar to e-mail. Alternative includes build their own systems or work with a VAN (value added network) provider. Most VANs also provide a network on which to transmit information (e.g., internet banking).

Just in time (JIT) is a business strategy that reduces costs by keeping only the necessary level of inventory on hand. By acquiring raw materials as needed, or "just in time," both beginning inventory or raw materials and finished goods inventory storage costs are significantly reduced, creating a comparative advantage. JIT can be accredited for the contemporary successes of companies like Southwest Airlines and Dell Computers. Prompted by multinational growth and globalization, JIT software was created to meet the demand for cost-saving software.
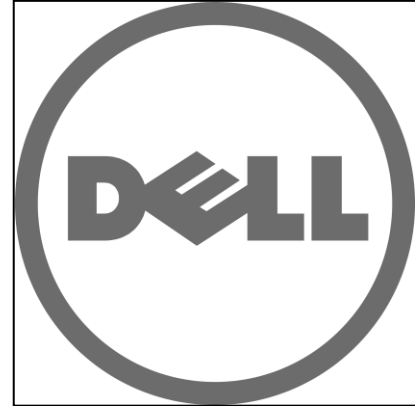
- **1799:** Eli Whitney, who would go on to invent the cotton gin, perfects the concept of interchangeable parts. He was contracted by the US Army to manufacture 10,000 muskets at $13.40 each.

- **1890s:** Frederick Taylor conducts time studies of individual workers, methods, and standardized activities that he referred to as "scientific management."

- **1910s:** Henry Ford applies JIT to manufacturing at Ford Motor Company. He described his success in *My Life and Work* (1922):

  "We have found in buying materials that it is not worthwhile to buy for other than immediate needs. We buy only enough to fit into the plan of production, taking into consideration the state of transportation at the time. If transportation were perfect and an even flow of materials could be assured, it would not be necessary to carry any stock whatsoever. Carloads of raw materials would arrive on schedule and in the planned order and amounts, and go from the railway cars into production. That would save a great deal of money, for it would give a very rapid turnover and thus decrease the amount of money tied up in materials. With bad transportation one has to carry larger stocks."

  It was JIT that allowed Ford to contribute to the war efforts in the 1930s at his Willow Run Bomber plant that built "a bomber an hour."

- **1950s:** Toyota Motor Corporation adopted JIT not from Ford, but from Piggly Wiggly grocery stores, while touring US businesses. JIT is often referred to as TPS or Toyota Production Systems.

- **1980s:** US companies like Kawasaki and General Electric begin to use JIT.

Oracle uses JIT through a system of logistic inventory visibility (LIV) to maintain control of their supplies. This single system assists Oracle through monitoring of the motions of the supply chain. LIV also helps Oracle to manage its inventory. Oracle launch dates for versions of their transportation management software occurred on February 7th, 2006, and September 12th, 2006. A newer transportation management version was launched on April 7th, 2009.

Quick response (QR) is also known as rapid response, and gathers and transmits information about consumer tastes and preferences, quickly modifying production decisions to reflect changes in a timely fashion. When first used in the late 1980s, QR focused on lead time reduction in every aspect of manufacturing in the clothing industry.

QR is likely to be more valuable to firms manufacturing a wide variety of products with significant demand volatility. For the fashion industry, the primary benefit of QR arises when timely sales-related information is used to modify forecasts and, therefore, reduce forecasting errors. Likely benefits include quality enhancement, cost reduction, target audience flexibility, and rapid delivery.
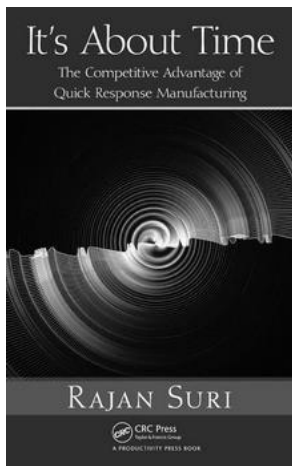
QR was developed in 1985 to sustain competitive advantages by reducing inventory levels, improving merchandise quality, increasing worker productivity, increasing stock turnover, and reduce merchandise markdowns and inventory costs. Rajan Suri was the first to implement QR and, in 1993, founded the Center for Quick Response Manufacturing at the University of Wisconsin. In 2006, Rajan Suri won the Albert M. Sargent Progress Award.

Firms using QR have enjoyed reductions in lead-times by as much as 50% or more in manufacturing, produce development, sales, and office operations. Barcodes and website URLs accelerate flows of information, which can be read by devices with cameras, including cell phones.

Continuous product replenishment (CPR) was introduced in the grocery industry in the late **1980s**. Retailers used an Electronic Data Interchange (EDI) to transmit its inventory information to a supplier on a daily basis. Suppliers used this information to determine the amount of inventory necessary to ship to the retailer. ORACLE produced an updated form of CPR in their Collaborative Planning, Forecasting, and Replenishment (CPFR), first launched in 1998 and revised in 2004. CRP facilitates EOQ.

An updated form of CPR is continuous replenishment program (CRP). CRP is a part of CPFR. CPFR maintains low inventories, reducing costs and keeping supply in relation to demand to achieve faster inventory turnover. Other benefits include improved customer service, decreased stock-outs, improved warehouse efficiency, and enhanced perception of value (Intentia).

Associated with CPR is vendor managed inventory (VMI). VMI is an arrangement where the supplier, not the customer, decides when and how much of the customer's stock is replenished. It is a cost reduction measures that maintains low inventories throughout the supply chain.

Efficient consumer response (ECR) can be traced to 1962 to a grocery manufacturer's association (GMA) executive conference workshop, and it has changed the face of the industry since launched in 1993. Beginning with the Universal Product Code (UPC) and scanning in the late 1980s and early 1990s. An ECR working group was formed by industry leaders in 1992 to study ways to provide even greater value to consumers:

- **Efficient Assortment** - revision of categories for increased customer satisfaction and optimization of product profitability and known as category management (CM).
- **Efficient Product Introduction** - cooperation of commerce and industry for a common development and introduction of new products.
- **Efficient Replenishment** - optimization of the logistics chain by replacing the *push* with *pull* strategies and known as continuous replenishment (CR).
- **Efficient Promotion** - replacement of the stock-up system with large quantities and campaign prices by an efficient common purchase policy.

Theory of constraints (TOC) focuses on improvements in critical success factors (CSFs), including cycle time, rates at which raw materials are converted to finished goods, and the

elimination of bottlenecks. Dr. Eliyahu M. Goldratt's TOC originates from a limited scheduling program based on a proprietary algorithm called optimized production technology (OPT). In 1979, he brought OPT to the US and developed it to form a company called Creative Output, Inc. The software and philosophy of OPT were utilized to construct the foundation of TOC. His book, *The Goal*, was initially published in 1984 and revised and released again in 1986, 1994, and 2004. It describes the TOC manufacturing management philosophy to help corporations improve the rate of conversion from raw materials to finish products. TOC states that every firm has at-least one constraint (internal resource, market, or policy) at any time that prevents a system from achieving optimal performance. These constraints create bottlenecks where completed products accumulate as they await processing. There are five steps that TOC uses to eliminate the bottlenecks and generate more throughputs:
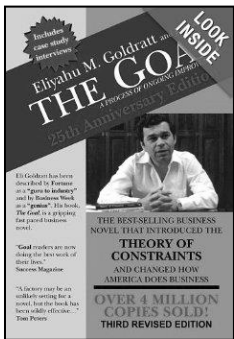
[1] Identify the constraint;

[2] Decide how to exploit the constraint
[3] Subordinate all other processes to above decision
[4] Elevate the constraint
[5] If, as a result of the first four steps, the constraint reappears, repeat the sequence.

Implementation of TOC will achieve increased profits by increasing outputs through buffering the constraint or altering the product mix.

According to Dr. Eliyahu M. Goldratt's website, Goldratt.com, "The core constraint of virtually every organization The Goldratt Institute

has worked with over the past 16+ years is that organizations are structured, measured and managed in parts, rather than as a whole." This assumption causes various constraints or problems in an organization such as decreased output, financial hardships, and increased difficulty in gaining a strategic advantage. One reason why companies encounter bottlenecks in their operations is because they fail to look to the future, and they're consumed merely by their short-term performance. Goldratt warns not to let inertia become the constraint.

Another important tool for managing product flow in the third of the five steps of TOC is the drum-buffer-rope (DBR) system. The DBR is defined as a system for balancing the flow of production through a constraint, thereby reducing the amount of inventory and improving overall productivity.

To explain this system, the drum is the constraint, and all production flows are synchronized through it. The rope is all processes up to and including the drum. The objective is to balance the flow of production throughout the rope with effective timing and scheduling. The buffer protects the drum so that work is always flowing through it. This system maximizes workflow and productivity through your constraint.

Vendor managed inventory (VMI) originated in the 1990s as a supply chain cost reduction technology. It is when the inventory of a distributor is managed by the vendor (manufacturer). Historically, many distributors placed orders for products at on specified days or dates. With VMI, the manufacturer controls this function, as the distributor sends or provides access to sales date and inventory levels, electronically.

The distributor enjoys a reduction in administrative or ordering costs and order errors are reduced. The effectiveness of promotions and the identification of and reactions to stock overages and obsolete or slow-moving inventory is facilitated and greatly accelerated.

Oracle's E-Business Suite allows a firm to run a VMI system. E-Business Suite 11i was originally released in 2000, where it was the first fully integrated e-business applications bundle. The software package allows the distributor to share inventory levels with key trading partners (or manufacturers) and can be configured to interface with almost any firm. This automated system will send notifications to suppliers when inventory is low, reducing stock-out risks. This system analyzes inventory trends allowing it to forecast future sales more accurately.

The distributor controls the timing and size of the order being placed and maintains the inventory plan and optimal levels. The manufacturer receives electronic data (usually via EDI or the internet) that describes sales activity and inventory stock levels. The manufacturer, not the distributor, generates the purchase order.

VMI reduces waste, as manufacturers generate only what the distributor needs at any point in time. As the distributor enjoys sales, the manufacturer receives this information and produces only what is required.

The first version of the **automatic replenishment program (ARP)** was created by Jean-Pierre Dechirot in 1986. ARP seeks to make inventory management more efficient. Scanning the

product that owns its own bar code or label, corresponding data are input to a calculator that automatically determines the quantities of goods to be ordered.

ARP systems may restock inventory based on actual demand rather than on estimated long-range forecasts. Shorter product development cycles and global-based competition have made it more difficult to successfully manage demand and creates an opportunity for automation. Actual sales figures and buyer-supplied information triggers replenishment. This requires close cooperation between retailers and manufacturers.

Point-of-sale (POS) data are typically collected at the retail level and transmitted to the supplier. The supplier is then able to respond to demand on a just-in-time (JIT) basis. Replenishment is triggered by actual sales figures rather than by manual ordering based on stock counts. Too often product availability and order quantities fail to match up resulting in problems including excessive inventory investment, poor customer service, lost sales opportunities, and production scheduling issues. Thus arbitrary loading of the supply chain is wasteful and ultimately expensive. Retailers want high-volume, high-turn items delivered on a JIT basis.

When inventory is accurate and customer service levels rise and carrying costs, labor costs, and inventory write-offs are reduced. Popular automatic replenishment programs include continuous replenishment planning (CRP) and vendor managed inventory (VMI), which are very similar, except t vendor assumes responsibility for deciding what and when to ship.

Industry-specific automatic replenishment programs have also been developed. For example, efficient consumer response (ECR) is widely used within the grocery industry and quick response (QR) programs are common in the apparel industry. The intent of ARPs is to make inventory commitment more efficient through precise planning and replenishment practices.

The first **radio frequency (RF)** system was the "wireless telegraph" (radio), but extensions include television, cell phones, radar, navigation, digital radio, microwave ovens, and equipment used in surgical procedures. RF dates back to the 1890's with experiments using electricity. In 1896 Guglielmo Marconi was awarded the British patent for the radio, and in 1897 started the world's first radio station in England. In 1906 after the invention of the vacuum tube detector the first radio program broadcast took place from MA. The microwave oven became widespread in the 1970's and 1980's invented by Percy Spencer (in 1945 Spencer was building radar sets when he realized while working his peanut chocolate bar in his pocket was starting to melt).

By late 1946, the Raytheon Company filed for a patent to mass produce microwave ovens for the purpose of cooking food. It was in 1947 when the first commercial microwave oven, known as the "Radarange," became available to the public. As the decades went on, technological

advancements helped make the microwave oven become more cost efficient. In 1975, microwave oven sales surpassed the sales of gas, and in 1976, microwave ovens became more commonly owned kitchen devices than dishwashers.

The **manufacturing execution system (MES)** creates a paperless system for discrete manufacturing processes. Oracle released *Workbench* on April 2, 2007, allowing the shop floor to be paperless, with real time paperless clock-in/out, error reduction, and/or non-truths in reporting hours worked. MES gathers and records information about current operations and can be used in decision making for future batch production.

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It holds in its memory, the quantities used/needed for certain batches, allowing standard setting and price control, and assists in the determination of required inventory levels and the timing of their introduction of required quantities and process into the manufacturing process. It also has features to assist in hedging for inputs with increasing costs. Barcodes and labeling provides for this paperless system.

Enterprise resource planning (ERP) systems grew out of material requirements planning (MRP) systems. Before ERP systems were introduced, each department (e.g., accounting, human resource, and marketing) might have had their own, separate and incompatible computer networks. ERP systems computerize and optimize business operations by providing interfaces for (at least two separate) systems into a single system.

An ERP is operationally defined as a system that improves functionality to one unit that would otherwise require the use of multiple systems, and include payroll and accounting. The first such system was MRP in 1975.

ERP followed in the early 1990s. ERP systems may cost as little as a few hundred thousand dollars to millions of dollars. The top 10 ERP systems are: [1] Microsoft Dynamics AX 2009, [2] SAP R/3, [3] SAP Business One, [4] Infor ERP XA, [5] Net Suite, [6] Exact Software, [7] Syspro, [8] Accpac, [9] Epicor, and [10] Excel ERP.

ERP was introduced by a research and analysis firm by the name of Gartner in 1990. Some examples of models in an ERP are supply chain management (SCM), product lifecycle management, and customer relationship management (CRM). In the early 2000's the term ERP II was used to describe the next generation of ERP software, which was web-based.

Examples of ERP software vendors are Oracle, Infor, Microsoft, SAP, and IFS. Also, see *top10erp.org* for a listing of the top ten ERP vendors and software. Quick Books may also be categorized as an ERP, since it provides both accounting and payroll functions.

With **advanced planning systems (APS)**, management is able to look at customer requirements in nearly real-time, and modify production and inventory requirements. APS is used to forecast or predict what might occur under a variety of "what-if" scenarios for manufacturing and distribution firms. An APS delivers an improved information flow, which results in reduced inventory

requirements, improved on-time delivery, and reduction in expedites and reschedules both on the shop floor and at supplier levels. It extends to the vendors and customers that make up an integrated supply chain, where vendors have made significant architectural and functional improvements to APS systems, adding additional capabilities such as improved collaboration works flows, pricing optimization and analytics, and even adding web service platforms to improve inter-enterprise access and greater interface capabilities.

Starting in 2001 and then accelerating in 2002, APS implementation time frames started dropping across the board. For example, in 2000, a production planning/scheduling solution, on average, required nearly 10 months to implement. By 2002, this cycle had dropped to only 6 months. Reduced project time results in lower project cost and faster time to revenue generation, which leads to increases in project ROI.

Users report that their use of APS software is critical for gathering more fundamental results and results in favorable business transformation. It has been credited with significantly increasing market share, capturing and keeping these customers and customer segments, achieving significant process improvement, such as sales and operations planning processes, and contributing to the globalization and integration of supply chains.

IBM led the production of APS, launching their software in the early to mid-1980s. Inspired by IBM's launch of advanced planning systems, Oracle followed shortly after, launching the software in the mid- to late-1980's. Although IBM started the trend of APS, Oracle later became the frontrunner in the industry. Oracle, however, attributes much of its success to the software originally created by IBM, as their software served as a model for the APS industry. Firms providing software used for forecasting, planning, and budgeting include: Oracle, Microsoft, SAP AG, IBM, Adobe Systems, CA, and Intuit.

Supply chain management (SCM) is the process and oversight of raw materials through production to the end consumer, whether it is data or physical product. The most cutting edge technology in SCM allows for businesses to make decisions quickly and precisely. **Extended decision management (XDM)** facilitates accurate and timely decision-making.

The two primary form of SCM are (1) planning applications and (2) execution applications. Both are included in XDM. It is extremely helpful for real-time applications.

Before a decision is required, there is already a decision rule or algorithm available for immediate access and application. For example, credit card companies use XDM-based algorithms for fraud detection. By using XDM software, some financial professionals were able to avoid wealth reductions associated with stock prices decreases during the fall of 2008, liquidating investments before the stock market decline.

XDM continuously improves the targeting, relevance and results of decisions, and connects decisions across customer views, functions and channels to maximize value, where the goal is to

increase customer profitability, build stronger customer relationships, reduce fraud and credit risk, and lower the cost of decision-making. XDM works by combining data, business rules and advanced predictive analytics. Today, this might be referred to as "big data." It gives most critical highly important decisions greater precision, consistency and agility drawing new measures of value from decades of IT events.

Collaborative planning, forecasting, and replenishment (CPFR) enhances supply chain integration by supporting and assisting joint practices. It allows information to be shared between suppliers and provides for continuous updating of inventory and upcoming requirements, and makes the end-to-end supply chain process of a company more efficient. CPFR originated in 1995 as an initiative by the vice president of Wal-Mart and was called collaborative forecasting and replenishment or (CFAR). In 1996 there were about 20 major companies using this method including Wal-Mart, Nabisco, Sears, J.C. Penney, and Gillette. CFAR was introduced to the Board of Directors of the voluntary inter-industry commerce standards committee (VICS). VICS established an industry committee to prepare for rolling CFAR out as an international standard. Based on the suggestion of Procter & Gamble's vice president of supply chain, the standard was renamed CPFR to emphasize the role of planning in the collaborative process.

CRM Software (millions of US$)				
Company	2008 Revenue	2008 Market Share (%)	2007 Revenue	2007 Market Share (%)
SAP	2,055	22.5	2,072	25.5
Oracle	1,475	16.1	1,320	16.2
Salesforce.com	965	10.6	676	8.3
Microsoft	581	6.4	332	4.1
Amdocs	451	4.9	419	5.2
Others	3,620	39.6	3,311	40.7
Total	9,147	100.0	8,130	100.0

Source: Gartner (July 2009).

Oracle was the market share leader as a vendor of **customer relationship management (CRM)** software, from the time when they first launched their product in 2001. Since the acquisition of Siebel Systems, Inc. in 2006 for $5.85 billion, Oracle has been doing increasingly well. Siebel was the leading provider of CRM software at one point, making them a very strong competitor. Once Siebel was acquired by Oracle, Siebel became the foundation for Oracle's CRM strategy. With any acquisition, a product line may suffer, but this acquisition seemed to bring significant growth to Oracle's share; a little more than that of SAP. SAP also reports in Euros and then converts into US$. Because the US dollar had declined in value, relative to the Euro, SAP may look larger due to exchange rate variations.

Oracle was the largest in business software, with SAP in second place. As of November 15, 2008, Oracle appeared to be doing well when compared to SAP AG. Oracle acquired Sun Microsystems, in April of 2009 for $7.4 billion, including Sun's two major assets, Java and Solaris.

Oracle released Accelerate in 2006; improved as recently as September of 2009, with demand planning, product lifecycle management, and business intelligence (*Oracle CRM On Demand*). They also launched the Accelerate Marketplace, Oracle's online storefront, to create a direct link between customers and solution providers. The new online features included user demonstrations and customer ratings. Oracle's believed that by launching this new version of Accelerate along with Accelerate Marketplace they would be serving their customers with the finest solutions at the lowest possible cost.

Radio frequency identification (RFID) is used for managing traffic, collecting tolls without stopping, preventing theft, automating parking, gaining entrance to buildings, tracking library books, and the growing opportunity to track assets in supply chain management. RFID could be traced back as early as World War II, used to identify enemy aircraft. The first true ancestor to RFID was patented by Mario Cardullo in 1973, which was a passive radio transponder with memory. From 1970 to 1980 there was an explosion of RFID development, and early adopters began implementations of RFID. From 1980 to 1990 commercial applications of RFID entered mainstream use in applications such as animal tracking and toll collections. From 1990 to 2000 RFID was being used on an expanded scale and standards emerged. In 2006, Oracle announced significant enhancements that would be made to the Oracle *Sensor Edge* server, to enable organizations to cost effectively integrate their existing IT environments with RFID technology. This late version of Oracle's server provides several new features for customers investing in RFID technology.

Oracle announced release date for R12 (a product presumed to represent what some might refer to as **enterprise resource planning** II or **ERP** II, on <u>January 31, 2007</u>.

When the term Enterprise Resource Planning (ERP) was coined, it was only intended to interface accounting, shipping, and human resource department systems. The difference between ERP II and **enterprise commerce management (<u>ECM</u>)** is that ECM interfaces <u>all</u> major systems with networked Business2Business (B2B) connections between vendors, online. Some selected event dates follow:

- December 2004: Oracle purchased PeopleSoft/J.D. Edwards, an ERP software company, for $10.3 billion.
- March 1, 2007 Oracle purchased Hyperion Solutions for $3.3 billion.
- March 31, 2007 Oracle launched a new ECM program – *Universal Contact Manager*.

In 1986, Bill Smith convinced Motorola to use his new quality control process – **Six Sigma (6σ)**. Jack Welsh adopted Smith's idea in 1995 for General Electric. Six Sigma is a management strategy used to improve the processes of a business, using a common framework that aims to Define, Measure, Analyze, Improve, and Control (DMAIC) defects. StatPoint Technologies, a leading developer of statistical tools used in data analysis, announced a new product called *Statgraphics Centurion XVI*. This new version offers users a powerful, menu-driven statistical data analysis solution that enables organizations of any size to identify critical information that will improve operational efficiencies. Because this is a newer version, companies who already implemented Six Sigma and are looking for the next innovation may find this tool helpful.

Other companies like MoreSteam.com, offer online training classes for Six Sigma. MoreStream is the leading global provider of online Lean Six Sigma training and support technologies. The Blended Learning Playbook was designed to improve a business' existing training models.

Although these companies have contributed to Six Sigma growth, Larry Ellison, Bob Miner, and Ed Oates developed a special database program called Oracle in 1977. After 30 years Oracle continues to remain the leading supplier of software for information management. Oracle has begun debuting new products and functionality that reflect the company's goal: connecting all levels of enterprise technology to contribute to customer access and development of the knowledge required to respond to market conditions with speed and agility.

The official launch date for *Oracle Crystal Ball* was January 1, 1988. Oracle Crystal Ball is a spreadsheet based program. Six Sigma focuses on complete customer satisfaction. It is a methodology based on already existing techniques including statistical control management (SCM) and total quality management (TQM).

Activity-based costing (ABC) became a technique of interest by SAP in September 1998. In 1999, SAP released their first ABC software. Activity-based management (ABM) represents the application of ABC for a variety of purposes, include customer profitability measurement (CPM) systems, where the relative profitability of customer classes or groups are identified for expansion or elimination.

Emerging Markets

As inexpensive computational power increased, firms were better able to cost effectively and more precisely compute the costs of a variety of activities using activity-based costing or ABC. Cost reduction opportunities for low-skilled activities were identified in countries where the cost of both direct and indirect labor related tasks was very low. These activities have, increasingly, been outsourced to these *emerging markets* (EMs), many of which had previously been referred to as "Third World countries." A listing of these EMs is provided below (as of June 2006, these countries were included in the *Morgan Stanley Emerging Markets Index*:

1	Argentina	10	Indonesia	19	Poland
2	Brazil	11	Israel	20	Russia
3	Chile	12	Malaysia	21	South Africa
4	China	13	Mexico	22	South Korea
5	Columbia	14	Morocco	23	Taiwan
6	Czech Republic	15	Pakistan	24	Thailand
7	Egypt	16	Peru	25	Turkey
8	Hungary	17	Philippines	26	Tunisia
9	India	18	Russia	27	Vietnam

The list included by *The Economist* is the same, but included Hong Kong, Singapore, and Saudi Arabia, where the first two were characterized as "developed" markets.

Outsourcing (a component of which is referred to as business process

outsourcing or BPO) to emerging markets was a prominent issue during the 2008 U.S. Presidential campaign. In this campaign the U.S. and world economies, including emerging market economies, appeared to be entering an economic contraction stage, phase or period.

Outsourcing is not a new idea, but the 1990s and early part of the 21st century enjoyed dramatic increases in outsourcing of manufacturing jobs to emerging markets, particularly Asia (i.e., India and China) and Mexico. During this period, big emerging markets (BEMs) and economies were operationally defined as Brazil, China, Egypt, India, Mexico, Poland, Russia, South Africa, South Korea, and Turkey.

To illustrate just how significant the above innovations in inventory and supply chain management have been, the examination of the increase in the stock price of a firm, providing software for many of these SCM techniques, is illustrated below:

An Illustration of Oracle Stock Price Increases

During the early 1990s, several software companies enjoyed phenomenal growth through the introduction of software packages, the vast majority of which dealt with the efficient management and cost reduction of inventories. There of these firms were PeopleSoft, SAP and Oracle. To illustrate just how successful these firms were, we can examine the stock price, per share, over a period of time. We could also examine revenues, or what *Wall Street* refers to as *top line growth*. SAP and Microsoft were also significant participants in revenue growth.

Oracle, a publicly traded software provider, enjoyed a dramatic price per share increase during the 1990s, as they produced much of the SCM software referred to in this appendix. At an extreme, an investment in Oracle (ORCL) of $10.76 in 1990 could have resulted, after stock splits, in $3,751.10 in 2000, for a return of about 3,500% in a single decade. Effectively, a $1,000 could have grown to $350,000 or a $10,000 investment could have grown to $3.5 million. The chart, below, provides some early January measures for Oracle stock on a split-adjusted price per share from 1990 through 2000.
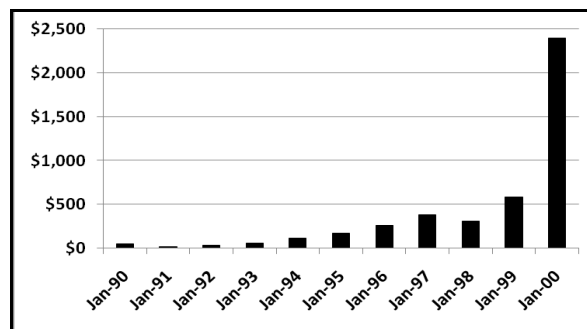
The Reduction in Computational and Information Storage Costs

In order to analyze data, it must be stored. The 1980s and 1990s saw a dramatic reduction in the cost per megabyte of computing power and information storage and, therefore, computational costs, as follows:

Year	Nominal U S$	Year	Nominal U S$
1956	$ 10,000.00000		
1980	$ 193.00000	1993	$ 2.00000
1981	$ 138.00000	1995	$ 0.66900
1983	$ 119.00000	1996	$ 0.17300
1984	$ 80.00000	1997	$ 0.08000
1985	$ 71.00000	1998	$ 0.04260
1987	$ 45.00000	1999	$ 0.01500
1988	$ 16.00000	2000	$ 0.00690
1989	$ 12.00000	2001	$ 0.00299
1990	$ 9.00000	2002	$ 0.00207
1991	$ 7.00000	2003	$ 0.00139
1992	$ 4.00000	2004	$ 0.00115
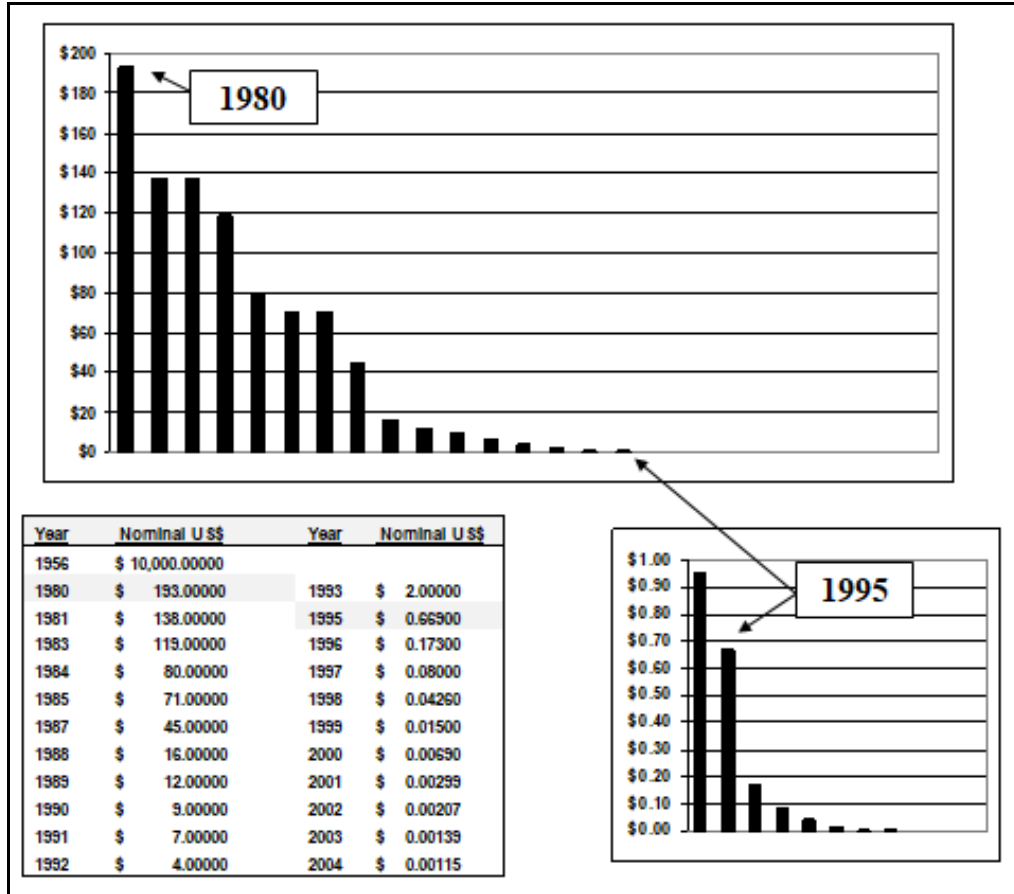
Summary

The events representing the contents of this appendix did not occur in a linear fashion. Generally, ideas and SCM techniques evolved before the software was developed. Once computing speeds and storage capacity increased, and the costs of information and data storage declined, complex computations became cost-effective and led to the identification of cost-savings through improved materials and inventory handling and management, as well as outsourcing to emerging markets. Direct labor and indirect labor were outsourced to these emerging markets at an increasing pace, raising the standard of living in emerging markets, and increasing their standard of living and resulting in an evolutionary improvement in their local labor force, from no- to low- to semi-skilled and professional levels, with related increases in income and greater demand for scarce resources (i.e., direct materials and indirect materials).

EOQ and ROP appear to have arisen in the 1960s and 1970s (the "dark ages"), MRP, MRP II, DRP, FAX and EDI in the early-1980s and JIT, QR, CPR, ECR in the mid-1980s, are referred to as the "era of material management," the early-1990s enjoyed extensions including TOC, VMI, ARP and RF, where the mid-1990s might be characterized as the "era of supply chain management" and extended technologies to include MES and ERP, and, by early 2000, APS, XDM, CPFR, CRM and RFID through 2006, forward, with ERP II and ECM. This timeline and these characterizations are adapted from Davis and Spekman, *The Extended Enterprise*.

While these techniques may be easily related to inventory and systems management, they are also incredibly important for auditors, as public accountants will have to audit, trace and test these electronic relations from inventory through cost of goods sold and "audit through the computer," perhaps through off-site locations.

A New Textbook First Edition Launch: Profitability and Ethical Considerations

Mini-Case 1

Evil Capitalist Publishing, Inc. (Evil) is considering launch of a new textbook for introductory managerial and cost accounting. Presently, the market consists of approximately twenty-five competitors, at introductory through graduate levels. The last significant innovation incorporated into most texts occurred more than a decade ago, and included coverage of activity-based costing (ABC) and the balanced scorecard (BSc).

Two text proposals are under consideration. Only 1 may be selected for launch:

- The 1st text is adequate and technically sound, but the author(s) are from large universities and development and publication of this alternative will secure a significant, initial unit sales count, as adoptions are presumed by these very large institutions with many sections for the course for which the text is designed. This text can be launched, immediately achieving unit sales above break-even and is nearly assured to be and remain profitable for several years.
- The 2nd text is superior and innovative. The sole author is an untenured assistant professor at a very small university, where neither the faculty member nor the university is particularly well-known. Few adoptions would result, at least initially, were this text selected for development and launch. This text can be launched below break-even and will not be profitable in the first year.

The following graphic provides some additional information, in terms of the profitability and economies of scale likely to result, initially, from development and launch of text (1) versus the alternative, text (2):
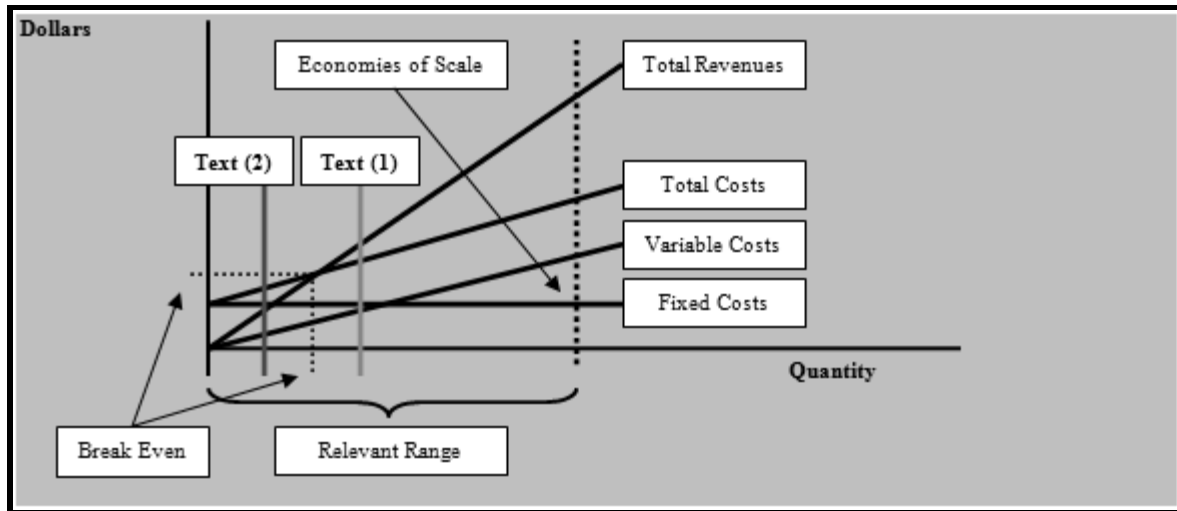
Question for discussion: Is Evil under any obligation to take quality under consideration, or is the free market and capitalism the best mechanism for selecting between text (1) and text (2).

Author's Note: There are no correct or incorrect answers, as these mini-cases are designed to encourage critical thinking and classroom discussion and the practical application of basic managerial and cost accounting concepts and mechanics.

One of the sales representatives is attempting to make a case for the selection of text (2), due to its superior quality and innovative content. He points out that, by including a large number of compensated external editors at smaller institutions, text (2) can capture a significant portion of the market and actually exceed initial, unit sales for text (1), within a very few years. The sales representative has presented the following strategy:

- First, he and other sales representative, across the country, will attempt to identify key, decision-making faculty at as many institutions not already using one of their competing managerial or cost accounting texts. He argues that avoiding focus on those institutions where faculties have already adopted their texts will reduce what marketers refer to as *cannibalization*.
- Second, these university faculties, determined to be the decision-makers, will be offered honorariums in the amount of $600 to review and provide editorial comments for the new text, either prior to launch or in anticipation of a second edition, 3 years from the initial launch date. These modest amounts strengthen ties or relationships between Evil and decision makers, but also provide an economic incentive for the institutional contact or decision-maker to review the text. Some will simply prefer the new text and adopt it. Others will feel some psychological obligation to, at least, consider adopting the text, where they are otherwise indifferent or have

some concerns with respect to their current text. Reviewer names will be prominently listed in the front section of the text, providing a line item on their resume and constituting "service" or "compensated service" at some institutions. While these reviews will add to the cost of the text, careful monitoring and financial projections will prevent the suggested retail price of the text from exceeding reasonable thresholds, already established for competing texts or alternatives already available and on the market.

Questions for discussion: Is Evil bribing faculty to achieve increased unit sales or text adoptions? Is Evil simply employing an ethical business practice design to provide an economic incentive for faculty to read and consider the new text? If you do not like the process employed by Evil, what alternative would you propose?

Additional questions for discussion: How would your responses, above, apply to healthcare? Should pharmaceutical companies be permitted to risk large amounts of capital and economic resources to provide research and develop new, innovative drugs, anticipating large profits for successful risk-taking? Do pharmaceutical companies also employ sales representatives to visit physicians to recommend prescriptions for new, approved drugs? Are free samples provided to physicians and pharmacists and other healthcare professionals? What if the above fact patter is altered? Assume that the 1st and 2nd editions of a text are rarely, if ever, profitable and almost always fail to achieve break-even, not unlike research and development costs for life-saving pharmaceuticals? Would this make the new text more comparable to the new, life-saving pharmaceutical drug? How is innovation and continuous improvement to be achieved and maintained in these very different industries?

Author's Note: There are no correct or incorrect answers, as these mini-cases are designed to encourage critical thinking and classroom discussion and the practical application of basic managerial and cost accounting concepts and mechanics.

Mini-Case 2
Evil Capitalist Publishing, Inc. (Evil) is in the process of revising a 6th edition text for a new, 7th edition. This text already enjoys significant market share, but a new edition is, typically generated, every 3 years.

Faculty members of a variety of institutions have been identified and are being hired to serve several purposes for the new, 7th edition:

- First, targeted faculty members, to be involved in the development of the 7th edition, have already adopted the text and/or are possible adopters of the new edition.
- Second, these work-for-hire assignments will focus on some editorial modifications, homework and test bank question and problem modifications, and power point slide modifications. The content will not change, but names and the sequence of problems will be altered. One by-product of this process will be to make earlier editions difficult to use for future courses, particularly where a syllabus specifically identifies a homework problem as assigned on the faculty member's syllabus.
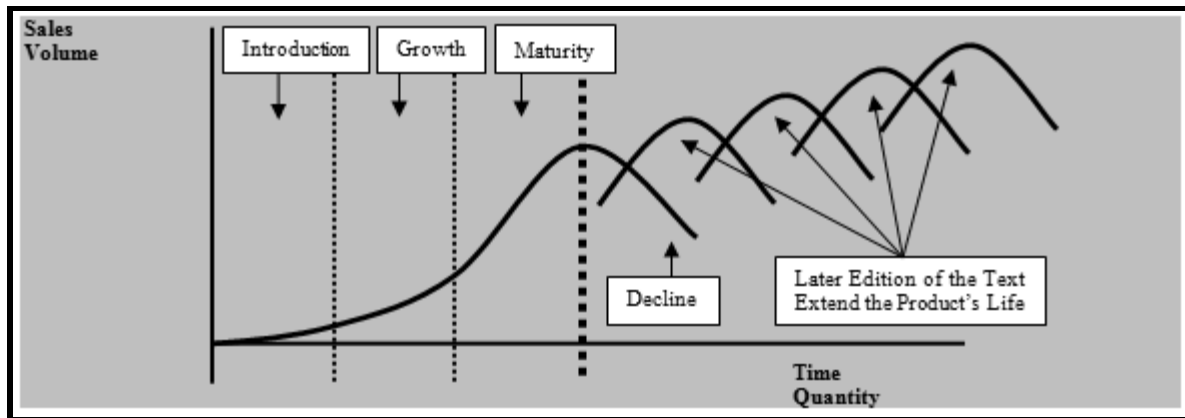
For example, a problem number 5 in chapter 2 (6th edition) will become problem 4 (7th edition) of chapter 2. This will alter the sequence of all later problems published for that chapter. The firm's name for this problem will be altered from ABC to XYZ. No content will be altered for this problem, but the end result will be greater difficulty for a student buying a 6th edition, purchased from the secondary market, once this edition is replaced by the 7th edition. Some might refer to this as *planned obsolescence*. Alternatively, the production of new editions, in the fashion described above, extends what is referred to as the text or *product life cycle*.

The above graph summarizes the sales or product life cycle, in four stages. Generally, a product's life is limited. However, the new editions of a text, effectively, extend the text's life:

> *Questions for discussion: Is planned obsolescence and extension of the product life cycle an acceptable business practice or a violation of ethics? What would you recommend as an alternative?*

> *Author's Note: There are no correct or incorrect answers, as these mini-cases are designed to encourage critical thinking and classroom discussion and the*

practical application of basic managerial and cost accounting concepts and mechanics.

Mini-Case 3

Perfesser Altruism has noted that *planned obsolescence* has increased the cost of the most recent edition of the text he uses in his introductory managerial and intermediate cost accounting courses, and some students are complaining about these costs and even choosing not to purchase the text. There is no evidence of any significant improvements in content or *substance* in these later editions, though the *form* is quite professional, using multiple colors and high quality paper and binding.
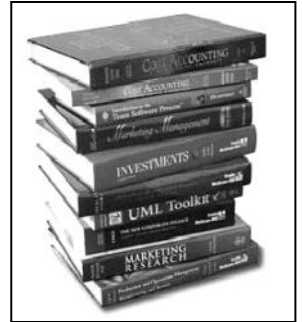
Earlier editions of the same text used by Perfesser Altruism are available for as little as $4 on amazon.com and other websites. Some of the above is summarize in the below table, where Perfesser Altruism has generated a table and a strategy.

Cost Reduction/Savings, per Student,
Ignoring Shipping, Handling and Other Distribution Costs

Alternative Text	Alternative Text Cost	Cost of this Text	Cost Reduction or Savings per Student
1	$186.95	$19.95	$167.00
2	$182.95	$19.95	$163.00
3	$180.00	$19.95	$160.05
4	$173.49	$19.95	$153.54
5	$167.99	$19.95	$148.04
6	$143.82	$19.95	$123.87
7	$143.80	$19.95	$123.85

The Perfesser's university is responsible for approximately 300 unit sales of these late edition texts, per year, every year. This assumes that all enrolled students purchase these texts. At $150 per text, this would approximate $45,000 in annual student costs for these texts. An alternative is available on the market, but for approximately $20 per text. This alternative would approximate $6,000, in aggregate, per year. Therefore, the cost reduction to students, in aggregate, would approach $40,000 (e.g., $45,000 less $6,000), per year, every year. Perfesser Altruism's strategy follows:

- Replace the late edition text with the lower cost alternative. The fee will be assessed and associated with the course, so that all students must have the same text, for consistency in classroom coverage. This will completely avoid cases where students choose to avoid the purchase of any text – a practice that greatly increased student risk of failure in the successful completion of the course. Students will print out and bring scheduled chapters to class for discussion.
- Provide students with cost information regarding earlier editions of alternative texts. For example, as supplements, they may choose to also purchase the $4 editions (including shipping and handling costs).
- Provide students with cost information for the latest editions of alternative texts.

> *Questions for discussion: Is Professor Altruism's strategy reasonable? Does this strategy provide for the greatest good for the greatest number of students? Is the aggregate cost for texts a reasonable approach for analysis? Are those students with significant economic resources harmed by this strategy? Do students with limited resources enjoy gains from this strategy? Is it more ethical or reasonable for Perfesser Altruism to simply require the latest edition of a traditional text at, perhaps, a cost of $150 plus distribution costs plus sales taxes? Is this even an ethical issue? What is your, alternative solution?*

> NOTE: Latest edition text alternatives followed: (1) *Managerial Accounting: Tools for Business Decision Making*, 4th Edition, Weygandt, Kimmel & Kieso. ISBN: 978-0-470-11726-2; **$186.95**; (2) *Managerial Accounting,* 4th Edition, Jiambalvo; ISBN: 978-0-470-33334-1; **$182.95**; (3) *Introduction to Management Accounting,* 2nd Edition, Werner & Jones; ISBN-10: 0130327506; ISBN-13: 9780130327505; **$180.00** (suggested retail); (4) *Managerial Accounting,* 10th Edition, Warren, Reeve, Duchac; ISBN: 032466382X; ISBN13: 9780324663822; **$173.49**; ebook: **$96.49**; eChapters: **$11.99 each**; (5) *Managerial Accounting,* 8th Edition, Crosson & Needles; ISBN-10: 0618777180; ISBN-13: 9780618777181; **$167.99**; (6) *Managerial Accounting: Creating Value in a Dynamic Business Environment*, 8th Edition, ISBN: 0073526924; Hilton; **$143.82** (Amazon.com); & (7) *Introduction to Managerial Accounting*, 4th Edition, Brewer, Garrison & Noreen; ISBN: 0073379325; **$143.80** (Amazon.com).

> *Author's Note: There are no correct or incorrect answers, as these mini-cases are designed to encourage critical thinking and classroom discussion and the practical application of basic managerial and cost accounting concepts, mechanics and, in this case, strategies for aggregate textbook cost reduction.*

Mini-Case 4

Perfesser Altruism is having some trouble convincing faculty that the internal text should be adopted. There are a variety of legitimate reasons for faculty to adopt the external texts produced by Evil Capitalist Publishing, Inc. (Evil).

For example, Evil includes automated test banks to accelerate the production of examinations by faculty. This saves faculty time. Also, online examinations and online support and supplemental homework problems are available for students to work. The internal text also does not have power point slides, though Perfesser Altruism knows that these could be produced in a matter of a few days.

Perfesser Altruism would like to involve other faculty in the production and fine-tuning of the text to see to it that their preferences are included in the finished product. Once the text is completed to the satisfaction of the faculty adopting and using the text, Perfesser Altruism would also produce the power point slides.

While Perfesser Altruism does not have automated test banks and homework problems, he does have a Word file including homework problems and test questions. It is not finished and is crude. Again, he was hopeful that others would work with him to develop this product.

The following tables were developed by Perfesser Altruism to, again, attempt to gain support from others in his department. A count of the number of students in six sections of the course for which the text is being developed follows:

Section	N
01	40
02	36
04	35
05	33
06	35
80	35
	214

Assume that the cost of the internal text is $20. One faculty member is allowing students to purchase Evil's electronic text for $80. The bookstore is selling used copies of Evil's text for $143.70 and new copies of Evil's text for $191.60. The table that follows summarizes some projections, where N=214 is the number of students taking the course during the current semester, which is multiplied by 3 to arrive at an estimate of annual savings.

	External Hardbound New Text $191.60	External Hardbound Used Text $143.70	External Electronic Text $80.00	Internal Electronic Text at $20.00	
	$192	$144	$80	$20	
Less: Internal	$20	$20	$20	NA	
Equals: Difference	$172	$124	$60	$20	
Multiply by 214	214	214	214	214	
Equals: Difference	$36,722	$26,472	$12,840	$4,280	Semester
Multiply by 3	3	3	3	3	
Equals: Difference	$110,167	$79,415	$38,520	$12,840	Annual

The savings for students, in aggregate, would approximate $110,167 per year, every year, forever. This assumes that all students purchase a brand new, hardbound version of Evil's text. This computation ignores the recovery of some portion of this cost, should the student decide to sell the book back to the bookstore.

The savings for students, in aggregate, would approximate $79,415 per year, every year, forever. This assumes that all students purchase a used, hardbound version of Evil's text. This computation ignores the recovery of some portion of this cost, should the student decide to sell the book back to the bookstore.

The savings for students, in aggregate, would approximate only $38,520 per year, every year, forever. The electronic text sold by Evil cannot be returned.

The fee of $20 per unit is one that Perfesser Altruism recommended to go to the University to a building fund. The anticipated amount paid by students and contributed to this fund, if all faculty will work together to fine-tune the text and supplements, should approximate nearly $13,000 per year, every year, forever.

> *Questions for discussion: Assume that you are a faculty member and have been asked to participate in this project. How much time would you be willing to devote to this effort, without any compensation? How would your answer change if your participation in this project added 10 hours per semester to your workload? How would your answer change if your participation in this project added 40 hours to your workload, but only for the first semester, since any work you put into this project benefits you for all future semesters? How much time do you, presently, devote to charitable activities? If none, then why should others?*
>
> *Author's Note: There are no correct or incorrect answers, as these mini-cases are designed to encourage critical thinking and classroom discussion and the practical application of basic managerial and cost accounting concepts, mechanics and, in this case, strategies for aggregate textbook cost reduction.*

Appendix D
More on Cost Behavior & Statistics

A variety of techniques may be used to separate total costs (TC) or mixed costs (MC) into fixed cost (FC) and variable cost (VC) components for further development into a cost equation, as follows:

TC = FC + VC

and/or

MC = FC + VC

A cost equation is developed from data that represents some relevant range (RR) of activity, and may only be applied, appropriately, to the same RR of activity.

Generally, direct materials (DM) and direct labor (DL) are presumed to represent purely variable costs (VCs) and manufacturing overhead (OH) is presumed to represent a mixed cost (MC), containing both fixed cost (FC) and variable cost (VC) components. Operating expense (OPER) also consist of MC, separable into both FC and VC components.

Techniques for separating costs into fixed and variable components include visual inspection of scatter plots and line graphs, while manually drawing a trend line (the slope or VC) and the y-axis intercept (the FC). This approach is unscientific, but the scatter plot does tend to reveal any extreme values, outliers or influential outliers for investigation (i.e., MBO or management by exception).

An alternative approach is the high-low method, but this technique only uses two observations.

The preferred technique is regression, where the results are quantitative and objective. If only one independent variable or cost driver is under consideration, the only relevant measure of goodness of fit is the coefficient of determination or the r-square measure.

Regardless of the technique used, the development of a relevant and reliable cost equation presumes the use of accrual-based financial data and, though not a random sample (when

---

viewing data that is sequential and monthly), a large sample size (N≥30) containing whole seasonal periods (e.g., N=36, N=48, and so on) is desirable.

($H-$L) ÷ (#H-#L) = VC

---

where H is TC and L is FC

---

y = a + bX or **y = Intercept + Slope**

Some Statistical Review and Additional Statistical Considerations
Some statistical concepts and mechanics warrant review, extension and consideration.

First, it is presumed that only one independent variable existed. Some texts assume that more than one independent variable is useful. While this is true in the case of natural sciences like cancer research, it is less applicable for practical managerial and cost accounting applications, where the objective is to develop a cost equation useful to managers.

Second, transforms are not used. A transform, in very simple and non-technical terms, straightens out a curved or curvilinear line so that a linear relationship might be developed. For example, a measure might be squared, cubed or the square root of a measure might be used to straighten out the line and increase the coefficient of determination or r-square measure. Again, while the use of transforms is helpful in the case of natural sciences, this is less helpful for practical managerial and cost accounting applications, where the objective is to develop a cost equation useful to managers.

Transformation
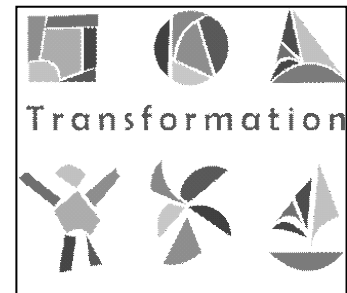
To illustrate the first two points, try to image saying the below to a sales manager, where you have two independent variables that your firm uses to predict total costs:

> *Hi, Bob…here is the formula to forecast total costs on a daily basis: TC = FC + (Sales Revenues for the Day)^2 + (Unit Sales)^3*
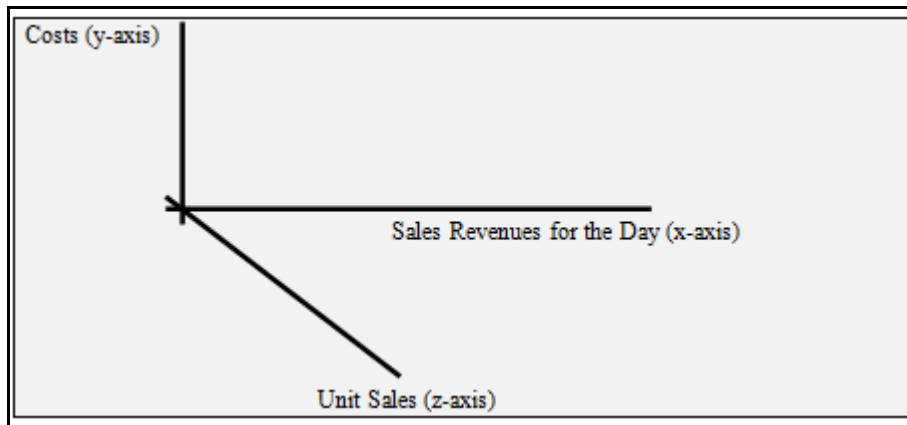
Bob might be able to use a calculator to apply the above computation, but you have just asked him to square one measure and cube another, and Bob might be a great sales manager, but not a great mathematician or statistician. Furthermore, to graph the cost equation that you have just given to Bob, you would have an x-axis, a y-axis, and a z-axis. Statisticians think multi-dimensionally – Bob, the sales manager, may not be able to think multi-dimensionally. You may recall the use of the x-axis, y-axis, and z-axis (see above) from some of your math courses.

To graphically review simple, ordinary least squares (OLS) regression, the below shows a scatter plot, complete with a dashed trend line, where there is a very strong relationship between the matched pairs or the x/y coordinates, as follows:
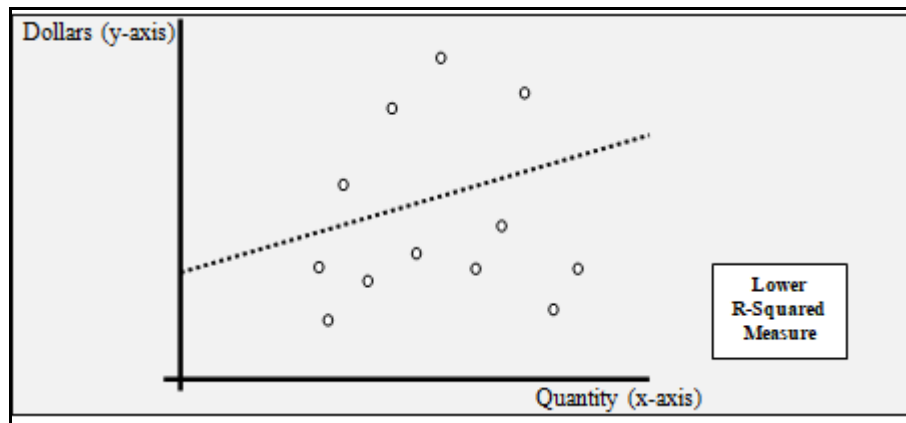
The above, twelve observations or matched pairs, would generate a very high coefficient of variation or r-square measure – probably above 0.95 or 95 percent. If this is so, the quantity produced (x-axis) predicts more than 95 percent of the total cost (y-axis), where the fixed cost is the y-axis intercept and the variable cost is the slope multiplied by the quantity of units produced (recall TC = FC+VC = a + bX). Cost (in dollars) is the dependent variable and quantity (or units produced) is the independent variable.

The twelve observations or matched pairs would generate a much lower coefficient of variation or r-square measure. Notice that the variation or distance for each observation from the trend line is far greater in the next example.
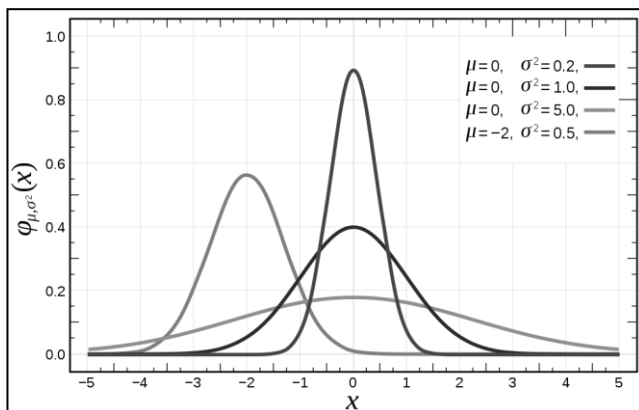
Recall that r-square is a measure between 0.00 (0 percent) and 1.00 (100 percent). It is a measure of the explanatory power of the cost equation. Therefore, an r-square measure of 0.95 or 95 percent suggests that the resulting cost equation and change in the independent variable (quantity or x-axis) explains 95 percent of the change in the dependent variable (dollars or total cost or y-axis). This is a measure of the predictive power or value of the cost equation. The dependent variable (total cost) is dependent on the independent

variable (quantity produced, sold or produced and sold).

Would you use a cost equation to predict or forecast costs, if the r-square measure was 95 percent? …50 percent? Probably "yes" in the former case; probably not or "no" in the latter case.

A third set of statistical concepts and mechanics are the overall F-statistic, t-statistic and p-value.

As the case has already been made for the use of a single independent variable (and the avoidance of the use of transforms), with only one independent variable, the t-statistic for that independent variable and the overall F-statistic for the model or cost equation, may often approximate the same measure. If the overall F-statistic, for the entire cost equation or model, and the t-statistic, for the single, independent variable, are the same or comparable (or both very high or both very low), we can eliminate one of these statistics from further discussion.

Focusing only on the t-statistic and the p-value, these statistical measures are related. The t-statistic represents the number of standard deviations from the mean or measure of central tendency and the p-value is a measure of the area under a normal or Gaussian or bell curve.

A low t-statistic suggests little or no statistical relationship between the independent and dependent variables. A t-statistic of 2-to-3 or higher is, generally, desirable to achieve what some refer to as "statistical significance." In a typically managerial or cost accounting application, a cost equation with a single independent variable and a low t-statistic is also likely to have a low r-square measure.

Alternatively, the p-value represents the probability of observing the estimated coefficient value, randomly. We would like the p-values for the intercept (fixed cost) and slope (variable cost) in the cost equation to be very, very low.

Consider the following statistical output:

```
SALARY = $106,866.00 - $110.10 X
Predictor   Coefficient      Std Deviation      t-statistic   p-value
Constant    106,866.00       10,793.00          9.90          0.000
X           -110.10          70.17              -1.57         0.122
s = 25300  R-sq = 4.1%

Analysis of Variance
SOURCE   DF    SS             MS              F-statistic    p-value
Regression  1   1576139648     1576139648      2.46           0.122
Error    58    37126524928     640112512
Total    59    38702665728
```

While it is not necessary to evaluate each and every component of the above, the cost equation has a fixed cost of $106,866.00. The variable cost or slope is negative, at -$110.10X.

The r-square is 4.1 percent, suggesting that this cost equation explains only 4.1% of SALARY. This means that the remaining 96% is left unexplained by this cost equation. Effectively, this cost equation does not appear to be at all useful, and its application could prove to lead to very poor forecasts.

Notice that the t-statistic for X is negative and only 1.57. This is the number of standard deviations from the mean, where a t-statistic of 2-to-3 or higher would be preferable. The overall F-statistic is higher, at 2.46, and relates to the entire model or cost equation, whereas the t-statistic only relates to the variable cost (X).

The p-value for the variable cost is not significant at 0.122. We would probably prefer a t-statistic of 10 percent or less (i.e., < 0.10). The same p-value was generated for the overall F-statistic, also at 0.122.

Finally, the number of observations, in the above case, was N=60 (i.e., DF or degrees of freedom of 60 less 1 independent variable equals59).

The cost equation generated a very low r-square, at 4.1%, leaving nearly 96% to be explained by some alternative means. The slope is negative, which does not make sense (i.e., as activity rates increase, SALARY decreases?). The t-statistic is not high and the overall F-statistic is also not very high, as is consistent with the higher than desirable p-values. We, clearly, have a problem with this cost equation, which is not usable for any purpose. There must be some problem with the data or the cost driver is flawed.

The scatter plot used to generate the above statistics follows, where X equals new retail vehicles sold (NRVS). This data for SALARY was generated from an automobile retail dealership. The cost driver is not the problem. NRVS is the industry-wide cost driver. This cost driver is commonly and effectively employed by automobile retail dealerships.
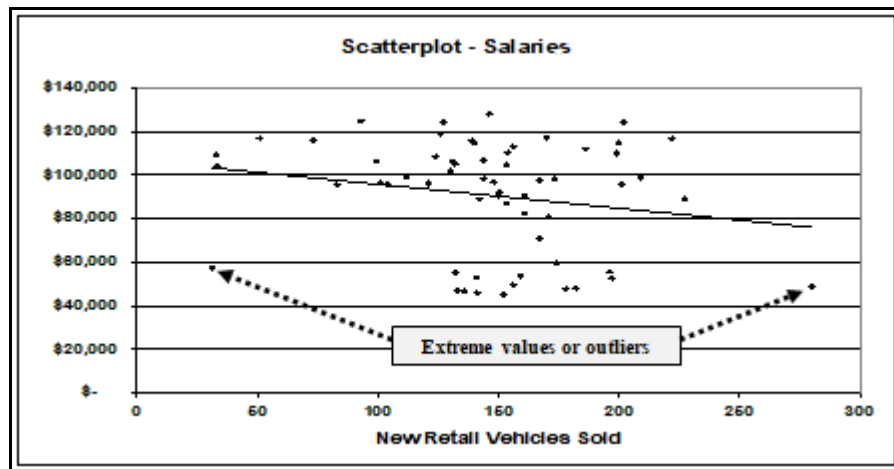
At least two extreme values or outliers appear in the above table, but removing them would not appear to represent a solution or be likely to alter the negative slope of the trend line, where higher NRVS reduces SALARY for this retail automobile dealership. These two extreme value or outliers are, therefore, not influential.

The below provides an alternative. In the below case, the extreme value or outlier is, clearly, influential. In the below case, the extreme value or outlier is influential in shifting the slope (variable cost) and even the intercept (fixed cost), so the cost equation would be fundamentally altered.
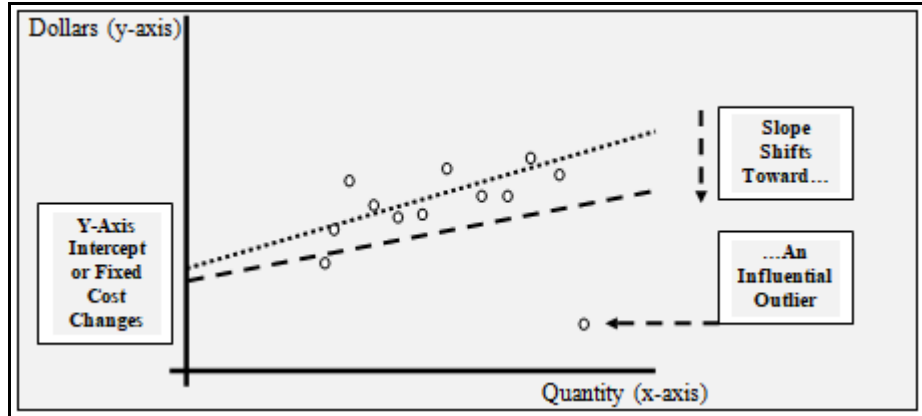
Trends may be present in the data, as might seasonality. Seasonality may be desirable, to generate variance. Some trends, however, may not be desirable.

Inflation, if low, may not require adjustment. If material or significant, inflation may require indexing to some base period.

For example, the use of five years or sixty months of financial information for the purpose of generating a cost equation for forecasting is not likely to reduce the r-square measure. However, if the inflation rate were the jump, or if the price of commodities were to spike, then, return to normal (e.g., steel prices as a raw material input for a manufacturing firm), this volatility may have to be "controlled for" by way of a control variable in the regression model. Generally, this level of statistical analysis is beyond the scope of this text.

Chapter 6
Cost-Volume-Profit Applications

Learning Objectives

- Describe the impact of changes in activity on contribution margin (CM) and operating income.
- Prepare and explain all components of a cost-volume-profit (CVP) graph, including the profit, break-even (BE), and loss regions.
- Apply the CM ratio to changing sales volume, describing the relation between sales volume and operating profit, BE, and loss.
- Review the variable costing format income statement, illustrating the impact of volume, selling price and variable cost per unit, and fixed costs within the relevant range.
- Compute the BE point.
- Explain how a desired target profit can be achieved using sales volume levels.
- Illustrate your understanding of the margin of safety.
- Review financial leverage, from financial accounting, and compare and contrast it to operating leverage, from managerial or cost accounting.
- Understand the impact of sales mix on CM, BE point, and operating income or loss (profitability) and for varying levels of product sales when products have different CM ratios.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

		External Use IRS/GAAP Absorption Costing Full Costing	Internal Use Contribution Approach Direct Costing Variable Costing	Only Product Cost

Type of Product Cost	Product Costs	Per Unit	Total	Total	Per Unit	Listed
		SP	+ SP	+ SP	SP	DM
		CGS	- CGS	- VC	VC	DL
Prime	DM	GM	= GM	= CM	CM	OH (VC)
Conversion	DL		- OPER	- FC		OH (FC)
	OH		= NOI	= NOI		

Typically covered in a single chapter

NOI will be **equal** if
[1] no BI & [2] no EI

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Only
Non-Product
Cost
Listed
OPER (VC)
OPER (FC)

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

A very basic, cost behavioral framework is introduced in this chapter, building on your understanding of fixed and variable costs. Cost-volume-profit (CVP) analysis represents a basic framework that has broad, practical applications value for a variety of internal decision-making problems.

The Basic Cost-Behavioral Framework

The basic format that can be used to solve a variety of problems is summarized below. In the below case, break-even is $100,000 in sales or revenues and, at $100 sales price per unit, and 1,000 unit is the break-even point. What is referred to as the contribution margin (CM) ratio is at 40 percent (i.e., $40,000 ÷ $100,000 or $40 ÷ $100).

	Total	per Unit	Percent of Sales
Sales or Revenues	$100,000	$100	100%
Variable cost	$60,000	$60	60%
Contribution margin	$40,000	$40	40%
Fixed cost	$40,000		
Net operating income	$-0-		

Note that sales or revenues are presumed to be purely variable. Any fixed revenues would be netted with fixed costs to arrive at net fixed costs.

Contribution Margin

You are familiar with "gross margin" from your introductory financial accounting course. "Contribution margin" is different. It is sales or revenue after variable costs have been subtracted.

Contribution margin is used, first, to cover fixed costs, and any remainder **contributes** directly to the "bottom line" or to net operating income. Assume, for example, that 1 additional unit is sold for 1 unit <u>above</u> the break-even point, using the above example as a starting point:

	Total	per Unit	Percent of Sales
Sales or Revenues	$100,100	$100	100%
Variable cost	$60,060	$60	60%
Contribution margin	$40,040	$40	40%
Fixed cost	$40,000		
Net operating income	$40		

One additional unit sold above the break-even point, at a $100 sales price, contributes $40 to both contribution margin and net operating income (see above).

Alternatively, assume that the firm sells 1 unit <u>below</u> the break-even point:

	Total	per Unit	Percent of Sales
Sales or Revenues	$99,900	$100	100%
Variable cost	$59,940	$60	60%
Contribution margin	$39,960	$40	40%
Fixed cost	$40,000		
Net operating income	$(40)		

One unit sold below the break-even point, at a $100 sales price, results in a $40 reduction to both contribution margin and net operating income of zero, for a $40 loss (see above).

Therefore, using the break-even point as a point of reference, with a contribution margin of $40 per unit:

- 1 unit sale <u>above</u> the <u>break-even point</u> results in net operating <u>income</u> of $40.
- 1 unit sale <u>below</u> the <u>break-even point</u> results in net operating <u>loss</u> of $40.

A variety of formulas all based on the above table and framework may prove useful:

1. **S or R = VC + FC + NOI or $100,000 = $60,000 + $40,000 + $-0-**
2. **NOI = (S − VC) − FC or $-0- = ($100,000 - $60,000) - $40,000**
3. **Break-even point in units (BE PT$_{UNITS}$) = FC ÷ CM per unit (CM$_{UNIT}$) or**
   BE PT$_{UNITS}$ = FC ÷ CM$_{UNIT}$ = $40,000 ÷ $40 = 1,000 units
4. **Break-even point in total sales or revenues (BE PT$_S$) = FC ÷ CM ratio, where CM ratio = CM ÷ SP or BE PT$_{SP}$ = FC ÷ CM ratio = $40,000 ÷ 40% = $100,000**
5. **Unit sales to achieve some target NOI = (FC + NOI) ÷ CM$_{UNIT}$, where target NOI is $1,000 = ($40,000 + $1,000) ÷ $40 = 1,025**
6. **Dollar sales to achieve some target NOI = (FC + NOI) ÷ CM ratio = ($40,000 + $1,000) ÷ 40% = $102,500**

BE PT$_{UNITS}$ (see item 3, above) is likely to prove to be the most useful of the above formulas. Items 5 and 6 (above) are illustrated (below), using the same basic framework already introduced:

	Total	per Unit	Percent of Sales
S or R	$102,500	$100	100%
VC	$61,500	$60	60%
CM	$41,000	$40	40%
FC	$40,000		
NOI	$1,000		

A Graphic Illustration of Cost-Volume-Profit Analysis and Cost Behavior

The below illustrates the BE PT, total revenues, total costs, variable costs and fixed costs within a relevant range of activity. Economies of scale are also illustrated, where a firm operating at near-capacity minimizes fixed costs on a per unit basis.
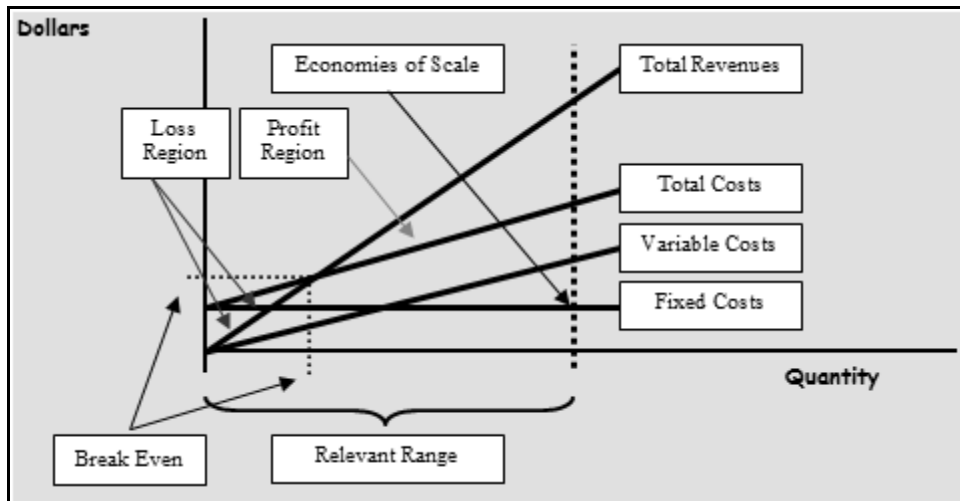
That region where total revenues exceed total costs (or expenses) is the region above the firm's BE PT, where the firm is profitable. That region where total revenues fall below total costs (or expenses) is the region below the firm's BE PT.

Margin of Safety

A term gaining popularity and expansion in texts over the past decade or so is the *margin of safety*. This is nothing more than the sales in excess of the BE PT (using the above example), as follows:

7. **Margin of safety (sales) = S – BE$_{SP}$ = $102,500 - $100,000 = $2,500**
8. **Margin of safety percentage = Margin of safety (sales) ÷ S = $2,500 ÷ $102,500 = 2.4%**

Operating Leverage (and Financial Leverage)

Recall that all assets are financed with debt or equity, as follows:

$$A = L + OE$$

The level of debt (or L for liabilities) in the firm's capital structure is also known as *financial* leverage (or risk). Higher debt is associated with higher risk.

Similarly, recall that all costs might be defined as fixed or variable within some relevant range of activity, as follows:

TC = FC + VC

The higher the degree of fixed costs in the firm's total cost structure, the higher the degree of *operating* leverage (or risk). Higher fixed cost is associated with higher risk.

The degree of operating leverage can be computed, using the above fact pattern, as follows:

9. **Degree of operating leverage = CM ÷ NOI = $41,000 ÷ $1,000 = 41**

Generally, this measure would be compared to industry averages to determine whether a single firm's degree of operating leverage is sufficient.

The Worst Possible Scenario – The U.S. Automobile Industry in 2009-
By far, the worst possible scenario for a firm is to enter a period of economic contraction when also facing both high *financial* leverage and high *operating* leverage, as follows:

- **Financial leverage increases with L and higher L = higher risk, where A = L + OE**
- **Operating leverage increases with FC and higher FC = higher risk, where TC = FC + VC**

A contemporary case is that of the U.S. automobile industry. General Motors (NYSE: GM), Ford (NYSE: F) and Chrysler (privately held) faced severe hardship due to a dramatic reduction in industry-wide demand for new automobiles, which forced these firms and the entire automobile industry to operate well below their break-even point. GM (filed chapter 11 bankruptcy reorganization on June 1, 2009) and Chrysler also faced working capital shortfalls, requiring taxpayer assistance to survive.

Ford did not face these working capital needs in the form of a taxpayer bailout, because Ford increased borrowings immediately before the contemporary financial crisis. While this increased the level of financial leverage at Ford, it was strategically well-timed and those considering the purchase of a new automobile were less concerned by what the automobile industry refers to as the *orphan effect* when purchasing Ford automobiles and trucks, as opposed to General Motors and Chrysler automobiles and trucks.

When considering the purchase of a new automobile or truck, a buyer wants to be assured of the availability of parts and service for the life of the vehicle. They do not want to risk being "orphaned." A March 30, 2009, speech illustrated the importance of this issue, as reported by Christopher Jensen of the **New York Times** under the title, *Understanding Obama's Auto Warranty Plan*:

> *On Monday morning, President Obama announced that the Treasury Department would back the warranties of new General Motors and Chrysler vehicles. "If you buy a car from Chrysler or General Motors, you will be able*

to get your car serviced and repaired, just like always," President Obama said during a speech from the White House. "Your warranty will be safe. In fact, it will be safer than it's ever been, because starting today, the United States government will stand behind your warranty."

The Worst Possible Scenario – The U.S. Housing Market in 2008-

Consider high *financial* leverage and high *operating* leverage on a household and personal level. As the housing bubble burst led to declining values in securities derived from mortgages (e.g., credit default swaps), financial institutions also required taxpayer assistance, to avoid a worldwide financial and economic collapse.
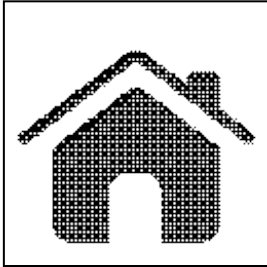
Someone with a large and/or expensive home and a very large mortgage has both a very high fixed cost and a very high level of debt. This does not take into consideration that larger and/or more expensive homes may require higher fixed, variable and mixed costs for maintenance, insurance, real property taxes, and utilities. Therefore, both high financial and high operating leverage are present for some homeowners.

As official unemployment rates rose to 10.2 percent in the US, the risk enjoyed by this homeowner has increased (as of October 2009, fifteen states had official unemployment rates above 10 percent.) This is particularly true when the supply of housing, perhaps due to higher foreclosures, increases. As the supply of housing increases, given constant demand, we might anticipate a reduction in the marketability and the market value previously anticipated and enjoyed by this homeowner. It would have been less risky for this homeowner to own a smaller home, with a lower fixed cost and less debt. Stated alternatively, the homeowner might have been better off to maintain a lower level of both *financial* leverage and *operating* leverage in his or her personal finances.

Sales Mix and Break-Even Analysis

Different products, within the same firm, are likely to have different contribution margin ratios and, therefore, different break-even points. The sales mix refers to the relative proportions of sales for these different products. Three sales mix variations or cases of a two product example can be used to illustrate the impact of differing sales mixes on the overall profitability of a firm.

All three cases are developed for a firm with two products, Product A and Product B:

- Product A sells for $100 per unit and has a contribution margin of $40 and, therefore, a contribution margin ratio of 40%.
- Product B sells for $100 per unit and has a contribution margin of $50 and, therefore, a contribution margin ratio of 50%.

The sales prices for both Products A and B are held constant, at $100, to simplify this illustration, but the same framework used, above, could be used for products with differing sales prices on a per unit basis.

Fixed cost at $20,000 is common to both products and cannot be directly *traced* to Product A or Product B, so a separate break-even point cannot reasonably be computed for Product A and Product B. Any technique used to <u>allocate</u> these common fixed costs would produce different contribution margin ratios and break-even points, introducing subjectivity into this unreliable computation for forecasting or projection purposes. However, a break-even point can (and will) be computed for Products A and B, in aggregate.

NOTE: Some texts distinguish between *discretionary* fixed costs and *committed* fixed costs. The former are easily changed, in the short-term. The latter are not easily changed.

In CASE 1, 50% of sales are from Product A and 50% of sales are from Product B. Therefore, the overall variable cost is $55 or 55% of sales and the overall contribution margin ratio is 45%. The break-even point for the firm, overall, is computed at 444 to 445 units: $20,000 ÷ $45 = 444.44. In this case, net operating income is $2,500.

In CASE 2, 30% of sales are from Product A and 70% of sales are from Product B. Therefore, the overall variable cost is $47 or 47% of sales and the overall contribution margin ratio is 53%. The break-even point for the firm, overall, is computed at 377 to 338 units: $20,000 ÷ $53 = 377.36. In this case, net operating income increases to $6,500. The increase in net operating income, when compared to CASE 1, results from the *increased* proportion of Product A sales, with its *higher* contribution margin ratio of 60%.

In CASE 3, 70% of sales are from Product A and 30% of sales are from Product B. Therefore, the overall VC is $57 or 57% of S and the overall CM ratio is 43%. The BE point for the firm, overall, is computed at 465 to 466 units: $20,000 ÷ $43 = 465.12. In this case, NOI decreases to $1,500. The decrease in NOI, when compared the CASE 1, results from the <u>increased</u> proportion of Product B sales, with its <u>lower</u> CM ratio of 50%.

	CASE 1			50% of Total Sales		50% of Total Sales	
	Total	Total Per Unit	Total Percent of Sales	Product A Per Unit	Product A Percent of Sales	Product B per Unit	Product B Percent of Sales
S	$50,000	$100	100%	$100	100%	$100	100%
VC	$27,500	$55	55%	$60	60%	$50	50%
CM	$22,500	$45	45%	$40	40%	$50	50%
FC	$20,000						
NOI	$2,500						
	CASE 2			30% of Total Sales		70% of Total Sales	
	Total	Total per Unit	Total Percent of Sales	Product A Per Unit	Product A Percent of Sales	Product B per Unit	Product B Percent of Sales
S	$50,000	$100	100%	$100	100%	$100	100%
VC	$23,500	$47	47%	$60	60%	$50	50%
CM	$26,500	$53	53%	$40	40%	$50	50%
FC	$20,000						
NOI	$6,500						
	CASE 3			70% of Total Sales		30% of Total Sales	
	Total	Total per Unit	Total Percent of Sales	Product A Per Unit	Product A Percent of Sales	Product B per Unit	Product B Percent of Sales
S	$50,000	$100	100%	$100	100%	$100	100%
VC	$28,500	$57	57%	$60	60%	$50	50%
CM	$21,500	$43	43%	$40	40%	$50	50%
FC	$20,000						
NOI	$1,500						

The general rule, in a case of scarce resources or limited capacity, is to direct production to those products with the higher contribution margin (CM) ratio in terms of the scarce or limited resources (e.g., labor hours or raw materials).

Cost-volume-profit (CVP) analysis collapses detailed financial information, usually revenues and expenses, to a cost-behavioral framework. This technique is useful in setting prices for products and services, whether it is a mature product or the firm is considering investment to launch a new, innovative product. CVP may also be used to examine the impact of replacing labor with machinery (e.g., a variable cost with a fixed cost), an old machine with a more efficient piece of equipment, development and daily use of the firm's break-even point for short-term managerial decision-making, whether to make or buy, buy or lease, sell or process further, and a variety of what-if analyses.

A review of some basic formulas follows:

S or R – VC = CM – FC = NOI

S or R = sales or revenues, VC = variable cost, CM = contribution margin, FC = fixed cost and NOI = net operating income. CM may be computed on a per unit basis or in aggregate and TC = total cost.

TC = FC + VC

The above represents the basic cost equation, where higher FC is associated with higher operating leverage (computed by dividing CM by NOI) and higher risk or return.

BE PT = break-even point, where a lower BE PT is, generally, presumed to be less risky.

$$\text{FC} \div \text{CM}_{\text{UNIT}} = \text{BE PT}_{\text{UNITS}}$$

A ratio can also be generated. Below is the formula for the contribution margin (CM) ratio.

$$\text{CM} \div \text{S or R} = \text{CM Ratio}$$

The CM ratio can be useful when seeking the break-even point in units.

$$\text{FC} \div \text{CM ratio} = \text{BE PT}_{\text{SorR}}$$

If you adjust the numerator, by adding some desired or target net operating income (NOI) to fixed cost (FC), you can develop the necessary quantity of unit sales required to achieve this target, as follows:

$$(\text{FC} + \text{NOI}) \div \text{CM}_{\text{UNIT}} = \text{Target Unit Sales}$$

&

$$(\text{FC} + \text{NOI}) \div \text{CM ratio} = \text{Target Dollar Amount of Sales or Revenues}$$

The margin of safety is nothing more than those sales or revenues in excess of break-even sales or revenues, as follows:

$$\text{Sales or Revenues} - \text{BE Sales or Revenues} = \text{Margin of Safety Sales or Revenues}$$

&

$$\text{Margin of Safety Sales or Revenues} \div \text{Sales or Revenues} = \text{Margin of Safety Percentage}$$

Applications of Cost-Volume-Profit Analyses

Consider the value of CVP analysis. Once the break-even point per year is established, it is a simple matter to convert this measure to a break-even point per month (divide the annual break-even point by 12 months) or even per day (divide the annual break-even point by 365 days).

Armed with this tool, the sales manager of a department can tell, daily, if he or she is achieving or exceeding the break-even point. The manager need not wait until a few days after the end of the month to receive an income statement for the department or business unit, for the prior month, to know whether the department is operating profitably or unprofitably. The manager, armed with the

basic tools of CVP analysis, can react to an anticipated profit or loss measure, <u>during</u> the month, and before ever receiving the income statement shortly after month end.

CVP may be combined for any forecasting application. For new products or product lines, it may be used for target costing (an approach that integrates product pricing and product features, cost, and design, so accounting and financial professionals would work closely with production, engineering and marketing managers) throughout the product life-cycle, where the composition of costs may shift from variable to higher fixed costs (replacing direct labor with machinery or automating) for firms able to compete as a product, product line, or industry approaches and achieves maturity.

Incorporating Income Taxes into Cost-Volume-Profit Analysis

Income taxes might be included in an equation, along with target net income (NI), to determine the targeted level of activity in units. First, recall the formula from above:

(FC + NOI) ÷ CM$_{UNIT}$ = Target Unit Sales

The new formula, taking income taxes into consideration, follows:

(FC + [NI ÷ {1-T}]) ÷ CM$_{UNIT}$ = Target Unit Sales

Notice that **NOI** is replaced with **[NI ÷ {1-T}]**. While these formulas are useful and covered in texts, it is important to note that Excel and alternative software may be used to very quickly and very efficiently forecast an infinite number of *what ifs*, with quantitative precision.

Review

- Thoroughly explain and distinguish between gross margin and contribution margin.
- Thoroughly explain and distinguish between mixed cost, fixed cost, and variable cost.
- Thoroughly explain and describe the break-even point and its relevance when forecasting a profit or a loss.

True/False Questions

1. Gross margin and contribution margin are the same.
2. Gross margin is used for external reporting and US GAAP and contribution margin is used in Europe, Canada, and other foreign nations.
3. Contribution margin contributes, first, to the offset of overhead, and, then, to profits if the break-even point is exceeded.
4. Gross margin contributes, first, to the offset of overhead, and, then, to profits if the break-even point is exceeded.
5. Sales price per unit less variable cost per unit equals contribution margin per unit.
6. Sales price per unit less variable cost per unit equals gross margin per unit.
7. Higher fixed costs suggest higher risk and higher operating leverage.
8. When total revenues exceed total variable costs, profitability is achieved.
9. When total revenues exceed total fixed costs, profitability is achieved
10. When total revenues exceed total costs, profitability is achieved

Appendix A

A Capacity Constraint at a CPA Firm: Dealing with Clients and Practice Management

Mini-Case 1

You have been hired by a local CPA or public accounting firm. The office space is scarce and you have heard the firm's partners discussing the alternatives:

1) Move or relocate to a larger office at a location a block away or
2) Harvest, keeping only the most profitable customers.

Under the first alternative, the firm does not expect to lose clients, simply due to the relocation, but the lease payment per square foot is significantly higher. Under the second alternative, some decisions must be made with respect to "firing" clients.

> *Question for discussion: In very broad terms, could CVP analysis be used to examine these alternatives? Discuss the approach.*

Mini-Case 2

Consider the facts in Mini-Case 1. Assume that the decision to "harvest" has been made. Therefore, the relocation will not take place, the firm will not expand, and the client base must not increase.

One partner wants to call clients and refer them to a smaller firm. Another partner wants to simply send out a notice, advising all clients that a fixed increase in fees will occur.

> *Question for discussion: Which partner's recommendation do you prefer? Discuss the likely outcome of each approach.*

Mini-Case 3
Consider the facts in Mini-Case 1 and 2, above. You are at a bar having a drink with a colleague. You overhear the following conversation from two persons sitting next to you at the bar:

○Do you have a good CPA? Mine raised his prices.
○Wow, he must be very good!

Question for discussion: Reconsider Case 2, above. Is this a likely outcome if the firm decides to raise fees for all clients?

Mini-Case 4
Again, consider the facts in Mini-Case 1 and 2, above. Again, you are at a bar having a drink with a colleague. This time, you overhear the following conversation from two persons sitting next to you at the bar:

○ Do you have a good CPA? Mine referred me to a smaller firm, telling me that my business and the fees generated from my small business were not profitable for his firm.
○ Wow, that dirty, rotten *&^%$#!

Question for discussion: Reconsider Case 2, above. Is this a likely outcome?

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Chapter 7

Activity-Based Costing

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Learning Objectives

- Distinguish between activity-based costing and job order and process costing.
- Understand the complexities involved in the installation of an activity-based costing (ABC) system and the traditionally employed levels to which ABC might be applied.
- Understand that applications of ABC are not restricted to manufacturing overhead, a product cost.
- Understand that ABC is not GAAP.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

		External Use IRS/GAAP Absorption Costing Full Costing		Internal Use Contribution Approach Direct Costing Variable Costing		Only Product Cost Listed

External Use
IRS/GAAP
Absorption Costing
Full Costing

Internal Use
Contribution Approach
Direct Costing
Variable Costing

Only Product Cost Listed

Type of Product Cost		Per Unit		Total		Total	Per Unit	
	Product Costs	SP	+	SP	+	SP	SP	DM
		CGS	-	CGS	-	VC	VC	DL
Prime — DM		GM	=	GM	=	CM	CM	OH (VC)
Conversion — DL				OPER	-	FC		OH (FC)
OH				NOI	=	NOI		

Typically covered in a single chapter

NOI will be **equal** if
[1] no BI & [2] no EI

Only
Non-Product
Cost
Listed
OPER (VC)
OPER (FC)

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

Activity-based costing (ABC) became popularly applied in the early 1980s. It is a technique used to cost effectively **trace** costs that might, alternatively, be **allocated**. Job order and process costing are traditional, GAAP-based techniques, and differ from ABC. ABC is not GAAP.

Recall that in the case of job order costing, direct materials and direct labor are significant or material in dollar amount and easily **traced** to the finished good, because they tend to be purely variable costs. However, the third category of product costs, manufacturing overhead, is often **allocated** to jobs, using a pre-determined overhead application rate, because it is a mixed cost.

ABC treats manufacturing overhead costs as though they are purely variable costs, which eliminates the need to develop a predetermined overhead allocation rate. ABC **traces** costs that have shown strong relations (or correlations) to specified activities.
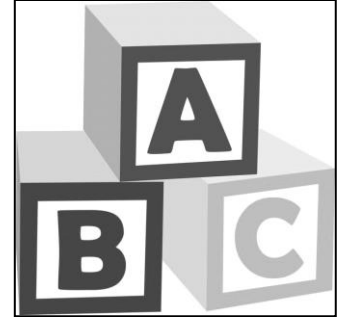
Therefore, under ABC, think of direct materials, direct labor and manufacturing overhead as purely variable costs, while direct material and direct labor are significant or material in dollar amount and manufacturing overhead is also **traced**, but by using **activities** grouped into multiple cost pools and using multiple cost drivers.

Illustrating the Value of Activity-Based Costing: A Comparison to Job Order Costing & Process Costing
In the case of job order costing, actual costs flow into the manufacturing overhead account, as debits, and these costs are applied to jobs, using some predetermined overhead application rate. Direct materials and direct labor are purely variable costs, significant in dollar amount, and relatively easily traced to the finished good. Therefore, manufacturing overhead is the only product cost that is not a purely variable cost.

Again, under job order costing, the actual costs for manufacturing overhead are not likely to precisely equal the amount applied during a period. This will result in some over-application or under-application of actual manufacturing overhead costs.

This under-application or over-application of actual manufacturing overhead costs must be closed out at the end of an accounting period. The simplest choice is to close this balance out to the cost of goods sold section of the income statement, since this matches the generation of the manufacturing overhead over-application or under-application to the period in which it was generated.

Recall that under process costing, equivalents units are used to "pool" costs in beginning inventory, work-in-process, and finished goods. Finished goods from one department become the beginning inventory costs transferred to the next department in the process, until, eventually, completed and sold to an external party.
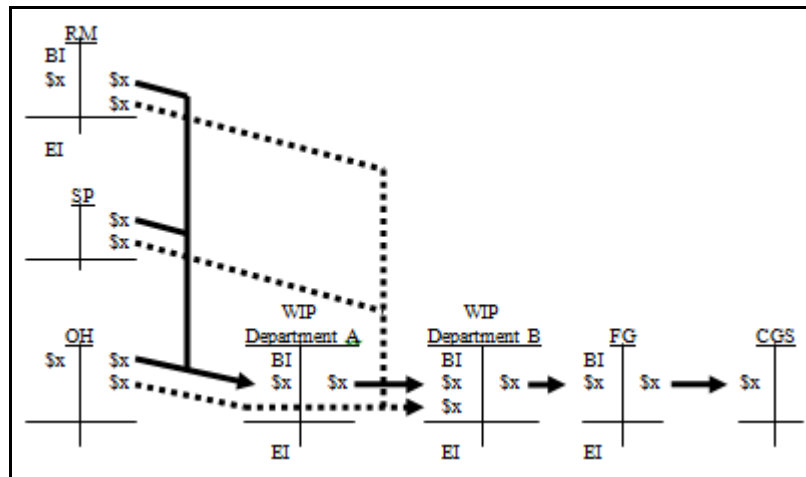
But how is ABC developed and what happens when ABC is used? Clearly, ABC is not necessary for direct materials or direct labor, as these purely variable costs are easily traced to the finished good.

First, consider the activities occurring and relating the manufacturing overhead costs.

Second, attempt, perhaps through a data mining or trial and error process, to identify those costs highly correlated to the activities identified. Back-testing might be used to identify these relations. Back-testing refers to the process of examining prior periods.

These prior periods should be full seasonal periods of at least twelve months, though at least 36 months is preferable, to exceed the small sample size of N<30. The Pearson product moment correlation or "r" measure might be use for this purpose.

Third, once these activities have been identified, the costs associated with these activities might be developed. However, just as is the case for the traditional GAAP-based technique of job order costing, the application of ABC is likely to result in over-applied or under-applied manufacturing overhead. This, unless the firm has been able to precisely identify, completely, all activities that drive all manufacturing overhead costs.

In order to perform these analyses, where the cost of an activity is developed, accounting or financial information and non-financial, administrative or, more specifically, activity-related data must be assembled and stored in some easily accessed fashion to facilitate analysis. It is, therefore, helpful, if this data is already stored electronically, to avoid the additional costs and errors likely to be associated with assembly and data entry, which must precede analysis.

Some Examples of ABC

Some examples of applications of activity-based costing whether at cost or in a cost-plus form, are likely to be easy to relate to and apparent to the average consumer. For example, the utility company may charge a connection fee, where the connection is the activity. The local cable television provider may also charge a connection fee, but might waive this fee for a minimum contract for one year. An electrician, plumber, or contractor might charge a service call fee, which may or may not include the first hour at your residence or place of business.

For the manufacturing firm interested in using ABC to trace manufacturing overhead costs to jobs or production runs, the focus is on cost and cost of goods sold development. For the utility or cable provider, electrician, plumber or general contractor, ABC might be used to charge a consumer in a cost-plus for sales or revenues form. The latter case is probably market-based and competitively-driven. As the above suggests, ABC applications are not limited to product costs or manufacturing overhead. The next section, however, continues to focus on product costs and manufacturing overhead.

GAAP-Based Job Order Costing May Produce Misleading Information for Costing

Note that the overhead T-account has an unspecified subtotal of $47 of costs flowing into the manufacturing overhead account during the period (see below). Assume that this amount includes depreciation expense for machinery used in production. Further assume that all amounts are in thousands (e.g., the $47 in the manufacturing overhead account is actually $47,000, and so on). Finally, assume that all measures are for a single month.
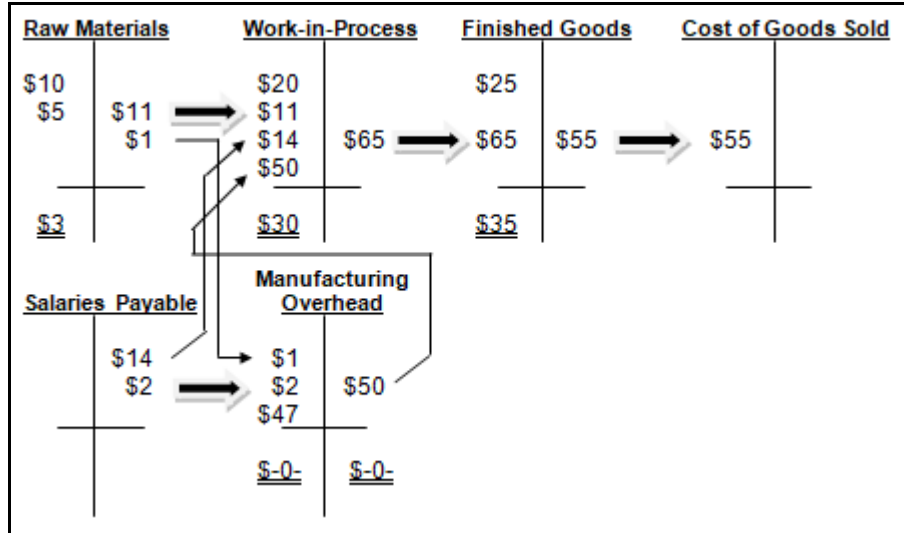
Focusing only on depreciation expense for machinery, assume that 3 product lines are manufactured by the firm, which uses only 2 machines for their production. Further assume that Machine B was recently purchased (replacing its predecessor) and is significantly more costly than Machine A.

The cost of the older, fully depreciated Machine A is $100,000 and the cost of the more recently purchased Machine B at $1 million (with a 20 year life and no salvage value). Therefore, the depreciation expense for Machine A is zero and the depreciation expense for Machine B, the new machine, is $1 million divided by 20 years, or $50,000 per year, and $4,167 (rounded) per month. Machine B depreciation, therefore, represents $4,167 of the $47,000 for the month (see above).

Machine B is used for Product Line 2 and 3, but not Product Line 1. Therefore, it does not make sense to use a predetermined overall or factory-wide overhead application rate, because doing so could significantly increase the cost per unit of Product Line 1, while significantly decreasing the cost per unit for Product Lines 2 and 3, and in a misleading fashion.

Be cautious when *unitizing* fixed costs. This provides the appearance that a fixed cost is variable. This may be appropriate under ABC, but not for other applications.

Stated alternatively, if the cost of the depreciation for the very costly Machine B is allocated to production runs for Product Line 1, it is clearly overstating the cost per unit for Product Line 1 while understating the cost per unit for Product Lines 2 and 3. By using a predetermined overhead application rate, we have failed to take into consideration that Machine B is not involved in the *activities* leading to the manufacture of Product Line 1.

	Product Line 1	Product Line 2	Product Line 3
Machine A	X	X	X
Machine B		X	X

Assume that the cost driver is machine hours, direct labor hours, raw materials costs, or any other reasonable method, and focus only on the monthly depreciation expense for Machine B, at

$4,167. For simplicity, assume that the cost driver, under GAAP and job order costing, tends to result in equal applications of all manufacturing overhead costs to Product Lines 1, 2, and 3. Therefore, even though Product Line 1 does not require the use of Machine B, some portion of the cost of Machine B is being allocated to Product Line 1, as follows:

	Product Line 1	Product Line 2	Product Line 3
GAAP or Job Order Costing	$1,389	$1,389	$1,389
Activity-Based Costing		X	X

Using a plant-wide or overall predetermined manufacturing overhead application rate, GAAP-based job order costing allocates $1,389 per month to each of the 3 product lines. This overstates the cost for Product Line 1, by $1,389. It also understates the cost for Product Lines 2 and 3, (amounts rounded and) as follows:

	Product Line 1	Product Line 2	Product Line 3
GAAP or Job Order Costing	$1,389	$1,389	$1,389
Activity-Based Costing		$2,084	$2,084
Difference	$1,389	-$695	-$695
Cost Overstated	$1,389		
Cost Understated		-$695	-$695

Consider the following additional facts:

Since the purchase of the very costly Machine B, which is only used for Product Lines 2 and 3, the firm has noticed an increase in unit sales for Product Lines 2 and 3 and a decrease in unit sales for Product Line 1. Overall profitability for the firm is also declining over this same period. The firm prices all 3 Product Lines based on a 50 percent markup above cost (i.e., cost-plus pricing, where the firm adds some standard mark up to their cost), as is the industry standard. However, the cost is incorrect!

This fact pattern is consistent with the flawed technique by using a predetermined overhead **application** rate. Would the use of ABC and *tracing* costs to activities provide more reliable costing and, therefore, pricing data? The answer is "yes."

The firm's experience is consistent with the above fact pattern. They are gaining market share in Product Lines 2 and 3 because their 50 percent markup is based on a cost that has been reduced (or subsidized) by Product Line 1. Product Line 1 sales are declining due to the same flawed costing system. This illustration presents a *classic* case for the application of ABC, where wide variations in costly activities exist between revenue-generating product line sales. Therefore, where conditions of this sort persist, ABC is likely to provide insights and/or "big hits."

Steps Involved in Developing and Applying Activity-Based Costing
Steps involved in developing and applying activity-based costing (ABC) include meetings, using personnel at all levels of the organization, to develop an "activities dictionary." This serves 2 purposes:

(1) Employees, at all levels, are educated and support is developed for the ABC and activities-based management (ABM) goals and objectives and

(2) The activities dictionary, using all applicable terms or jargon specific to that organization and its activities, is developed for future application.

Most texts recommend a structured approach to ABC system development, as follows:

- Step 1 – Identify and define activities and resource costs: This is not unlike time and motion studies and will require knowledge of what tasks or activities are performed by all personnel and how much time they spend on each activity. Resources maintained and consumed to perform these activities and the actual value-added to the product, service, customer or organization must also be identified and, if possible, quantified.

  This is already a fairly common practice, applied for at least two decades, in professional service firms (e.g., public accounting and law firms), where professional services hours, in increments, are coded and billed to clients, sometimes at different billing rates. For example, a staff accountant might "bill out" at $200 per hour for tax research, but $150 per hour for compliance or tax return preparation work. The "cost," in this case, might be a function of hourly salaries and benefits for this staff accountant, multiplied by 250 to 300 percent. While this is an imperfect illustration of ABC, consider the development of the 250 to 300 percent "rule of thumb," which might include all overhead items like office rent, utilities, and so on.

Levels of activities include the following:

o UnitVolume-based, the unit level activity might include direct materials, direct labor hours, and/or machine hours. These costs tend to be pure VC.

o BatchBatch or production run-based, the batch level activity might include machine set-ups, purchase orders, production scheduling, batch quality control or inspections, materials handling, and production expediting activities. These costs tend to be behaviorally mixed.

o ProductFirms manufacturing or selling a variety of products or models within a product line will identify product-sustaining activities that might include product design, raw materials purchasing, and engineering modifications.

o FacilityAlso known as business or infrastructure or capacity sustaining activities, these are costs that cannot be traced or causally linked to units, batches or products, and may represent facility sustaining activities, including building and facility security and safety, general purpose machinery maintenance, and property taxes and insurance.

Unit → Batch → Product → Facility

There may be one or more units in a batch level activity, one or more batches in a product level activity, and one or more products in a facility level activity, but a reversal of this sequence cannot occur.

- Step 2 – Resource cost assignment to activities: Cost drivers that consume resources are causally identified. This can be achieved, in part, through statistical or correlational studies. For example, the Pearson product-moment correlation or *r* measure, typically taught in introductory undergraduate statistics course work. It must be noted that correlation does not ensure causality. Examples of **UNIT LEVEL** cost drivers include: machine hours for a highly automated facility, direct labor hours for a labor-intensive facility, direct materials cost for a process that does not add significant value from the raw material to the finished good stages, professional labor hours for professional firms. Examples of **BATCH LEVEL** cost drivers include: number or production orders and number of production order revisions.

- Step 3 – Activity cost assignment to cost objects: Cost objects are, frequently, the products and services sold by the firm (e.g., audits by a public accounting firm).

Identifying Value and Non-Value Added Activities

ABC has been used to identify both value and non-value added activities, where non-value added activities might be eliminated to achieve cost reductions and, therefore, competitive advantages. Alternatively, those activities identified and remaining classified as *value adding* may be identified for possible outsourcing (e.g., direct labor or indirect labor tasks or activities might be outsourced to emerging market countries), where doing so might result in overall cost reductions. For these reasons, ABC implementation may result in staff resistance. Staff may perceive ABC as similar to manufacturing time and motion studies, where their position is in jeopardy and might be targeted for elimination or outsourcing.

Other problems with ABC are implementation-related. While ABC seeks to solve problems associated with traditional, GAAP-based job order and process costing systems, ABC systems are likely to be founded in the existing general ledger-based financial and cost accounting and information system, but ABC system implementation incurs costs *in addition* to these traditional and existing systems.

The motivation for incurring the additional costs associated with ABC implementation is ABM, which is often focused on identifying "big hits" (i.e., big cost reductions). There is no guarantee, however, that these "big hits" will result from the process. The process may take 2-3 years to implement, before the big hits, if any, are identified.

In fact, a taped, educational series on cost accounting, featuring the Chrysler's Toledo North Assembly Plant (TNAP) in Toledo, Ohio, failed in their pilot test of an ABC implementation effort. The process was costly and did not result in any "big hits." The failure was so significant and costly that management accountants at the post-merger DaimlerChrysler world

headquarters in Michigan characterized "ABC" as a "dirty word," not to be mentioned aloud in the corporate headquarters common areas. (This was mentioned to Professor Cataldo, personally, by DaimlerChrysler management accountants during a meeting conducted to plan a continuing education course for DaimlerChrysler staff.)

If a firm can eliminate non-value activities, cost reductions may be presumed. Cost reductions by one competitor may lead to reduced prices to the end-user, which, all other things held constant, should lead to greater market share and operations nearing economies of scale. Once a competitor in an industry has achieved these cost reduction and market share increases, it can be difficult for competitors to "catch up" and remain competitive in an industry.

ABC Implementation - Customer Service: A Non-Product Cost Example

Perhaps you – if you are living in the US – have had the experience of telephoning customer service, only to have your call answered by someone in India. This represents an example of an activity that has been outsourced. However, this was not always the case. A decade or so ago, telephone calls did not result in a recording or a menu, requiring routing, and these calls were dealt with domestically (for US firms and products). Consider the process of analyzing the cost of a customer service call for possible outsourcing of this customer service activity.

Assume that the firm's headquarters are housed in a ten story building. One entire floor (i.e., 10 percent of the building) is used for customer service. A firm in India has approached your firm, offering to provide all customer service call services at $3 per call. However, you do not know how much a customer service call costs. You do, however, know how many customer service calls are handled at any point in time, through your telephone company records, where these measures are recorded and maintained. Therefore, to determine the in-house or internal cost of a single customer service call, your firm must assemble all costs for customer service and divide these costs by the number of customer service calls. What are the costs?

If 10 percent of the building cost is associated with customer service, then the fixed assets or property, plant and equipment accounts must be examined and the cost of the building and later improvement examined through the depreciation schedule, to determine the amount of accumulated depreciation and depreciation expense associated with the building. Ten percent of the depreciation expense (or square footage) is the first cost or our starting point, but 10 percent of other costs might be added to this amount, as follows:

- Property or real estate tax expense for the building
- Insurance costs for the building
- Utility costs for the building (e.g., electricity, natural gas, water, sewer, trash removal, and so on)
- Interest expense for the building, if mortgaged
- Rent expense for the building, if leased

In addition to the above, all non-realty (i.e., personal property) that is depreciated and results in depreciation expense for this single floor of the ten story building, where the customer service

personnel are located. This would include all file cabinets, personal computers, telephones, desks, chairs, and other furniture and fixtures. These, also, would be identified in the firm's depreciation schedule.

Supplies consumed by customer service personnel must also be added to arrive at the total customer service cost. These would include paper, toner, paper clips, staples and staplers and staple removers, post it notes, and other supplies. Any service contracts for printers or copiers and the expenses associated with related leases would also have to be tracked down through the appropriate general ledger account.

Salaries would be likely to represent a significant cost, as would the cost of all employer payroll taxes and benefits (e.g., health insurance and retirement). Assembly of these costs would require the examination of salaries and payroll expense-related general ledger accounts. These might be relatively easy to assemble, perhaps by employee Social Security number or employee identification number within the firm's salary or payroll subsidiary ledger.

While the above might seem to represent a complete listing, consider the fact that the customer service department consumes some portion of time by one or more executives, located on the tenth floor of the corporate headquarters. All of these executives have assistants and secretaries, and you can see how this entire process must, now, be repeated, though the computations may become more complex and the person accumulating these customer service costs must possess great expertise with respect to the firm's chart of accounts, general ledger, and accounting system.

The above, of course, was for the purpose of determining the cost of a single activity, a customer service call. Consider just how much more complex this process would be to identify the cost of many activities, simultaneously. This process would be conducted and, perhaps, based on the existing general ledger accounting and administrative system, but would be *in addition* to that system, probably implemented in a parallel fashion. Therefore, the development and examination of the costs of all activities and ABC is costly. The risk associated with the installation of the ABC system is that no ABM or "big hits" will result from the process.

Furthermore, note that the fixed or variable cost behavior is ignored. This is because ABC is very long-term focused and the fact that a cost may be fixed or sunk in the short-term is not relevant to the approach. As the term suggests, a sunk cost is a cost incurred in the past, does not change and is not relevant to alternative decisions under consideration.

In the long-term, in the above case, the floor (10 percent of the building) that is vacated, were the customer service function to be outsourced, might be leased to another firm or used for some alternative, internal purpose. This point bears repeating.

ABC seeks to *trace* (and not *apply*) costs, based on activities. ABC presumes that there are no sunk costs (in the long-term) and there are no fixed costs (also in the long-term). All costs are *traced*, based on activities, and, so, treated as though purely variable costs.

Review

- Distinguish between ABC and US GAAP.
- Distinguish between job order costing, process costing, and activity-based costing.
- Explain 2hen are order costing, process costing, and activity-based costing likely to be employed.

True/False Questions

1. ABC is US GAAP.
2. ABC treats all costs as though they are fixed and sunk costs.
3. ABC is nothing more than an extension of process costing.
4. ABC is the same as job order costing.
5. ABC requires the use of relational data base software like Excel.
6. ABC treats all costs as though they are purely variable.
7. ABC can be traced back to the early 1900s, when first use by Ford Motor Co.
8. ABC uses the same chart of accounts and accounting system used for US GAAP techniques like job order or process costing.
9. ABC was used to identify items cost-effectively outsourced to emerging markets.
10. ABC assumes that all costs are sunk costs.

Appendix A
SWOT Analysis and Benchmarking

SWOT is an acronym for [1] strengths, [2] weaknesses, [3] opportunities and [4] threats, as follows:

A SWOT analysis is a strategic planning technique, beginning with the operational definition of a desired objective. Once value-added and non-value-added activities have been identified, and once activity-based costing (ABC) has resulted in the development of costs associated with these activities, a SWOT and related strategic analyses might be performed, perhaps in a parallel fashion.

For example, if an activity has been identified for possible outsourcing to and emerging market, the firm's SWOT may reveal which alternatives present the best strategic decision for the location (e.g., emerging market country) of the outsourced activity.

Each of the questions relating to each component of the SWOT analysis must be asked many times, and throughout the process:

- Strengths – *internal* attributes likely to be helpful in achieving the objective.
    o How can we use/capitalize on our strengths?
- Weaknesses – *internal* attributes likely to hinder progress toward the objective.
    o How can we eliminate/improve on our weaknesses?
- Opportunities – *external* conditions helpful in achieving the objective.
    o How can we exploit/benefit from opportunities?
- Threats – *external* conditions with the potential to harm the project or objective.
    o How can we eliminate/mitigate threats?

Competitive (and comparative) advantages are identified by matching strengths to opportunities. If weaknesses or threats cannot be converted into strengths or opportunities, strategies to avoid weaknesses or threats should be developed.

PRIMO-F analysis may also be useful in identifying strengths and weaknesses. (PRIMO-F is an acronym for People, Resources, Innovation & Ideas, Marketing, Operations and Finance. The PROMO-F model refers to a hard and soft data collection process.)

PEST or PESTLE analyses may be useful in identifying opportunities and threats. (PEST is an acronym for Political, Economic, Social, and Technological analysis, describing a framework for macro-economic and macro-environmental factors; PESTLE or PESTEL is an acronym for PEST, but add Legal and Environmental factors to extend the model and acronym.)

Notice that these acronyms might enjoy particular application when identifying and deciding upon an emerging market to outsource some activity, where several alternatives exist. For example, should I outsource a labor intensive activity to Mexico or India? Which emerging market has the most stable political system (i.e., the "P" in PEST or PESTLE)? Which emerging market has the most stable social system (i.e., the "S" in PEST or PESTLE)?

Strategy is frequently a topic addressed in marketing departments. The SWOT team should include a broad task force, comprised of personnel with a variety of backgrounds so that they might examine cost structure, profit sources, resources and competencies, competitive positioning and product differentiation, degree of vertical integration, historical responses to industry developments, and a variety of other factors.

Benchmarking
Benchmarking is a procedure where a firm examines or identifies successful practices, *critical success factors* (CSFs) and/or *best practices* employed by other firms or organizations through a process that includes self-reflection, and adopts these winning practices and strategies from competing (or noncompeting) firms within (or outside of) the firm's industry.

(The International Organization for Standardization (<u>ISO</u>) and the International Benchmarking Clearinghouse (<u>IBC</u>) facilitate and assist firms with strategic benchmarking efforts; CSF identification is a step that must precede *business process improvement* and is part of a process of *continuous improvement*.)

The focus is on firms or organizations that consistently distinguish themselves as leaders, and may focus on performance, strategic or process improvements. Pilot-testing might also reveal CSFs within the firm, but at other units within the firm.

CSFs provide the detailed information used to develop the balanced scorecard.

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Appendix B
The Balanced Scorecard

</div>

Return on investment (ROI) was frequently the only measure used to gauge a business unit's performance prior to the widespread acceptance of the balanced scorecard (BSc). ROI is a financial measure and this purely financial approach was found to be less than desirable, as other, non-financial measures grew to become available, electronically. The BSc includes, but does not exclusively rely on ROI or any pure financial measure. While both vehicles for performance evaluation are imperfect, the BSc technique is more strategic, effectively including the evaluation of measures that, if improved, should lead to increased ROI.

Return on Investment
ROI is computed, as follows:

ROI = Margin x Turnover

or

ROI = NOI ÷ Average Operating Assets

Recall that NOI is an income statement (IS) measure, and operating assets represent beginning and ending balance sheet (BS) measures, as follows:
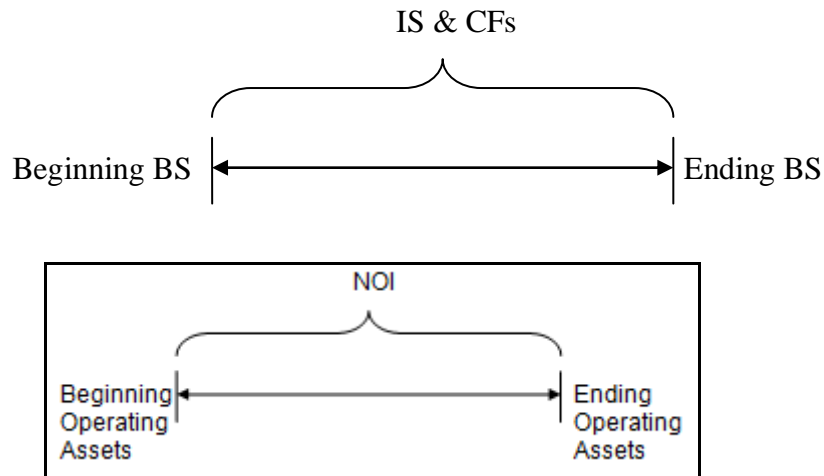
Another criticism of ROI includes ease of ST manipulation. For example, a manager receiving quarterly bonuses might choose to defer investments in new, labor-saving machinery and equipment to maximize their bonus. This deferral may not be in the best interest of the firm or its

stakeholders. Effectively, the numerator (NOI) is maintained, while the denominator (average operating assets) is also maintained, or not permitted to increase. The result is a higher ROI.

Residual Income

Residual income or RI is investment center net operating profit after taxes (NOPAT) and in excess of required (or target) profit. An investment center is responsible for generating revenue, controlling costs, and investing in assets (investment) for the generation of revenues less costs or expenses. Some formulaic descriptions follow:

RI = NOPAT – Required Profit, therefore,
RI = NOPAT – Cost of Capital x Investment, therefore,
RI = NOPAT – Cost of Capital x [Total Assets – NIBCL], where
NIBCL is an acronym for noninterest-bearing current liabilities.

Economic Value Added

Economic value added (EVA) is a performance measure credited to a consulting firm – Stern Stewart (1993-). It is RI adjusted for "accounting distortions" arising from the application of US GAAP, including the treatment of research and development (R&D) costs.

US GAAP requires immediate expensing, ignoring the benefits of the expenditures to future periods, proponents of EVA would argue. EVA capitalizes this "expense" and amortizes it over the anticipated period where benefits are anticipated, therefore, EVA is somewhat judgmental and, perhaps, less objective, if not more representative of economic reality.

A formula for EVA follows:

$$\text{EVA} = \text{NOPAT}_{\text{adjusted}} - [\text{Cost of Capital} \times \text{Investment}_{\text{adjusted}}]$$

Balance Scorecard

As the below illustrates, the balanced scorecard (BSc), in its generic form, links a firm's vision and strategy to four broad categories of performance or critical success factors (CSFs) or measures. The BSC is actually a *weighted scorecard*, where the importance of each element identified by the firm is linked to their vision and strategy. Then each component is weighted (balanced to achieve the firm's vision and strategy). Therefore, each of the 4 dimensions of analysis (e.g., financial, customer, and so on), need not be equally weighted, these weightings are subjectively developed, and, therefore, they are subject to participant manipulation for personal gain (e.g., increased bonuses).
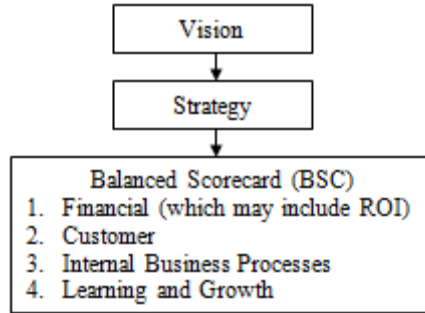
Alternatively:
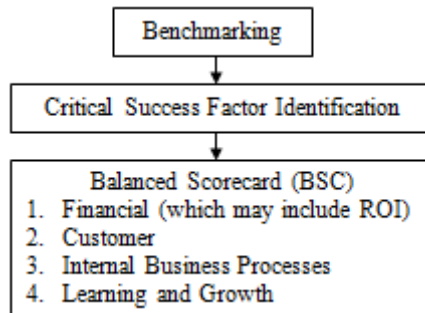
The balanced scorecard will vary in framework and design. For example, in the academic arena, the focus is not on (1) financial, (2) customer, (3) internal business process, and (4) learning and growth, but, instead, is based on (1) research, (2) teaching, and (3) service, where a research-oriented institution will place greater weight on research and a teaching institution will place greater weight on teaching, as follows:

Balanced Scorecard *Research* University **1.Research(50%)** 2.Teaching(35%) 3.Service(15%)	Balanced Scorecard *Teaching* University 1.Research(35%) **2.Teaching(50%)** 3.Service(15%)
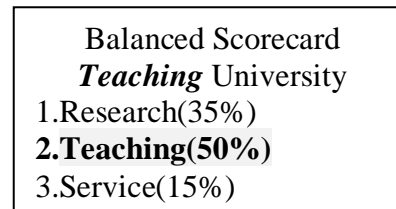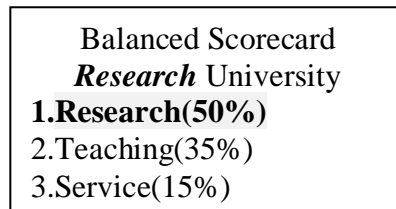
The below illustrates some possible, partial variations for a BSc that might be developed within a firm, focusing on the internal business process dimension:

	Alternative 1	Alternative 2	Alternative 3
Financial	25%	25%	25%
Customer	25%	25%	25%
Internal Business Processes			
Percent Sales or Revenues from new products	15%	10%	5%
WIP as a percent of CGS	5%	10%	15%
Setup time	10%	10%	10%
Learning and Growth	20%	20%	20%
Total	100%	100%	100%

First, the scorecard components must equal 100 percent. The details of each of the other three dimensions of self-evaluation are not fully-developed, where the focus is on two of the internal business processes dimensions.

The BSc is usually developed with significant input by those likely to be evaluated (and rewarded) for their performance. So a BSc development participant in the marketing or new product development department with internal knowledge of a significant number of new products to be launched early in the next quarter might push for Alternative 1 to maximize his or her bonus in the near term, where a relatively low base or benchmark of new product launches may have occurred in prior periods.

The production manager may have just installed a new inventory management system, likely to minimize the cash or other current assets (CA) invested in work-in-process (WIP), and might prefer Alternative 3.

While Alternative 2 might present a reasonable compromise, one of these two participants might be particularly politically powerful and may be able to manipulate the BSc weightings, completely out of self-interest, in a successful effort to maximize personal bonuses in the near term quarter or short-term.

Therefore, upper management must monitor the BSc process to minimize the risk of such manipulations for committee member or BSc development participant personal gain.

Executive & Management Compensation

Management and executive compensation includes salary, bonus (usually performance-based, but, if cash-based, taxed and treated like additional salary), and benefits. Management and executive compensation plans have been studied for decades, but came under significantly increased contemporary scrutiny during the mid- to late-2008 time period, when the US Government (taxpayers) bailed-out several insurance companies, financial institutions and automobile manufacturers. The new, Obama Administration (January 21, 2009-) imposed oversight on the compensation packages for the executives at these firms.

Historically, many executives were paid bonuses based on return on investment (ROI). Over the past few decades, there has been less focus on this single financial measure, as it became possible to use previously unavailable *electronically* stored accounting and administrative data to build and measure improvement in the firm's internally developed balanced scorecard (BSc).

Return on Investment – An Historical Perspective
Return on investment was the single most important financial measure of a firm's performance for decades, as follows:

ROI=Return on sales x Asset turnover
=(Profit ÷ Sales) x (Sales ÷ Assets)
=Profit ÷ Assets

The questions that arise when using ROI are (1) what measure of profit (numerator) and (2) what measure of assets (denominator) should be used. The comparability and consistency (secondary qualitative) characteristics from financial accounting are required for ROI to be useful.

For example, all subsidiaries, divisions and departmental units must use the same inventory (e.g., FIFO or LIFO or weighted-average) and depreciation (i.e., straight-line or double-declining balance or sum-of-the-years digits) techniques or methods. However, the use of book value might reduce the denominator for business units with older assets. Similarly, business units with older assets may be hindered with respect to their profitability due to lower productivity levels associated with these older or less efficient assets or machinery.

Generally, larger depreciation charges reduce ROI and capitalization policies, if varied, and may also affect ROI (e.g., expensing assets below a cost of $100 at one division, while expensing assets below a cost of $500 at another division). Inventory methods that increase cost of goods

sold (e.g., LIFO) reduce ROI. The selection of full or absorption costing tends to increase (decrease) net income or ROI when ending inventory levels are rising (falling). Standard costing variances may be closed entirely to cost of goods sold or include a proration to inventory accounts, which also affects profits and asset measures.

Consider how ROI might be manipulated by an executive seeking to maximize short-term ROI and related bonuses. By deferring investments in more efficient machinery and equipment, the denominator, assets, is minimized and depreciation expense is also kept low, maintaining a higher numerator and higher short-term profits. Other strategies might be developed by executives to manipulate and maximize short-term ROI measures, particularly in those cases where, for example, a general manager is preparing to leave one facility for another (e.g., scheduled to leave an automobile plant in the Detroit area for one in South America in 3 to 6 months).

Stock Option Backdating

Stock option or employee/executive stock option (ESO) underline backdating is the practice associated with providing incoming or existing executives with option that are "in the money" by backdating the grant date to a date when stock prices were relatively low. Backdating of ESOs is not necessarily illegal, as long as

(1) No documents have been forged,

(2) The backdating is clearly communicated to shareholders, since shareholders pay the inflated compensation typically resulting from backdating ESOs,

(3) Backdating is clearly reflected in the firm's earnings (backdated ESOs would be in-the-money instead of at-the-money and reported earnings for the firm should be reduced by this amount for the fiscal year of the grant, but since this rarely occurs, some companies engaged in or admitting to backdating of option have restated earnings for prior years), and

(4) Taxes (at-the-money options are considered deductible performance-based compensation, even if in excess of \$1 million (see IRC§162(m)); however, if in-the-money on the decision date, ESOs may not qualify for these tax deductions) for both the firm and the shareholder.

David Yermack provided the pioneering study in the ***Journal of Finance*** in 1997. He found that stock prices tend to increase shortly after the grants. Therefore, problems associated with ESO backdating include:

- Restating prior period financial statements for the firm; reducing earnings
- Amending the prior period tax returns for the firm; reducing tax deductions
- Amending the tax return for the individual ESO recipient; increasing taxable earnings
- Shareholder lawsuits against the firm, for overstating the firm's earnings

Professor Yermack hypothesized that "spring loading" (i.e., timing option grants to take place <u>before</u> expected <u>good</u> <u>news</u>) and "bullet dodging" (i.e., timing option grants to take place <u>after</u> expected <u>bad</u> <u>news</u>) had also taken place.

The Perfect Payday
In an article titled *The Perfect Payday*, written by Charles Forelle and James Bandler and published by **The Wall Street Journal** on March 18, 2006, support was found for Professor Yermack's published academic research. "*Good Timing: CEO Stock Option Awards and Company New Announcements*," **Journal of Finance**, American Finance Association, V52(2) (June): pp. 449-476.)

In a follow-up, **The Wall Street Journal** provided a detailed listing of firms involved and actions taken against them. This listing is <u>updated</u> through September 2007.

The next section explains [1] at-the-money, [2] in-the-money, and [3] out-of-the-money options. While the explanation is in the context of executive stock options (ESOs), these examples might also be used to illustrate call options, in general. Commissions are excluded from these examples, to simplify the illustrations. After you understand ESOs, the practice of back-dating stock options will be addressed in the context of the *The Perfect Payday* article appearing in **The Wall Street Journal** (above).
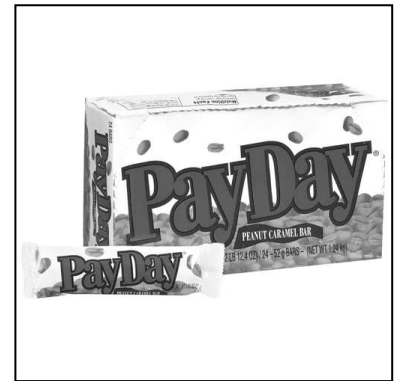
At-the-money ESOs
The following table illustrates a case where a stock is selling at $25 per share. If an executive is hired at this point in time, he or she might be issued performance-based stock options at this point in time, and at-the-money.

Option Type	Market Value	Strike Price	Difference
in-the-money	$30	$25	$ 5
at-the-money	$25	$25	$ -0-
out-of-the-money	$20	$25	$ (5)

In-the-money ESOs
If this newly hired executive contributes to the value of the firm through his or her superior performance, it is presumed that the firm's stock price will increase. Again, continuing to use the same information from the above table, which is replicated below, assume that the firm's stock price rises to $30 per share. If this were to occur, the executive's stock options, issued at the $25 per share strike price, would have increased by $5 per share to $30 per share. These options issued at $25 per share and, now, worth $30 per share are said to be in-the-money.

Option Type	Market Value	Strike Price	Difference
in-the-money	$30	$25	$ 5
at-the-money	$25	$25	$ -0-
out-of-the-money	$20	$25	$ (5)

If this executive was issued 1 million shares, and the firm's stock continued to stay at $30 per share, he or she would be anticipating an additional $5 million in compensation (e.g., $30 less $25 = $5 multiplied by 1,000,000 shares), when these options are exercised. This is in addition to his or her base salary. The presumption is that he or she contributed to the value of the firm and is being rewarded, in a performance-based compensation scheme, where he or she contributed to the increase in the firm's value.

Out-of-the-money ESOs

If, alternatively, this newly hired executive fails to contribute to the value of the firm, a lower stock price might be anticipated. Again, continuing to use the same information from the above tables, replicated below, assume that the firm's stock price rises to $20 per share. If this were to occur, the executive's stock options, issued at the $25 per share strike price, would not have increased, perhaps declined in value by $5 per share to $20 per share. These options issued at $25 per share are, now, unlikely to be exercised, as they are worth only $20 and out of-the-money.

Option Type	Market Value	Strike Price	Difference
in-the-money	$30	$25	$ 5
at-the-money	$25	$25	$ -0-
out-of-the-money	$20	$25	$ (5)

If this executive was issued 1 million shares and the firm's stock continued to remain below the $25 strike price at $20 per share, no additional, performance-based income would be anticipated. In this case, the presumption is that he or she failed to contribute to and/or increase the value of the firm, and no reward is warranted, as he or she did not contribute and increase in the firm's value.

		Financial Statements Impact on the Firm	Tax Return Impact on the Firm	Tax Return Impact on the Individual
Salary		Expense	Deduct	Taxed
Bonus	Current	Expense	Deduct	Taxed
	Non-current	Deferred expense	Deferred deduction	Deferred Tax
	Stock options Nonqualified	Expense	Deduct	Taxed
	Qualified	Expense	No deduction	Taxed
	Performance shares	Expense	Deferred deduction	Deferred Tax
Perks	Retirement plans	Expense	Deduct	Deferred Tax
	Other	Expense	Deduct	Not Taxed

US Government Control of Executive Compensation at Selected Firms

In an article titled *AIG chief gets OK for $10.5 million pay package: Kenneth Feinberg gives formal OK for Benmosche's salary, making AIG the first company to receive the pay czar's compensation approval*, Dave Goldman, *CNNMoney.com* staff writer, reported that the $4 million stock option package was comparable to that of other CEOs. In addition, Benmosche will take

home $3 million in "stock salary," which he cannot sell before August 2014. Finally, he is also eligible for $3.5 million in annual performance bonuses. Previously, Benmosche had been the CEO of MetLife (MET). Feinberg oversees executive compensation packages for 7 bailed-out companies (i.e., AIG, Chrysler, Chrysler Financial, Citigroup, Bank of America, General Motors and GMAC).

In an <u>article</u> titled *U.S. Unveils New Rules on Bankers' Pay: Pay Slashed at Firms that Got Bailouts; Fed Aims to Regulate Compensation Broadly*, Deborah Solomon, Maya Jackson Randall and Meena Thiruvengadam, *WSJ.com* reporters summarized new rules for executive compensation at banks, "marking a watershed moment for government intervention in the private sector." The Fed proposed rules limiting compensation at thousands of U.S. banks and American subsidiaries and the 7 firms receiving significant Government assistance will be limited to $500,000 for cash salaries, with a total compensation cut of 50%.

Balanced Scorecard – A Contemporary Perspective
The balanced scorecard (BSc), if developed properly and with management oversight, may be used as a tool to avoid or minimize management's short-term focus. Inexpensive and widespread electronic data collection and storage for both accounting and administrative information makes the BSc cost-effective and, therefore, a contemporary practical and possible approach to achieve goal congruence between individual and organizational goals and objectives.

Chapter 8
Variable Costing

Learning Objectives
- Define variable costing.
- Understand relevant costs, sunk costs and opportunity costs.
- Understand that applications of variable costing may assist in analyses of make or buy, lease/rent or buy, and sell or process further decisions.
- Describe how variable costing and cost behavior enter into the transfer pricing decision-making process.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.
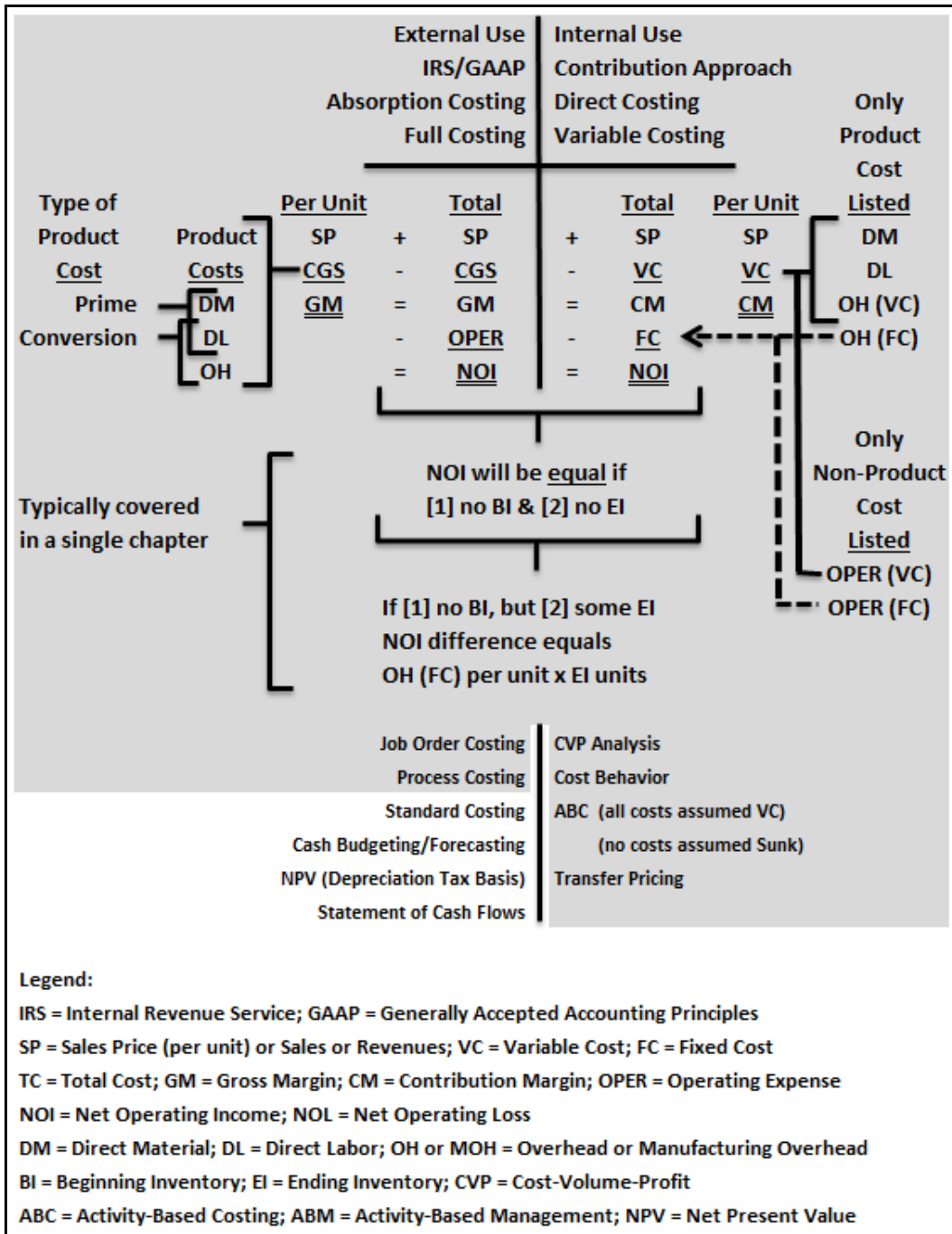
Management must decide which products to sell, whether to make or buy components, what the selling price should be per unit, how products are to be distributed, whether special orders should be accepted, and what data is relevant when making these decisions.

All decisions involve choices between at least two alternatives (e.g., make or buy, lease or purchase). Costs that differ between alternatives are known as *relevant* costs. Costs that do not differ between alternatives are said to be *irrelevant* to the decision (e.g., building rent in an automobile lease or buy decision) and can be ignored. Frequently, these decisions are framed in the context of variable costing.

Variable costing is also referred to as the *contribution approach* and/or *direct costing*, depending on the author and the text. Variable costing employs a cost behavioral approach, where total or mixed costs (MC) are separated into fixed cost (FC) and variable cost (VC) components. The VC is subtracted from sales or revenue (S or R), frequently presumed to be purely variable, to arrive at contribution margin (CM). This is why some refer to variable costing as the contribution approach, as follows:

S – VC = CM

On a per unit basis, assume that a firm sells a product costing $6 (VC) for $10 (S), where the contribution margin is $4 (CM), as follows: $10 - $6 = $4

The example above does not consider FC. Assume that FC is $100 and further assume that 100 units are sold to arrive at net operating income (NOI) as follows:

S – VC = CM – FC = NOI

($10 x 100) – ($6 x 100) = ($4 x 100) - $100 = $300
$1,000 - $600 = $400 - $100 = $300

The same information can be summarized in tabular form, as follows:

	PER UNIT	AT 100 UNITS
S	$10	$1,000
VC	$ 6	$ 600
CM	$ 4	$ 400
FC		$ 100
NOI		$ 300

As the above table suggests, variable costing uses a cost behavioral approach to separate all costs into their fixed and variable cost components, so that S – VC = CM. This technique is sometimes referred to as the *contribution approach*, because the contribution margin first "contributes" to the complete offset or coverage of FC and, thereafter, "directly" (i.e., direct costing) to the "bottom line" or net operating income (NOI).

Applications of Variable Costing
Variable costing has a wide variety of applications. Many are nothing more than incremental analyses of alternatives.

Incremental analyses involve the computation and analyses of incremental revenues and incremental expenses (or costs) and/or the incremental net result of incremental revenues and incremental expenses. It is applied in the context of

(a) Relevant costs,
(b) Sunk cost,
(c) Opportunity costs, and includes:

      (1) Make or buy a subassembly or component or product,
      (2) Lease or rent or buy property, plant and equipment (PP&E),
      (3) Sell earlier in the production process or process further, and
      (4) Retain or drop a product or product line are a few.

Additional variable costing applications include the distinction between absorption and variable costing, the implications of variable costing for transfer pricing, and an understanding of variable costing is essential for segment reporting.

(a) Relevant Costs
Relevant costs are those cost relevant to the decision between alternatives. For example, the monthly rent or lease payment for a building used for business purposes will be the same whether the decision is made to (1) lease or (2) purchase an automobile. Therefore, the cost of the rental or lease is not altered and is not relevant to the decision to (1) lease or (2) purchase an automobile. Generally, any cost (or revenue, for that matter) that is not altered between two options (or alternatives) is not relevant to the decision under consideration.

In managerial accounting, *relevant cost* is a term that might be used, interchangeably, with *avoidable cost* (a cost that might be avoidable or can be avoided in whole or part by selecting one alternative over another), *differential cost* (a cost that differs and where this cost differential might be identified and quantified under the alternatives being considered, and also avoided or an avoidable cost in whole or part under one of the alternatives under consideration), *incremental cost* (that increment or incremental cost that is relevant to the alternative decisions under consideration, and differs or has a quantifiable *differential cost* between these alternatives, where the *incremental cost* differential is both identifiable and quantifiable).

(Some texts use the terms *controllable* and *uncontrollable* to describe *avoidable* and *unavoidable* costs, in the context of the individual manager. Clearly, a cost that someone does not control is a cost that he or she should not be held accountable for.)

There are two steps involved in deciding between alternatives:

1. Eliminate costs and benefits that do not differ (or have no *differential costs*) between alternatives, where these *irrelevant costs* might consist of or include *sunk costs* and/or *future costs*.
2. Focus on the remaining or *relevant costs* and cost components that are *avoidable costs*, *differential costs*, and *incremental costs*.

(b) Sunk Costs
Sunk costs are those costs that have been incurred and cannot be avoided in the short-term. For example, the cost of a building in the form of a monthly cash outflow for a mortgage payment for real property cannot, typically, be avoided in the short-term. Similarly, the fixed portion of overhead (FOH) or other fixed costs are frequently sunk or unavoidable. Sunk costs are presumed not to exist in ABC (Chapter 6), where all costs are treated as through purely variable and traceable to activities and no cost is sunk in the long-term.
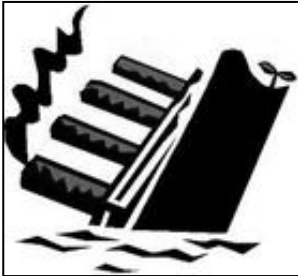
(c) Opportunity Costs
An opportunity cost is the highest valued alternative forgone. For example, you attend college rather than work full-time, so the opportunity cost is the higher income you might, alternatively, generate, by working full-time and forgoing the higher salary, upon graduation, that a degree might generate.

The following table illustrates the opportunity cost of attending college for a 10-year period, where attending college reduces earning for the 4-year period required to earn the 4-year degree. You could change these annual salary measures (in thousands of dollars per year) to more precisely suit your particular circumstances. You could also extend these measures through your anticipated retirement years. The critical point is that you can project and attempt to quantify to opportunity cost of this decision. In the below case, the opportunity cost of attending college is $10,000 for year 1, $11,000 for year 2, and so on.

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Totals
College	$10.0	$10.0	$10.0	$10.0	$35.0	$37.0	$40.0	$43.0	$46.0	$50.0	$195.0
No College	$20.0	$21.0	$22.0	$23.0	$24.0	$26.0	$28.0	$30.0	$28.0	$30.0	$194.0
Difference	($10.0)	($11.0)	($12.0)	($13.0)	$11.0	$11.0	$12.0	$13.0	$18.0	$20.0	$1.0

The above table ignores time value of money considerations.

(1) Alternatives - Make or Buy
Should you make a product or buy it from an external manufacturer? If you produce the product, internally, you will incur additional direct materials, direct labor, and variable overhead (VOH) costs. If you purchase the product from an external provider, some purely variable cost per unit will result and there may be some underutilized capacity, the cost for which is sunk and may be unavoidable, in the short-term. Generally, if these incremental and variable internal product costs are higher than the cost of purchasing the product, externally, the firm may decide to purchase the product from an external provider and visa/versa, as follows:

		Make	Buy
VC	DM	$XX	
	DL	$XX	
	VOH	$XX	
	Purchase Price		$XX
FC	Other	$XX	$XX
TC		$XX	$XX

There may also be traceable and avoidable fixed costs to consider, as well as those fixed costs that are common and unavoidable, even in the event that a product or product line is eliminated. The below table includes rows for these possibilities.

		Make	Buy
VC	DM	$XX	
	DL	$XX	
	VOH	$XX	
	Purchase Price		$XX
FC	Traceable & Avoidable	$XX	
TC	Unadjusted	$XX	$XX
FC	Common & Unavoidable	$XX	-0-
TC	Adjusted	$XX	$XX

Note that the common and unavoidable fixed costs may have been allocated to the product or product line under consideration for elimination. While this allocation might very possibly be systematic and rational, it is also subjective.

For example, there are several methods of depreciation expense (e.g., straight-line, sum-of-the-years digits, double-declining balance). All are systematic and rational; however, all result in different allocations between balance sheet (i.e., accumulated depreciation) and income statement (i.e., depreciation expense) accounts and, therefore, different net income measures.

Similarly, there are alternative methods of inventory valuation (i.e., LIFO, FIFO, weighted-average). All are systematic and rational; however, all result in different allocations between balance sheet (i.e., inventory) and income statement (i.e., cost of goods sold) accounts and, therefore, different net income measures.

In the case of common fixed costs, a firm may establish an allocation method that is both systematic and rational for the allocation of common fixed costs (e.g., square footage, personnel salaries, number of employees), but the allocation is still subjective and, because these costs may be common to the facility and sunk or unavoidable, this classification of fixed cost should not be allocated for product line deletion, addition or replacement decision-making purposes.

(2) Alternatives - Lease/Rent or Buy
Should you lease or buy the automobile for your business? These alternatives would be examined similarly, however, tax effects (i.e., the first time home buyer's tax credit of up to $8,000) may make the analysis or complex and difficult.

		Rent	Buy
VC	DM	$XX	
	DL	$XX	
	VOH	$XX	
	Purchase Price		$XX
FC	Traceable & Avoidable	$XX	
TC	Unadjusted	$XX	$XX
FC	Common & Unavoidable	$XX	-0-
TC	Adjusted	$XX	$XX

(3) Alternatives - Sell or Process Further, Beyond some Split-Off Point

Should you sell a product in an early stage of production, or process it further? Generally, if additional processing results in additional, incremental contribution margin, you are likely to process further, as follows:

	Sell Now	Process Further	Sell Later
S or R	$5	$2	$7
VC	$3	$1	$4
CM	$2	$1	$3
FC	$0		$0
NOI	$2	$1	$3

In the above example, if you sell without further processing ("Sell Now" column), NOI is $2. If you sell after additional processing ("Sell Later" column), NOI is $3. The increase arising from additional processing, in terms of both contribution margin and net operating income, is $1, so you would probably process further.

There may be exceptions. For example, if some alternative use of the resources (or space) used to process further might generate a higher contribution margin, in aggregate, this alternative to further processing might be selected by a profit-maximizing firm.

(4) Alternatives - Retain or Drop a Product or Product Line

Should you drop a product or product line or add a new product or product line? Generally, this decision is based on overall profitability or NOI under each alternative. In these cases, it is critical to identify which costs differ, are avoidable, and, therefore, relevant to the alternatives under consideration.

Proceed Cautiously When Dealing With Allocated Fixed Costs

It is important to proceed cautiously when dealing with or making decisions related to dropping a product line or business unit or segment with *allocated* fixed costs. The allocations may not represent the economic reality, in that the *allocated* fixed cost component may be both *sunk* and *unavoidable*.

	Product A	Product B	Combined
S or R	$50	$60	$110
VC	$30	$50	$80
CM	$20	$10	$30
FC	$10	$10	$20
NOI	$10	$0	$10

Questions to Ask When Analyzing Costs for Alternative Decisions

Some of the questions to ask and consider when performing financial projections or analyses of both variable costs and fixed cost under alternatives include the below:

- Is the cost *relevant* or *irrelevant* under alternatives under consideration?
- Is the cost *avoidable* or *unavoidable* under alternatives under consideration?
- Can the *differential* cost or *incremental* cost be quantified with a point estimate or a range for the alternatives under consideration?
- Is the cost *sunk* and over what time period?
- What is the *opportunity* cost associated with a particular decision or alternative?
- Is it appropriate to include *allocated* costs and/or *common fixed* costs for alternatives under consideration?
- Do allocations of fixed costs make these fixed costs appear as though variable?

Absorption Costing versus Variable Costing

The following table summarizes comparisons between

(1) *Absorption costing* (also known as *full costing*, as covered in a financial accounting course) and used for external reporting purposes or GAAP. This method is also required by the IRS, as they have taken the position that this technique provides for the clearest reflection of taxable income, and

(2) Variable costing (also known as *direct costing* or the *contribution approach*, and covered heavily in managerial and cost accounting disciplines as a tool designed for internal use and decision-making). Cost of goods sold included direct material, direct labor and overhead, whereas variable costs includes direct materials, direct labor and variable overhead, as well as non-product or operating variable cost.

	External Use IRS/GAAP Full Costing Absorption Costing	Internal Use Contribution Approach Direct Costing Variable Costing
	Sales or Revenues	Sales or Revenues
less:	Cost of goods sold	Variable costs
equals:	Gross margin	Contribution margin
less:	Operating expenses	Fixed costs
equals:	Net operating income	Net operating income

An expanded variation of the above generic format includes per unit columns, as follows:

	Absorption Costing		Variable Costing	
per unit	Total	Total		per unit
$	$	$		$
CGS	CGS	VC		VC
GM	GM	CM		CM
	OPER	FC		
	NOI	NOI		

The above framework will be used with a quantitative example to illustrate the mechanical differences between absorption costing and variable costing. Assume the following sales or revenues, variable costs and unit sales:

A firm sells each unit for $10, where per unit costs are $3 for DM, $2 for DL, and $1 for VOH. Variable operating expenses are $1 per unit. Assume 1,000 unit sales. To simplify the problem, both BI and EI for this manufacturing firm is zero.

	Absorption Costing	Variable Costing	
per unit	Total	Total	per unit
$10	$10,000	$10,000	$10
CGS	CGS	7,000	7
GM	GM	$3,000	$3
	OPER	FC	
	NOI	NOI	

Sales or revenues per unit and total revenues were available for both absorption costing and variable costs, at $10 and $10,000, respectively. Variable cost was provided at $7 per unit (direct materials at $3, direct labor at $2, variable overhead at $1 and variable operating expense (OPER) at $1 per unit). Given sales price and variable cost, it was possible to compute contribution margin on both per unit and in total, at $3 per unit and $3,000, respectively. It was not possible to compute cost of goods sold (direct material plus direct labor plus overhead, which includes both variable overhead and fixed overhead) or total fixed cost, because fixed overhead and fixed OPER were not yet provided:

Assume that FOH was $500 for the period (FOH at $500 divided by 1,000 units equals $0.50 per unit) and fixed OPER was $1,000 for the period.

Cost of goods sold is $6.50 per unit (direct materials at $3, direct labor at $2, variable overhead at $1 and fixed overhead at $0.50 per unit) or $6,500 for 1,000 units. Gross margin can be computed at $3.50 per unit ($10 less $6.50) or $3,500 in total.

Transfer Pricing
Transfer pricing involves both tax planning and financial and cost measurement.

First, firms operating in more than one state within the US are subject to net income, before tax (NIBT) rates applicable to all states. The same can be said for multinational firms, operating in more than one country. Each tax jurisdiction, whether domestic, international, or both, wants its fair share of the firms NIBT.
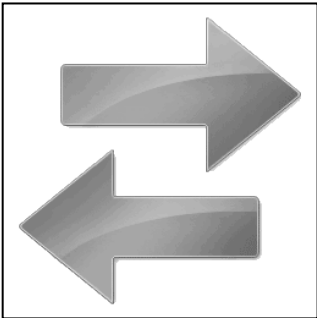
Second, and from a financial accounting perspective, vertically integrated firms must assign some value, internally, to the transfer of a component between subsidiaries or business units. Just as each tax jurisdiction wants its fair share of tax revenues, each business unit manager wants his or her share of profits from the value added at their facility. They expect to see these results, if favorable, in the form of bonuses.

Transfer Pricing - Tax Considerations
Domestically, states tend to apportion a firm's NIBT based on measures that a firm (or individual) cannot easily manipulate. These include the relative amount of:

1. Sales taxes,
2. Property taxes, and
3. Payroll taxes paid in each state or taxing jurisdiction

If states did not use the above measures, firms (and individuals) would prefer to "shift" NIBT from a high tax rate jurisdiction to a low tax rate jurisdiction. To illustrate, a brief summary of maximum corporate tax rates as of January 2009 are provided below (from the Tax Foundation):

AL	6.500%	HI	6.40%	MA	9.50%	NM	7.60%	SD	0.00%	DC	9.975%
AK	9.400%	ID	7.60%	MI	4.95%	NY	7.10%	TN	6.50%		
AZ	6.968%	IL	7.30%	MN	9.80%	NC	6.90%	TX	0.00%		
AR	6.500%	IN	8.50%	MS	5.00%	ND	6.50%	UT	5.00%		
CA	8.840%	IA	12.00%	MO	6.25%	OH	8.50%	VT	8.50%		
CO	4.630%	KS	7.10%	MT	6.75%	OK	6.00%	VA	6.00%		
CT	7.500%	KY	6.00%	NE	7.81%	OR	6.60%	WA	0.00%		
DE	8.700%	LA	8.00%	NV	0.00%	PA	9.99%	WV	8.50%		
FL	5.500%	ME	8.93%	NH	8.50%	RI	9.00%	WI	7.90%		
GA	6.600%	MD	8.25%	NJ	9.00%	SC	5.00%	WY	0.00%		

If a firm has operations in both California and Nevada, they would, if allowed to do so, attempt to report all NIBT profits in Nevada at a tax rate of zero and all NIBT losses in California, effectively saving 8.84% in state income tax. The use of relative payments of sales, property and payroll taxes paid in each state makes it ineffective for this firm to attempt to distort the apportionment of NIBT to inappropriately minimize overall state income taxes paid, domestically.

Transfer Pricing – Financial and Managerial Accounting Considerations
The general rule is to make all internal transfers at market price (the "ceiling"). While competitive pressures may persuade a manager to sell units at variable cost (the "floor"), doing so for an extended period would not be sustainable.

Using variable cost, the below presents a possible transfer between a single firm's departments, business units or subsidiaries, where the finished goods for Division A is used as a raw materials by Division B. The combined column reflects the overall contribution margin to the firm, where the transfer takes place at a market price of $100 per unit:

	Finished goods Division A	Raw materials Division B	Combined
Sales	$100	$125	$225
Variable costs	$50	$100	$150
Contribution margin	$50	$25	$75

Market is always the preferred price at which transfers should take place within a single firm. This allows management (and other stakeholders, if relevant) to assess the profitability of each of the business units, in this case, Division A and Division B. To illustrate the importance of transfers at market price, some alternatives are provided.

Alternative 1: Transfer at below market price of $90

With a transfer at a below market price of $90 per unit, Division A appears to be less profitable (at $40 versus $50 per unit) and Division B appears to be more profitable (at $35 versus $25 per unit). The overall profitability of the firm is not affected and remains constant at $75 per unit.

	Finished goods Division A	Raw materials Division B	Combined
Sales	$90	$125	$215
Variable costs	$50	$90	$140
Contribution margin	$40	$35	$75

What problems are likely to occur when this transfer between divisions is made at a below market price?

First, the profitability of each division is distorted, and cannot easily be compared to external, competing firms. Effectively, the reduced profitability for Division A is subsidizing Division B. If management uses this distorted information for decision-making purposes, they might be persuaded to keep Division B, even though increasingly competitive factors suggest that the more appropriate decision might be to sell Division B.

Second, the managers for Division A might, unless these measures are otherwise adjusted, received lower bonuses based on the appearance of lower profitability for Division A.

Alternative 2: Transfer at above market price of $110

With a transfer at an above market price of $110 per unit, Division A appears to be more profitable (at $60 versus $50 per unit) and Division B appears to be less profitable (at $15 versus $25 per unit). The overall profitability of the firm remains unaffected at $75 per unit.

	Finished goods Division A	Raw materials Division B	Combined
Sales	$110	$125	$235
Variable costs	$50	$110	$160
Contribution margin	$60	$15	$75

What problems are likely to occur when this transfer between divisions is made at an above market price?

Again, the profitability of each division is distorted, and cannot easily be compared to external, competing firms. Effectively, the reduced profitability for Division B is subsidizing Division A. If management uses this distorted information for decision-making purposes, they might be persuaded to keep Division A, even though increasingly competitive factors suggest that the more appropriate decision might be to sell Division A.

Second, the managers for Division B might, unless these measures are otherwise adjusted, received lower bonuses based on the appearance of lower profitability for Division B.

Transfer Pricing Alternatives & Related Decisions
Transfer pricing involves tax planning and financial and cost measurement considerations. These transfers may occur between departments, divisions or subsidiaries that operate in different tax jurisdictions, both [1] within the US and/or different states and [2] between the US and US trading partners and/or different countries.

Generally, taxing jurisdictions are concerned that they are receiving their fair share of tax revenues, and may ask firms to **apportion** taxable income using, as a test of reasonableness, relative payments of

1. Sales taxes,
2. Property taxes, and
3. Payroll taxes.

Firms attempt to arrange their financial and economic transactions, legitimately, to minimize overall taxes that would, then, become unavailable for distribution to shareholders.

The best practice is to make transfers at market price. This allows the firm to view and compare each department, division, subsidiary or business unit to external comparables or competitors. It facilitates the ever-changing portfolio of businesses that a firm chooses to continue, expand or discontinue. (Think in terms of "continuing operations" and "discontinued operations" in a firm's income statement.)

Transfers below or above market will distort the financial results for that department, division, subsidiary or business unit, and could mislead managers when making decisions to continue, expand or discontinue these operations. These transfer prices do not, directly, impact the overall pre-tax or before-tax profitability for firms operating in the multi-jurisdictional business environments.

Transfer Pricing Alternatives
Most texts discuss four basic transfer pricing alternatives: (1) market, (2) variable cost, (3) full-cost, and (4) negotiated, as follows:

1. Market-based transfer prices are always preferred. They are objective, not subject to manipulation, and lead to the correct make or buy decisions in the long-term.

2. Variable cost-based transfer prices may be advantageous to the selling division if surplus capacity exists, but the selling division will not recover any fixed costs. However, if the selling division has surplus capacity, perhaps the variable cost is, actually, the market price. Alternatively, if the selling division can sell above variable cost, it is in the best interest of the organization, overall, for the selling division to do this.

3. Full-cost transfer prices are simple, buy may result in little or no incentive for the selling division to reduce fixed costs. Again, if the buying division can purchase, externally, for a lower price, this is preferable, as it imposes market and competitive forces on the selling division.

4. Negotiated transfer prices consume additional time, but may also represent a market-based transfer price.

Effectively, while the above transfer pricing alternatives may appear to be alternatives, in name, they are really all "market" prices, unless some centralized authority is intervening and/or forcing the selling division to sell at some price that does not reflect market.

What is Market?
Is it possible for variable cost, full-cost, or a negotiated transfer price between divisions to also represent market value? Consider and apply the below definition of "market" or "fair market value":

> Fair market value (FMV) is an estimate of market value, based on what a knowledgeable, willing, and unpressured buyer would probably pay to a knowledgeable, willing, and unpressured seller. An estimate of FMV may be founded either on precedent or extrapolation. FMV differs from the *intrinsic value* that an individual may place on the same asset based on their own preferences and circumstances.

> Since market transactions are often not observable for assets such as privately-held businesses and most personal and real property, FMV must be estimated. An estimate of FMV is usually subjective due to the circumstances of place, time, the existence of comparable precedents, and the evaluation principles of each involved person. Opinions on value are always based upon subjective interpretation of available information at the time of assessment. ***This is in contrast to an imposed value, in which a legal authority (law, tax regulation, court, etc.) sets an absolute value upon a product or a service (emphasis added).***

> A real estate sale, in lieu of an eminent domain taking, would not be considered a FMV transaction since one of the parties (i.e., the seller) was under undue pressure to enter into the transaction. Other examples of sales that would not meet the test of FMV include a liquidation sale, deed in lieu of foreclosure, distressed sale, and similar types of transactions.

A Transfer Pricing Illustration
Assume that the below represents current and proposed operating levels for supplier (S) division. Currently, the supplier division is operating at below their break-even point.
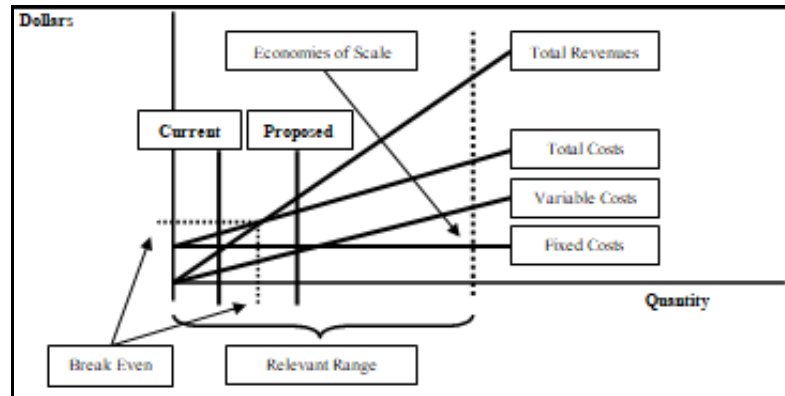
Purchaser (P) division may choose to offer a market-based price to supplier division for their finished goods. If S accepts this offer, S will become profitable and P will be paying a market-based price. Alternatively, any offer from P below market would not be accepted by S and the organization might decide that S will never be profitable and sell S or otherwise discontinue the operations for S.

What if P offered to purchase from S at a less than market-based price? Perhaps at variable cost or full-cost or some negotiated price that is below market? While S might decide to sell at one of these alternatives to market-based prices, this decision is likely to achieve some short-term objective (e.g., continue to employ the existing labor force, while searching for a buyer for S).

Additional Transfer Pricing Issues and Terms

Some authors refer to *insulating* and *non-insulating* allocations. The former refers to cases where cost allocated to one division is <u>not</u> dependent on operational performance for another division. The latter refers to cases where cost allocated to one division <u>is</u> dependent on operational performance for another division.

Review

- Define sunk costs and their relevance to managerial and cost accounting topics.
- Define opportunity cost and its relevance to decision-making.
- Define common costs and the issues their existence may cause when computing a break-even point or contribution margin on a per unit basis.
- Distinguish between absorption and variable costing.
- Compare and contrast the relevance of transfer prices for both internal or domestic and international applications and other considerations.

True/False Questions

1. Sunk costs are those costs below the break-even point.
2. Sunk costs are those costs that cannot be reduced or eliminated in the short- or near-term.
3. Opportunity costs are those costs and benefits forgone from the highest valued alternative.
4. To compute a reliable contribution margin, common costs should, first, be allocated, using the straight-line method.
5. Common costs are those costs that are most common, including rent, utilities, and so on.
6. Under absorption costing, only variable costs are absorbed.
7. Under absorption costing, only fixed costs are absorbed.
8. Under absorption costing, all costs are absorbed.
9. Transfer pricing can be used to legitimately minimize taxes between tax jurisdictions with different tax rates.
10. Pricing is always transferred between subsidiaries at fair market value.

Appendix A
Segment Reporting

Business segment reporting and analysis is nothing more than an extension of variable costing, with some cautionary considerations to keep in mind. Recall the coverage of sales mix covered in chapter 5, focusing on a portion of the CASE 1 example from that chapter, as follows:

CASE 1	Total	Total per Unit	Total Percent of Sales	50% of Total Sales Product A per Unit	50% of Total Sales Product A Percent of Sales	50% of Total Sales Product B per Unit	50% of Total Sales Product B Percent of Sales
S	$50,000	$100	100%	$100	100%	$100	100%
VC	$27,500	$55	55%	$60	60%	$50	50%
CM	$22,500	$45	45%	$40	40%	$50	50%
FC	$20,000						
NOI	$2,500						

Segment reporting is similar, with respect to the treatment of common FC. A common FC is, by definition, <u>not</u> <u>traceable</u>. While a firm might allocate these common FC for a variety of purposes, including bonus computations, it is not appropriate to allocate FC that are not traceable or common FC for the purpose of BE computations. Any such allocations would, even if systematic and rational (e.g., based on sales units or sales revenues), be arbitrary and subjective.

The below table modifies the above example, but emphasizes relevant points and distinguishes between traceable FC, appropriately allocated, and common FC, appropriately not allocated, at least for the purpose of BE computation:

	Total	Subsidiary A or Division A or Product A or Sales Channel A	Subsidiary B or Division B or Product B or Sales Channel B
S or R	$50,000	$20,000	$30,000
VC	$27,500	$12,500	$15,000
CM	$22,500	$7,500	$15,000
Traceable FC	$18,500	$9,500	$9,000
Segment Margin	$4,000	-$2,000	$6,000
Common FC	$1,500		
NOI	$2,500		

How would you allocate the "Common FC" of $1,500, in the above table, between A and B? One accountant might use sales units. Another might use S or R. Still another might use building square footage consumed by each. While all of these allocations might be supported by discussion, each will result in a different FC and, therefore, a different BE PT, and none will be correct, per se. Alternatively, if a FC is not common and is traceable, all will necessarily agree of the FC and BE PTs.

To make the point more clear, consider the case of depreciation expense. While double-declining balance (DDB) and straight-line (SL) and modified accelerated cost recovery system (MACRS) are all systematic and rational methods for depreciating long-lived assets, they are also arbitrary and subjective, in that each will result in a different net income, before tax (NIBT) and net income (NI). Similarly, the allocation of fixed costs not traceable to a subsidiary or a division or a product line or a sales channel (or any other segment) involves bias, at least to the extent of the selection of the method of allocation. Again, while these allocations might be useful and desirable for other financial and financial or cost accounting purposes, common fixed costs or fixed costs that are not traceable should not be allocated for the purpose of break-even computation, as the resulting fixed costs and break-even point will change, depending on the allocation method selected. The table, below, will further illustrate, as the same example from above is used.

METHOD 1	Total	A	B
		2,000 units	3,000 units
Sales or Revenues	$50,000	$20,000	$30,000
Variable costs	$27,500	$12,500	$15,000
Contribution margin	$22,500	$7,500	$15,000
Traceable fixed costs	$18,500	$9,500	$9,000
Segment Margin	$4,000	-$2,000	$6,000
Common fixed costs	$1,500	$1,000	$500
Net operating income	$2,500	-$3,000	$5,500
Break-even point	4,445	2,800	1,900

METHOD 2	Total	A	B
		2,000 units	3,000 units
Sales or Revenues	$50,000	$20,000	$30,000
Variable costs	$27,500	$12,500	$15,000
Contribution margin	$22,500	$7,500	$15,000
Traceable fixed costs	$18,500	$9,500	$9,000
Segment Margin	$4,000	-$2,000	$6,000
Common fixed costs	$1,500	$500	$1,000
Net operating income	$2,500	-$2,500	$5,000
Break-even point	4,445	2,667	2,000

The above involved the use of 2 different, very justifiable, systematic and rational methods of allocating common fixed costs – Method 1 and Method 2:

Method 1 results in total fixed costs at $10,500 for A and $9,500 for B. Therefore, for Method 1, the contribution margin is $3.75 per unit ($7,500 divided by 2,000 units) and fixed costs at $10,500 divided by $3.75 per unit produces a break-even point at 2,800 units for A and the contribution margin is $5 per unit ($15,000 divided by 3,000 units) and fixed costs at $9,500 divided by $5 per unit produces a break-even point at 1,900 units for B.

Method 2 results in total fixed cost at $10,000 for A and $10,000 for B. Therefore, for Method 2, the contribution margin is not changed and remains unaffected at $3.75 per unit, but fixed costs at $10,000 divided by $3.75 per unit produces a break-even point at 2,667 units for A and the contribution margin is not changed and remains unaffected at $5 per unit and fixed costs at $10,000 divided by $5 per unit produces a break-even point at 2,000 units for B.

In both cases, for both Methods 1 and 2, the break-even point for the segment, overall, remains unchanged, at 4,446 units ($22,500 divided by 5,000 equals $4.50 contribution margin per unit and fixed costs at $20,000 divided by $4.50 per unit equals 4,445) to achieve a break-even point.

A Cost-Benefit Analysis of Spring Internships and Summer School Attendance

Mini-Case

The West Chester University (WCU) Department of Accounting offers the vast majority of their accounting courses during two, 5-week summer sessions (Su10 in the below table). This is designed to assist WCU accounting majors, allowing them to complete their degrees in four years, while accepting internships during the spring semesters.

Perhaps ninety percent (90%) of the public accounting firms are hiring graduating accounting majors from their internship pool. Therefore, failure to secure a spring internship may leave a graduate in the remaining pool, competing for the other ten percent (10%) of the jobs available upon graduation.

Even ignoring the above, the cost of 15 credit hours (i.e., 5 three-credit hour courses) in two 5-week summer sessions is $4,140 (i.e., $1,668 plus $2,472), or only $534 (i.e., $4,140 less $3,606) more than the same 15 credit hours that might have been if completed during the spring 2010 (SP10 in the below table) semester.

Credit Hours	SP10 Tuition	SP10 Tech Fee	SP10 Genl Fee	SP10 Total	Su10 Tuition	Su10 Tech Fee	Su10 Genl Fee	Su10 Total
3	$693	$60	$181	$934	$693	$60	$111	$864
6	$1,386	$60	$361	$1,807	$1,386	$60	$222	$1,668
9	$2,079	$60	$542	$2,681	$2,079	$60	$333	$2,472
12	$2,777	$103	$726	$3,606				
15	$2,777	$103	$726	$3,606				
18	$2,777	$103	$726	$3,606				

Questions for discussion: Are the costs for 15 credit hours during the spring 2010 semester comparable to the same for the summer 2010 semester, with a $534 difference, or is this increased cost so significant that it would warrant avoiding a spring semester internship. Be mindful of the fact that the salary generated from the spring internship is likely to be more than $534.

Alternatively, would a May versus an August graduation also warrant the additional expenditure of $534? What if this difference required financing at, say, twenty percent (20%)? Is the summer job for an undergraduate student also a consideration? For example, would you prefer three month's salary as a junior or senior undergraduate student or would your salary level be higher after graduating?

An Emailing List Purchase Decision

Mini-Case 1 – Part 1

Assume that a West Chester University (WCU) is considering entering the distance and online education market. They are facing multiple barriers to entry, including the high cost of "branding" and name recognition. One possibility is to "dip their toe in the water" with some continuing professional education (CPE) courses targeted at CPAs.

Assume that a CPA might expect to pay an average of $16 per credit hour for CPE. Further assume that state boards of accountancy, depending on the state where the CPA is licensed, might require 30 to 40 credit hours per year.

WCU has a course that could be marketed to CPAs and, as an Association to Advance Collegiate Schools of Business- (AACSB-) accredited University, WCU courses are likely to be viewed as superior to alternatives. (Think in terms of "normal" goods and "inferior" goods, from your economics coursework, where courses offered by non-AACSB-accredited institutions would be perceived as relatively inferior.) WCU thinks the course would represent 4 credit hours.

In an effort to, quickly, gain name recognition, WCUs newly appointed Director of Distance Education has identified a website that sells mailing and emailing distribution lists of CPAs and is considering offering CPE to CPAs at $10 per credit hour. At this writing, the website claims to have about 72,000 records and about 28,000 include email addresses. The cost would approximate $300, and twelve months of access to the updated email distribution list is included in the fee. Some quick computations suggest that the cost per name is less than $0.01 (e.g., $300 divided by 28,000).

What is the break-even point, in terms of unit sales of this 4 credit hour course?

Mini-Case 1 – Part 2

Assume that this same course, as described above, could also be marketed to enrolled agents (EAs). If there are approximately 40,000 EAs in the US, how much might WCU be likely to pay for a similar emailing list? Would it be helpful to know the number of hours of CPE required by EAs each year? Research this issue and formulate some thoughts.

Mini-Case 1 – Part 3

Assume that this same course, as described above, could also be marketed to financial planners or certified financial planners (CFPs). If there are approximately 25,000 CFPs in the US, how much might WCU be likely to pay for a similar emailing list, or the cost of internal development of such a list? Would it be helpful to know the number of hours of CPE required for CFPs each

year? Research this issue and formulate a strategy to assist the WCU Director of Distance Education in developing a strategy to market this product.

Mini-Case 2 – Part 1

A recent graduate from the accounting program at WCU has passed the CPA exam in the state of Pennsylvania and is reviewing her future CPE requirements. She notices that she must report here CPE every other year, and that 80 hours are required each reporting period. She also noticed that **published articles & books (by applicant)** may represent 20 hours and **lecturer, discussion leader, speaker or professor** may represent 40 hours of the bi-annual requirements.

Therefore, instead of paying $16 for CPE (an average), she might write some articles for 20 hours. Strategically, she is considering that the article, which will carry her firms name and business contact information, might be read by possible clients. Some may contact her and become clients.

Therefore, she might save her firm $320 ($16 multiplied by 20 hours) and, also, pull in some clients to the firm, rather than attending some CPE session that she might not otherwise be interested in, merely to comply with a requirement to retain her license. Does this appear to represent a reasonable strategy?

Mini-Case 2 – Part 2

A CPA and alumni from WCU has been asked to teach a 3 credit hour course. He possesses significant expertise in financial accounting, and has been asked to teach an introductory course on this topic. With 3 hours at 15 weeks, the course consists of approximately 45 hours for the semester, but he notices that the Pennsylvania Institute of CPAs (PICPA) provides a maximum of 40 hours for **lecturer, discussion leader, speaker or professor**. Still, he concludes that he saves the firm $640 ($16 multiplied by 40 hours) and, also, has an opportunity to target some of the best students, first hand, for future internships and staff accountant positions for his firm. Does this appear to represent a reasonable strategy?

Mini-Case 2 – Part 3

Billy Bob, a CPA with a local public accounting firm, want to take a trip to San Francisco. He identifies a two-day conference in San Francisco, where he can pick up 16 hours of CPE. The hotel is $225 per day, for 3 nights, and the airfare is $1,200 round-trip. The CPE registration for the conference is $900, but includes a few meals. Billy Bob has never been to San Francisco, and knows that the firm lost a few clients in recent years and is not, presently, very profitable. Billy Bob could attend some local conferences, but asks the partner if he can attend the San Francisco conference, at the firm's expense. Billy Bob could also engage in local or regional speaking activities, complete some CPE in this fashion, and, perhaps, pick up a client or two to help improve the firm's revenues. Billy Bob really wants to go to San Francisco and does not enjoy "practice development." Assume that Billy Bob is not a strong asset to the firm, and only does the minimum, but Billy Bob is also not a liability to the firm. Billy Bob comes in to work, does his work, and leaves. Assume that replacing Billy Bob has not and will not be considered. Would you, as the partner in charge, approve Billy Bob's travel for reimbursement upon his return from the San Francisco conference?

Mini-Case 2 – Part 4

Assume the same fact pattern as in **Case 2 – Part 3**, but let's assume that Billy Bob is a faculty member at the public University and that the travel money comes from the taxpayer, at a time when the budget for Billy Bob's University and state is running at a deficit. In this alternate case, Billy Bob could simply change a single course he teaches and pick up 40 hours of free CPE. Also, consider the alternative focus, where Billy Bob might attend a local conference, not for the purpose of picking up clients for a firm, but to secure additional internship opportunities and recruiters for student graduates. None of the other faculty in Billy Bob's Department has requested University reimbursement for a trip to San Francisco – only Billy Bob. Would you, as the Department Chair or Dean of the School, approve Billy Bob's travel for reimbursement for the San Francisco conference?

Mini-Case 2 – Part 5

Assume the same fact pattern as in **Case 2 – Part 3**, but let's assume that unemployment is above 10%, nationwide, and that the public accounting firm continues to lose a few clients, here and there. Billy Bob has returned from his San Francisco conference, complained a bit about the speed at which his reimbursement for the conference was received, and has just received an unfavorable review from his immediate supervisor. The partner in charge, Bozo, reversed the supervisor's review, providing Billy Bob with a favorable review. Bozo believes that Billy Bob, if provided with carrots, will become more productive and become an asset to the firm. Also, Bozo's wife and Billy Bob's wife are good friends. As a staff accountant, manager, or partner (participating in profits) in this firm, how are you likely to feel about this pattern of behavior. Assume that Billy Bob has been receiving (and eating) all of the carrots provided by the managing partner, Bozo, for several years. When asked by his immediate supervisor why Billy Bob does not do more to help the firm, Billy Bob replies, "I do the minimum required at the firm; I show up for work on time and I do my job."

Mini-Case 2 – Part 6

You are a student, wrapping up you four-year degree in accounting. You ask a professor to provide you with preferential treatment, by accepting an assignment after the due date. Consider how this might work in a public accounting firm. Your supervisor misses a deadline when you, a staff accountant, fail to deliver your component of a tax return or an audit assignment on time. The supervisor (and the firm) loses the client and related revenues to the firm. This unhappy client is likely to go to another firm. The firm this lost client goes to is likely to ask the potential client why they left the prior firm. This information is likely to spread, both within the local public accounting industry and the lost client is likely to complain to others, including potential clients. Should the firm continue to employ you or let you go? Should the professor have accepted your late assignment? Keep in mind, the client did not withdraw <u>part</u> of the work from the firm, but simply left the firm for another. Similarly, <u>partial</u> credit from the professor may not represent a reasonable alternative. Therefore, you must consider the consequences of missing a deadline both in and outside of the classroom and work-related environment.

Standard Costing

Learning Objectives

- Define and explain what is meant by *standard*.
- Compute direct material price and quantity variances and direct labor rate and efficiency variances, using standard costs for direct material and direct labor inputs.
- Explain why the use of standard costing and variance analysis may not be desirable for the variable cost component or fixed cost component of allocated manufacturing overhead.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

	External Use IRS/GAAP Absorption Costing Full Costing	Internal Use Contribution Approach Direct Costing Variable Costing		

Type of Product Cost

Product Costs
Prime — DM, DL
Conversion — DL, OH

Per Unit: SP, CGS, GM
Total: + SP, - CGS, = GM, - OPER, = NOI
Total: + SP, - VC, = CM, - FC, = NOI
Per Unit: SP, VC, CM

Only Product Cost Listed: DM, DL, OH (VC), OH (FC)

NOI will be equal if [1] no BI & [2] no EI

Typically covered in a single chapter

If [1] no BI, but [2] some EI NOI difference equals OH (FC) per unit x EI units

Only Non-Product Cost Listed: OPER (VC), OPER (FC)

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:

IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles

SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost

TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense

NOI = Net Operating Income; NOL = Net Operating Loss

DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead

BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit

ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

Standard costing is used to analyze variances from the standard, where the standard is a budgeted or forecasted measure. Any significant variance from the standard attracts the attention of management, resulting in what is referred to as *management by exception*, where only exceptions from the standard or budgeted amount are investigated by managers. Standards may be further qualified as <u>ideal</u> or <u>practical</u>:

- *Ideal* presumes perfect, maximum and extraordinary efficiency in all operational aspects. This level or standard may result in frequent failures and demoralize personnel, but may also be necessary for a world-class firm charging a premium price for a relatively superior product or service.

- *Practical* or *attainable* presumes other than extraordinary efficiency, allowing for some reasonable level of imperfection or less than maximum efficiency.

This chapter addresses the latter, or what might be best characterized as practical or attainable standards. The below provides a summary of terms comparable to *standard*:

Estimated = Budgeted = Forecasted = Projected = Standard = Pro Forma

Standards may be costly to develop, but some fields have associations or subscription services that provide industry standards. For example, a body shop may subscribe to a service, for a fee, that provide the standard number of direct labor hours required to replace a right front fender for an automobile for a particular make, model and year. In this case, the body shop is paying for access to benchmarked data.

Consider the following, simplified form of variance analysis, where there is no favorable (F) or unfavorable (U) variance to investigate, as actual and budgeted amounts are precisely the same and the variance is zero ($0):

Actual Cost	Actual	Budgeted	Variance	Budgeted Cost
	$10,000	$10,000	$0	

In the above case, there is no difference or variance. Management will <u>not</u> investigate the components of costs, as there are <u>no</u> <u>exceptions</u> to warrant any investigation. However, consider the below, where direct material (DM) or direct labor (DL) may each be used to further investigate and develop useful information.

The below is precisely the same as the above fact pattern. Actual cost was $10,000 and budgeted (or standard) cost was also $10,000. However, in this case, a decomposition of components of the DM and DL cost has been generated.
In the above case, no investigation would be conducted, but, as the below illustrates, some variance or variation has occurred and may warrant investigation.

The **$** isolates the DM "price" or DL "rate" variance (where the labor "rate" is the "price" of labor) and the **#** isolates the DM "quantity" or DL "efficiency" variance. The fonts for the **$** and **#** have been increased and bolded in the below example, to draw your attention to the symbols.

Actual Cost	Actual Quantity (AQ)	→ Actual Quantity (AQ)	Standard Quantity (SQ)	*Budgeted Cost*
	x	x	X	
	Actual Price (AP)	Standard Price (SP)	→ Standard Price (SP)	

$10,000		$10,100		$10,000
	$		**#**	
	$100F		$100U	
		$-0-		
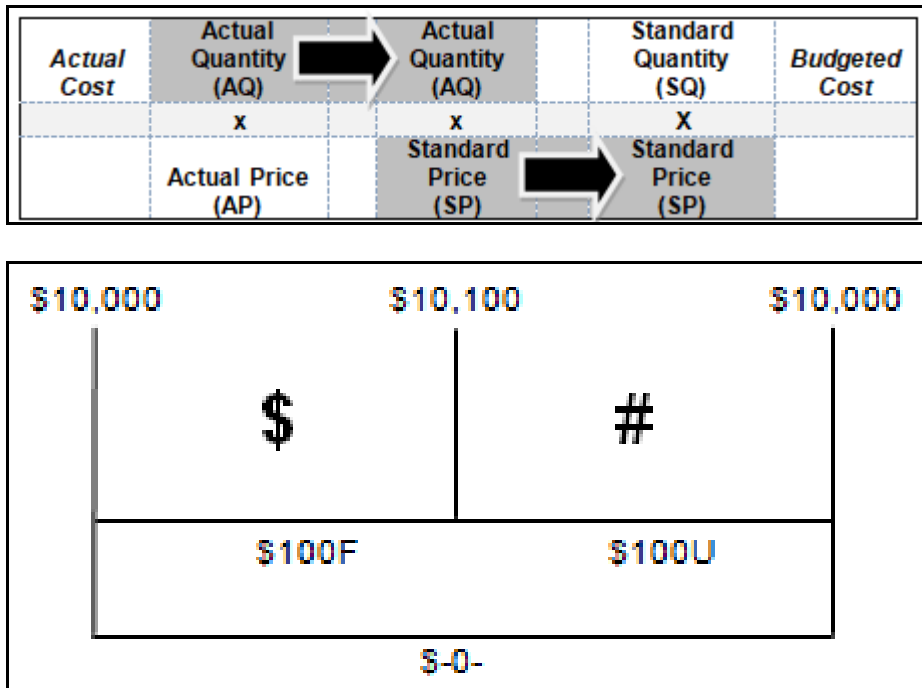
The actual quantity (AQ) is held constant to isolate the DM price or the DL rate variance ($) and that the standard price (SP) is held constant to isolate the DM quantity or the DL efficiency variance (#), as follows:

DM price or DL rate variance	= AQ x (AP – SP) = (AQ x AP) – (AQ x SP)
DM quantity or DL efficiency variance	= SP x (AQ – SQ) = (SP x AQ) – (SP x SQ)
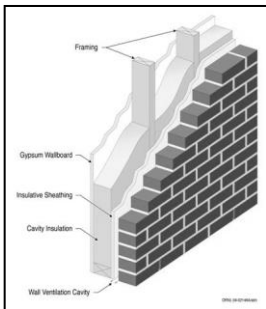
The Direct Material Scenario – All Direct Materials Purchased Are Consumed

The DM scenario provided for a budgeted cost of $10,000 and an actual cost of $10,000. However, when holding the price of these DM inputs constant at the budgeted amount (SQ x SP), an unfavorable (U) quantity (or usage) variance of $100 resulted ($10,000 - $10,100). This unfavorable quantity variance was completely offset by a $100 favorable (F) DM price variance ($10,100 - $10,000). The net result of the DM price and quantity variances was $-0-, yet some insights might result from this decomposition of cost variances.

Could it be that the purchasing agent received a favorable price, perhaps from a new supplier, which resulted in the favorable DM price variance, but the DM inputs from this new supplier resulted in additional scrap and, therefore, the consumption of additional DM? If you found this to be the case, would this information be of some value? The answer to both questions is "yes."

Recall that the first example, without the cost decomposition into DM price and quantity variances or components, did not result in any investigation and, therefore, would not have led the purchasing agent or management to learn this new piece of information. If we choose to use this supplier in the future, however, we know that the lower quality of DM input will result in additional scrap or DM consumption, but budgetary constraints can still be achieved.

The Direct Labor Scenario

The DL scenario provided for a budgeted cost of $10,000 and an actual cost of $10,000. However, when holding the price (or rate) of DL inputs (or hours) constant at the budgeted amount (standard quantity or SQ x standard price or SP), an unfavorable (U) quantity (or usage or efficiency) variance of $100 results ($10,000 - $10,100). This unfavorable (U) efficiency variance was completely offset by a $100 favorable (F) DL rate variance ($10,100 - $10,000). The net result of the DL rate and efficiency variances was $-0-, yet some insights might result from the decomposed cost variances.
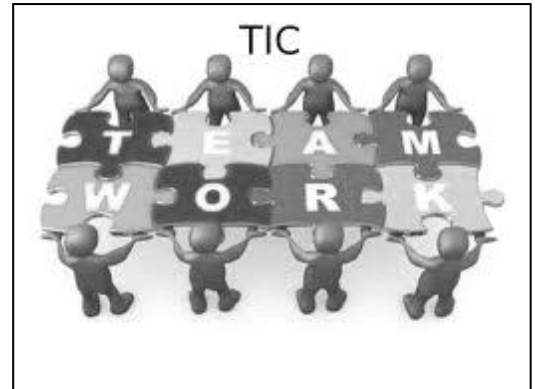
Could it be that the production manager used less skilled personnel than specified for a production run, perhaps due to some shortage of qualified personnel at the time? This could explain the F DL rate variance. Could DL hours used by these employees exceed the budget or standard amount of DL hours and, therefore, the consumption of additional DL? If you find this to be the case, would this information be of some value? The answer to both questions is "yes."

Recall, again, that the first example, without the cost decomposition into DL rate and efficiency variances or components, would not have resulted in any investigation and, therefore, would not have led the production manager to learn about the impact of these alternatives. If we choose to use these lesser qualified personnel than specified in the future we know that the less qualified personnel will result in the consumption of additional DL hours, but we can still meet our budgetary requirements.

The Direct Material Scenario – All Direct Materials Purchased Are <u>Not</u> Consumed

While all direct labor (DL) purchased is consumed in the same period, the same cannot be said for direct materials (DM). Therefore, an alternative scenario exists in the case of DM, as follows:
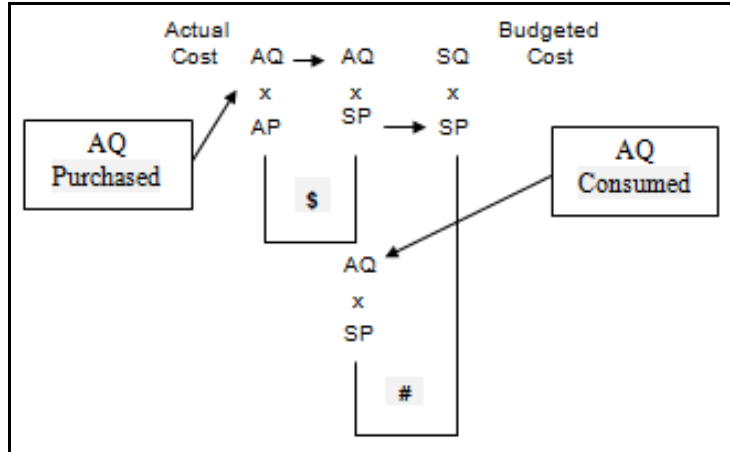
A Comprehensive Illustration: Direct Materials and Direct Labor

Assume the following: Standards suggest that 5 pounds of raw material (RM) inputs at a cost of $10 per pound are required to produce 1 unit of finished goods (FG). Standards suggest that 4 direct labor hours (DLHs) at a cost of $8 per direct labor hour (DLH) are required to produce 1 unit of FG.

100 units of FG were produced during the period or production run. Actual DM cost was $10.10 per pound. Actual DL cost was $8.50 per DLH. 550 pounds of RM inputs were purchased during the period. Beginning inventory was 50 pounds, while 430 DLH and 510 pounds of DM were consumed for the production run.

DM measures:

1. How many pounds of DM should have been used to produce 100 units of FG?
    100 FG x 5 pounds per unit of FG = 500 pounds of DM = SQ

2. What should the DM cost be to produce 100 FG?
    500 pounds x $10 per pound = $5,000

3. What was the actual cost of the DM purchased for the production run?
    550 pounds of DM inputs purchased x $10.10 per pound = $5,555
    What amount of DM remains in EI?
    DM BI at 50 pounds + DM purchases of 550 pounds = 600 pounds of DM available – 510 pounds of DM consumed = DM EI at 90 pounds

DIRECT MATERIAL FIGURE

Actual Cost	550		550		500	Budgeted Cost
	X		X		X	
	$10.10		$10.00		$10.00	

$55U

510
X
$10.00

$100U
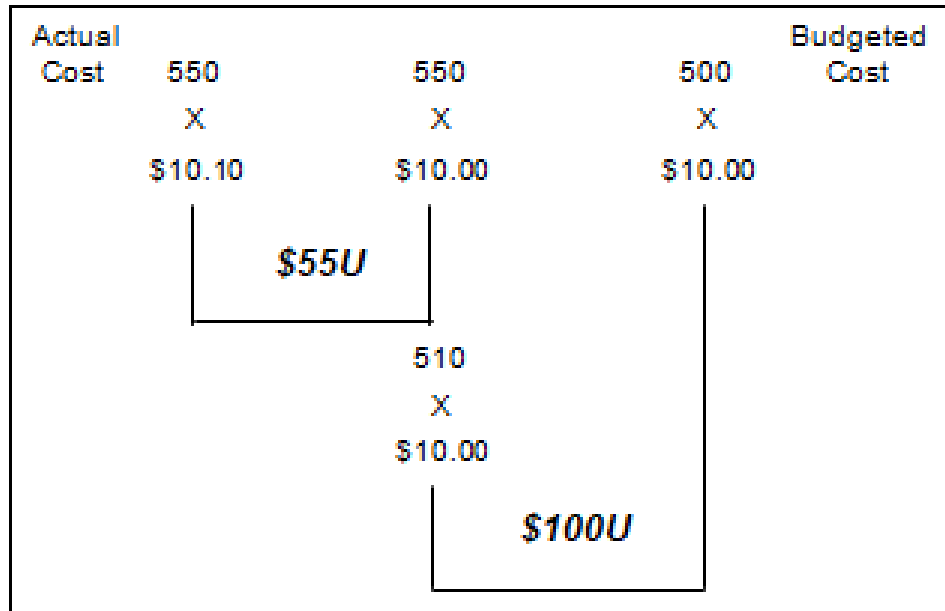
DM price variance (purchased)	= AQ x (AP – SP) = (AQ x AP) – (AQ – SP)
	= 550 x ($10.10 - $10.00)
	= (550 x $10.10) – (550 x $10.00) = *$55U*
DM quantity variance (consumed)	= SP x (AQ – SQ) = (SP x AQ) – (SP x SQ)
	= $10.00 x (510 – 500)
	= ($10.00 x 510) – ($10.00 x 500) = *$100U*

In this case, there was an unfavorable DM price variance, due to the purchase of DM inputs at $10.10 per pound, above the standard or budgeted amount of $10.00 per pound. There was also an unfavorable DM quantity variance, due to the consumption of 510 pounds of DM, 10 pounds above the 500 pounds at the standard or budgeted amount required for actual production.

DL measures:

1. How many DLHs should have been used to produce 100 units of FG?
   100 FG x 4 DLHs per unit of FG = 400 DLHs = SQ

2. What should the DL cost have been to produce 100 FG?
   400 DLHs x $8.00 per DLH = $3,200

3. What was the actual cost of the DLHs consumed for the production run?
   430 DLHs were consumed x $8.50 per DLH = $3,655

DIRECT LABOR FIGURE

Actual Cost	430	430	400	Budgeted Cost
	X	X	X	
	$8.50	$8.00	$8.00	

$215U $240U

$455U
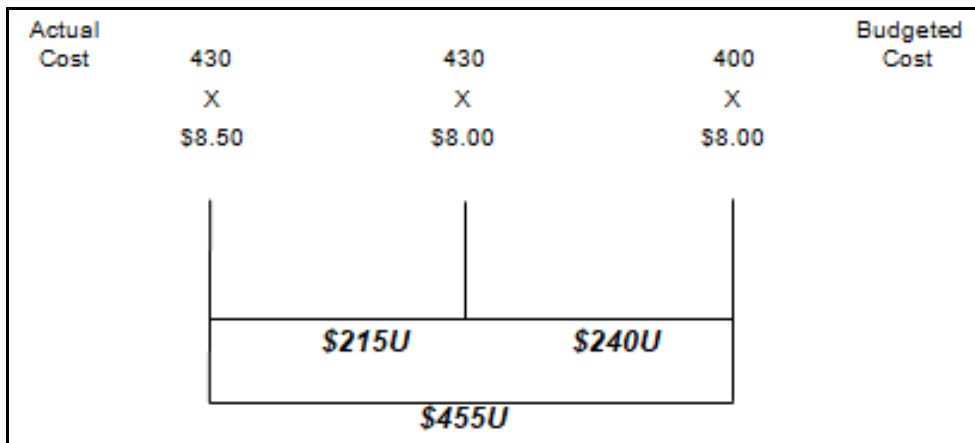
DL rate variance	= AQ x (AP − SP) = (AQ x AP) − (AQ − SP)
	= 430 x ($8.50 - $8.00)
	= (430 x $8.50) − (430 x $8.00) = *$215U*
DL efficiency variance	= SP x (AQ − SQ) = (SP x AQ) − (SP x SQ)
	= $8.00 (430 − 400)
	= ($8.00 x 430) − ($8.00 x 400) = *$240U*

In this case, there was an unfavorable DL rate variance, due to the use of personnel at a higher ($8.50) than budgeted labor rate of $8.00 per DLH. There was also an unfavorable DL efficiency variance, due to the consumption of 430 DLH, 30 DLH above the 400 DLH at the standard or budgeted amount required for actual production.

The Case of Variable and Fixed Overhead
This chapter has been devoted to the development of standards and analyses of variances associated only with direct material (DM) and direct labor (DL), both of which are presumed to be purely variable costs (VC). However, total costs (TC) or mixed costs (MC) may be separated into FC and VC components, using the scatter plot, high-low and/or regression techniques to arrive at a cost equation. The same may be said of the FC and VC components of manufacturing overhead (OH) (fixed overhead or FOH and variable overhead or VOH, respectively).

Many texts produce an analysis of FOH and VOH components of manufacturing OH. However, such an analysis presumes that OH is first separated into FC and VC components. Therefore, any such analysis of variances resulting from the standard is not applied to a pure VC, but to a VC developed from TC or MC OH measures and subject to the reliability established by goodness of fit measures (e.g., R-squared).

What if the goodness-of-fit is or R-squared measure is only 65%? Should it be used? Probably not.

These separate chapters in these texts rarely link the cost behavior chapter content to the VOH analysis or explain where these VOH originate. Frequently, VOH standards are linked to direct labor hours (DLHs) for a labor-intensive facility or machine hours for a highly automated facility.

Variable manufacturing overhead has a spending variance and an efficiency variance, but no production-volume variance and fixed manufacturing overhead has s spending variance and a production-volume variance, but no efficiency variance. The framework is very similar to that used for direct materials, when different amounts are (1) purchased and (2) consumed, as follows:

AQ x AR → AQ(purchased) x SR → AQ(budgeted) x SR → SQ x SR, where

AQ = actual quantity,
AR = actual rate,
SQ = standard quantity, and
SR = standard rate.

These analyses are characterized as 4-variance (separated variable and fixed manufacturing overhead measures), 3-variance (combined manufacturing overhead measures), 2-variance (combined manufacturing overhead measures), and 1-variance analyses (combined manufacturing overhead variances).

Alternatively, manufacturing OH may not be separated, but some form of activity-based costing (ABC) technique might, instead, be applied to the TC or MC for OH. When ABC is used to "trace" OH costs to activities, all OH costs are presumed to be purely variable with respect to the cost driver associated with the relevant cost pool.

In either case, the analysis of VOH, using, for example, DLH for standard costing, does not appear to make any sense. For this reason, standard costing for VOH and FOH is not pursued further in this chapter or in this text (at least not in this traditional form that predates the widespread use of regression or ABC).

A Review of Cost Measurement Systems
Different cost measurement systems treat the components of product costs differently.

- Actual costing, which includes ABC, uses actual costs for DM, DL and OH. Actual OH is applied to jobs.
- Normal costing uses actual costs for DM and DL, as they are significant or material in dollar amount and easily traced to the FG.
- Standard costing uses standards or budgeted or forecasted amounts to generate favorable or unfavorable variances, which are closed out to cost of goods sold or CGS at the end of an accounting period.

A summary of these alternative cost measurement systems and how they impact each produce cost (i.e., DM, DL and OH) is provided below:

Costing Systems	DM	DL	OH
Actual	Actual	Actual	Actual
Normal	Actual	Actual	Applied
Standard	Standard	Standard	Standard

Review

- Define and describe direct material, direct labor, and variable overhead variances.
- Explain the cost behavioral nature of the above.
- Define, describe and explain strengths, weaknesses and how the high-low and regression methods are used and useful.

True/False Questions

1. Direct materials are purely variable, so it is a relatively simple matter to develop a price variance.
2. Direct materials are purely variable, so it is a relatively simple matter to develop a quantity variance
3. Direct labor is purely variable, so it is a relatively simple matter to develop a price or rate variance.
4. Direct labor is purely variable, so it is a relatively simple matter to develop a quantity or efficiency variance.
5. Variable manufacturing overhead is purely variable, so it is a relatively simple matter to develop a quantity or efficiency variance.
6. Fixed manufacturing overhead is purely variable, so it is a relatively simple matter to develop a quantity or efficiency variance.
7. In order to develop separate fixed and variable manufacturing overhead variances, fixed and variable components must, first, be developed.
8. Regression is sometimes used to separate mixed costs into fixed and variable components in the form of a cost equation.
9. An unfavorable variance suggests that budgeted amounts are being exceeded and should be investigated to determine the cause and correct the budgeted measure or solve a problem.
10. A favorable variance means all is well and no investigation is needed.

Journal Entries Used to Record and Close Variances

The below journal entries (JEs) would be made for a financial and cost accounting system that incorporates standards and variances into the general ledger. Note that the standard or budgeted amount is recorded in raw materials (for direct materials) and wages payable (for direct labor) accounts, and that separate accounts titles are used for the temporary or nominal

(1) Materials (purchase) price variance,
(2) Materials quantity (or usage) variance,
(3) Labor rate (or price) variance, and
(4) Labor efficiency variance accounts.

An unfavorable variance (increased expense) is always a debit and a favorable variance (decreased expense) is always a credit. Because these are temporary or nominal accounts, they must be closed out to cost of goods sold at the end of an accounting period.

The first journal entry (JE-1) is designed to record the purchase of raw materials on account, where the price of raw material inputs exceeded the standard, and resulted in an unfavorable material price variance:

JE-1		
Raw materials (standard)	$20	
Materials price variance (unfavorable)	$10	
Accounts payable		$30

The second journal entry (JE-2) is designed to record the consumption of raw materials as consumed in the manufacturing process, where the quantity of raw materials consumed exceeded the standard, and resulted in an unfavorable material quantity variance:

JE-2		
Work in process	$40	
Materials quantity variance (unfavorable)	$25	
Raw materials (standard)		$65

The third journal entry (JE-3) is designed to record the consumption of direct labor as it was consumed in the manufacturing process, where the number of direct labor hours consumed exceeded the standard, resulting in an unfavorable labor efficiency variance, but the hourly rate paid per direct labor hour fell below the standard, resulting in a favorable labor rate variance.

JE-3		
Work in process	$70	
Labor efficiency variance (unfavorable)	$15	
Labor rate variance (favorable)		$35
Wages payable (standard)		$50

The fourth journal entry (JE-4) closes all temporary or nominal variance accounts to cost of goods sold.

JE-4		
Cost of goods sold (plug)	$15	
Labor rate variance (favorable)	$35	
Materials price variance (unfavorable)		$10
Materials quantity variance (unfavorable)		$25
Labor efficiency variance (unfavorable)		$15

This is not unlike closing over-applied or under-applied manufacturing overhead directly to

(1) Cost of goods sold,
(2) Work in process and finished goods, or
(3) Work in process, finished goods and cost of goods sold at the end of an accounting period.

Manufacturing overhead, like favorable and unfavorable variances, is a temporary or nominal account and must be closed out at the end of an accounting period and prior to preparing financial statements.

Flexible Budgeting

Flexible budgeting is nothing more than an extension of cost behavior (Chapter 5) and variable costing, initially presented within the below framework:

	Total	per Unit	Percent of Sales
S	$100,000	$100	100%
VC	$60,000	$60	60%
CM	$40,000	$40	40%
FC	$40,000		
NOI	$-0-		

The static budget or forecast is <u>not</u> flexible. The flexible budget is often covered, in most texts, within the framework of DM, DL and OH, where DM and DL are presumed to be purely VC and OH is presumed to be a mixed cost, requiring separation of these OH-based mixed costs into their fixed cost and variable cost components, and the development of a cost equation (Chapter 5), using the high-low, scatter plot and/or regression techniques. Therefore, the focus tends to be on the variable cost and fixed cost components of overhead.

	per unit	800 Units	1,000 Units	1,200 Units
S or R	$100	$80,000	$100,000	$120,000
DM-VC	$20	$16,000	$20,000	$24,000
DL-VC	$10	$8,000	$10,000	$12,000
OH-VC	$25	$20,000	$25,000	$30,000
CGS-based VC	$55	$44,000	$55,000	$66,000
CGS-based CM	$45	$36,000	$45,000	$54,000
OH-FC		$20,000	$20,000	$20,000
GM		$16,000	$25,000	$34,000
SG&A- or OPER-based VC	$5	$4,000	$5,000	$6,000
SG&A- or OPER-FC		$20,000	$20,000	$20,000
NOI		-$8,000	$0	$8,000
S or R	$100	$80,000	$100,000	$120,000
VC	$60	$48,000	$60,000	$72,000
CM	$40	$32,000	$40,000	$48,000
FC		$40,000	$40,000	$40,000
NOI		-$8,000	$0	$8,000

The above table, for the 1,000 unit column, is consistent with the above table. Portions are highlighted, in both the table above and below, to provide some reference points and focusing on the variable costs.

The 800 and 1,200 unit columns represent "flexible" components of a forecast at 3 levels of activity, where fixed cost remains constant within the relevant range of activity. The row titled "CGS-based CM" is a bit of a misnomer, for lack of a better term, but note that the overhead-fixed

costs at $20,000 plus the "SG&A- or OPER-based FC" at $20,000, combined, results in total fixed costs of $40,000 in both tables.

While most budgets would be expanded to include detailed components of fixed overhead and variable overhead, the "flexible" nature of this budget or forecast is the focus in this appendix.

- At 800 units, the firm will operate at a loss of $8,000.
- At 1,000 units, the firm will operate at break-even.
- At 1,200 units, the firm will operate at a profit of $8,000.

Chapter 10
Forecasting: Pro Forma Financials & Cash Budgeting

Learning Objectives
- Prepare a sales budget, including a schedule of cash inflows, a production budget, including a schedule of cash outflows for direct materials, direct labor and manufacturing overhead, a general sales and administrative expenses budget and the overall cash budget.
- Reinforce your understanding of how the historical balance sheet, pro forma cash budget, pro forma balance sheet, and pro forma income statement are integrated.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

			External Use IRS/GAAP Absorption Costing Full Costing	Internal Use Contribution Approach Direct Costing Variable Costing			Only Product Cost
Type of Product Cost	Product Costs	Per Unit SP CGS GM	Total + SP - CGS = GM	Total + SP - VC = CM	Per Unit SP VC CM	Listed DM DL OH (VC)
Prime Conversion	DM DL OH		- OPER = NOI	- FC = NOI		OH (FC)

Typically covered in a single chapter

NOI will be **equal** if
[1] no BI & [2] no EI

Only Non-Product Cost Listed
OPER (VC)
OPER (FC)

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:

IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles

SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost

TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense

NOI = Net Operating Income; NOL = Net Operating Loss

DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead

BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit

ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

Firms prepare cash budgets for multiple applications, including the determination of working capital (WC) and long-term (LT) financing needs. The starting point for a cash budget is usually the balance sheet for the beginning of the period. In addition to the beginning cash balance, this balance sheet will provide measures of accounts receivable (AR) and accounts payable (AP) which will result in approximations of anticipated cash inflows and cash outflows, respectively, during future months. A basic example and framework for a cash budget, where some modest amount of WC may be required at the end of the first quarter (January 1st through March 31st), follows:

		January	February	March
	Beginning cash	$5	$7	$8
Add:	Cash inflows	$6	$3	$1
Deduct:	Cash outflows	$(4)	$(2)	$(10)
Equals:	Ending cash	$7	$8	$(1)

Relating the Cash Budget to the Firm's Balance Sheet
In the above example, the beginning cash balance for January (January 1st) is $5. This measure should be the cash balance from the balance sheet for December 31st. Cash inflows of $6 for January are due, in part, from the January collection of accounts receivable (AR) from the December 31st balance sheet. Cash outflows of $4 for January are due, in part, from the January payments of accounts payable (AP) from the December 31st balance sheet. The ending cash balance of $7 budgeted for January 31st, is equal to the beginning cash balance of $7, on February 1st, and so on.

Relating the Cash Budget to the Firm's Income Statement
Cash inflows result from cash collections from revenues or sales. Cash outflows result from cash payments for expenses (e.g., direct material (DM), direct labor (DL), manufacturing overhead (OH) and operating expenses (OPER) or general, selling and administrative expenses (GS&A)). The exception, in the latter case, are noncash charges (e.g., depreciation, amortization and depletion), where no cash is involved in the transaction.

Relating the Cash Budget and Income Statement to the Statement of Cash Flows
While the *form* is different, the cash budget is not unlike the statement of cash flows (CFs). The statement of CFs is prepared from the firm's *historical* (1) beginning balance sheet (BS), (2) ending BS and (3) income statement (IS) for the period. It summarizes the CFs resulting from (1) operating, (2) investing and (3) financing activities during the period. The cash budget is not prepared from historical information, but is a pro forma or *projection* of cash flows, also from operating, investing and financing activities, as follows:

Cash Flows	Income Statement		Cost Behavior
Operating	Sales or Revenues	S or R	VC
	CGS	DM	VC
		DL	VC
		OH	MC
	GM	n.a.	
	OPER	SG&A	MC
	NIBT	n.a.	
	Income Tax	T	MC
	NI	n.a.	
Investing		PP&E	BS
Financing		L&OE	BS

As the above suggests, preparation of a cash budget must begin with a forecast and the preparation of a pro forma IS. The firm must project S or R in units, as well as the price per unit, CGS (which includes Direct Materials, Direct Labor and Overhead), OPER or SG&A expenses; federal, state and local income tax (T) payments; and any investing (e.g., equipment purchases) and financing (e.g., borrowing or repayment of debt, issuance or retirement of stock, and dividend payments) activities anticipated.

Also note the cost behaviors, where S or R, DM and DL are purely VC. To forecast or project DM and DL, S or R must first be forecast. SG&A and T may be MC, and PP&E and L & OE are BS accounts where cost behavior does not apply.

Revenues Become Cash Inflows and Expenses Become Cash Outflows
Generally, sales or revenues (Sales or Revenues) result in or become cash <u>inflows</u>. Sales made on credit become Accounts Receivable and are, eventually, collected as cash and used to finance additional inventory, in the form of product costs used by a manufacturing firm to manufacture this inventory (i.e., Direct Materials, Direct Labor and Overhead) as follows:
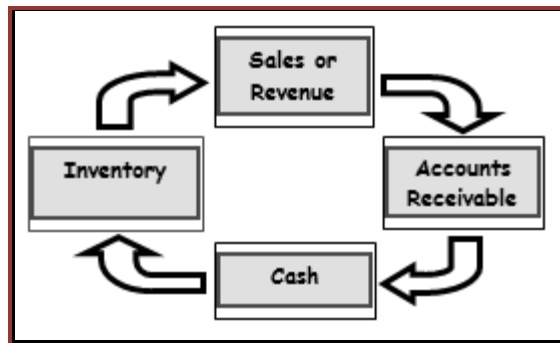
Expenses, other than noncash charges like depreciation, amortization and depletion, result in or become cash <u>outflows</u>. For example, direct materials are purchased on account (AP) and eventually paid off in cash. As sales are made, additional direct materials purchases are made, as follows:
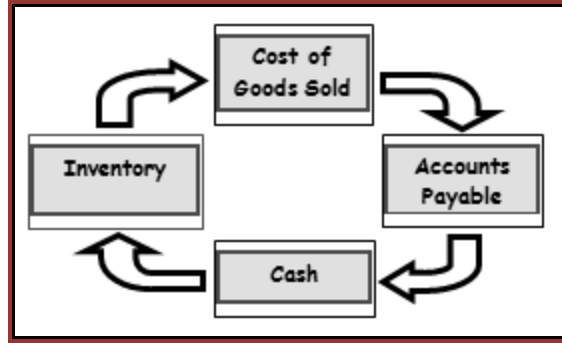
Note that in both of the above cases, operating or WC components are associated with cash inflows and outflows (i.e., Accounts Receivable, Accounts Payable and inventory). Cash inflows and outflows may also result from non-operating activities (e.g., sale or purchase of property, plant and equipment (Property, Plant &Equipment), issuance or payoff of debt, issuance or retirement of common stock and the payment of dividends).

The Sales Budget for the Entire Year, Focusing on May to Illustrate Cash Inflows
The following table provides a sales forecast and cash inflows budget for the entire year, but focuses only on the month of May (My) in great detail.

May Sales or Revenues are $1,000, with sales of 10 units at $100 per unit. Focus on the cash inflow pattern and relations between Sales or Revenues, Accounts Receivable, and the 3% estimated allowance for uncollectible Accounts Receivables or bad debts expense:

May sales on account of $1,000 result in cash collections of 38% in the month of sale, 26% in the month following sale, 17% in the second month following the month of sale, 11% in the third month following the month of sale and, finally, 5% collected in September (Se), the fourth month following the month of sale. This type of detailed cash budget or cash inflows forecast could be developed from historical patterns. In your financial accounting course, for example, you may recall the use of a schedule for the ageing of Accounts Receivable. These historical AR ageing schedules provide the data base for the development of the above estimated patterns of cash inflows. Also, note that the above example makes a provision for uncollectible or bad debt expense at 3% of gross or total Sales or Revenue.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	20X0
Unit sales	5	5	6	8	10	11	13	13	15	10	8	6	110
Per unit	$100	$100	$100	$100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$100	$100	$ 100
Sales	$500	$500	$600	$800	$1,000	$1,100	$1,300	$1,300	$1,500	$1,000	$800	$600	$11,000
May Example:													
38% in 0-30 days					$ 380								$ 380
26% in 31-60 days						$ 260							$ 260
17% in 61-90 days							$ 170						$ 170
11% in 91-120 days								$ 110					$ 110
5% in 120+ days									$ 50				$ 50
Subtotal					$ 380	$ 260	$ 170	$ 110	$ 50				$ 970
3% uncollectible					$ 30	$ -0-	$ -0-	$ -0-	$ -0-				$ 30
Total					$ 410	$ 260	$ 170	$ 110	$ 50				$ 1,000

The example below is more developed in that it focuses on the entire 12 month period. However, because no information has been made available for the prior calendar year, the cash inflows for January, February, March and April 20X0 cannot be fully developed. On the other hand, we can develop some cash inflows information for the first 4 months of the following year.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	20X0
Unit sales	5	5	6	8	10	11	13	13	15	10	8	6	110
Per unit	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100
Sales	$500	$500	$600	$800	$1,000	$1,100	$1,300	$1,300	$1,500	$1,000	$800	$600	$11,000
Cash Inflows:													
38% in 0-30 days	$190	$190	$228	$304	$380	$418	$494	$494	$570	$380	$304	$ 228	$ 4,180
26% in 31-60 days		$130	$130	$156	$208	$260	$286	$338	$338	$390	$260	$208	$ 2,704
17% in 61-90 days			$ 85	$ 85	$102	$136	$170	$187	$221	$221	$255	$170	$ 1,632
11% in 91-120 days				$ 55	$ 55	$ 66	$ 88	$110	$121	$143	$143	$165	$ 946
5% in 120+ days					$ 25	$ 25	$ 30	$ 40	$ 50	$ 55	$ 65	$ 65	$ 355
Subtotal	$190	$320	$443	$600	$770	$905	$1,068	$1,169	$1,300	$1,189	$1,027	$836	$ 9,817
3% uncollectible	$ 15	$ 15	$ 18	$ 24	$ 30	$ 33	$ 39	$ 39	$ 45	$ 30	$ 24	$ 18	$ 330
Total	$205	$335	$461	$624	$800	$938	$1,107	$1,208	$1,345	$1,219	$1,051	$ 854	$10,147

The 4th Quarter of 20X0

The remainder of this chapter focuses only on the cash budget for the 4th quarter of 20X0 (October 1st through December 31st). Therefore, a beginning balance sheet will be required (September 30, 20X0) to develop cash inflows from accounts receivable or AR and cash outflows for accounts payable, as well as the beginning cash balance for the cash budget. It is also possible to create a pro forma or ending balance sheet or BS (December 31, 20X0), as well as an income statement or IS for the 4th quarter (October 1st through December 31st). We will actually build or assemble all of the above, as we progress through this chapter.

STEP 1

Sales, Accounts Receivable and Cash Inflows

Twenty-four unit sales are forecasted for the 4th quarter of 20X0, with total sales or revenues of $2,400, total cash inflows at $3,052, and total bad debts expense of $72. We make the simplifying assumption that the allowance for uncollectible accounts receivable is equivalent to the bad debts expense reported in the firm's balance sheet. Relevant measures are highlighted and the relevant components of financial statements are produced, below:

	October	November	December	4th Quarter 20X0
Unit sales	10	8	6	24
Per unit	$100	$100	$100	$100
Sales	$1,000	$800	$600	$2,400
Cash Inflows:				
38% in 0-30 days	$380	$304	$228	$912
26% in 31-60 days	$390	$260	$208	$858
17% in 61-90 days	$221	$255	$170	$646
11% in 91-120 days	$143	$143	$165	$451
5% in 120+ days	$55	$65	$65	$185
Subtotal	$1,189	$1,027	$836	$3,052
3% uncollectible	$30	$24	$18	$72
Total	$1,219	$1,051	$854	$3,124

The beginning and ending balance sheet measures for accounts receivable must also be developed, where we make the simplifying assumption that the same pattern of sales and revenue occurs for the year prior to and following 20X1, as follows:

Accounts receivable December 31st 20X0	January	February	March	April	20X1
Accounts receivable cash inflows:					
26% in 31-60 days	$156				$156
17% in 61-90 days	$136	$102			$238
11% in 91-120 days	$110	$88	$66		$264
5% in 120+ days	$75	$50	$40	$30	$195
Accounts receivable Total on December 31st 20X0	$477	$240	$106	$30	$853

Accounts receivable December 31st 20X0	January	February	March	April
Source of Accounts receivable cash inflows:				
26% in 31-60 days	December			
17% in 61-90 days	November	December		
11% in 91-120 days	October	November	December	
5% in 120+ days	September	October	November	December

Note that December is highlighted so that you might see the pattern.

The above tables illustrate how the balance sheet ending accounts receivable measure is developed at $853 from the end of the 4th quarter of 20X0. This can be verified by adding **$9,817 (cash received) + $330 (bad debt) + $853 (ending AR)** to arrive at total sales or revenues at $11,000 for 20X0.

Also illustrated is a schedule showing the "Source of AR cash Inflows" – which shows the originating months of these anticipated 20X1 cash inflows.

The September 30, 20X0 accounts receivable or beginning balance sheet balance is developed, as follows:

AR September 30th, 20X0 (net)	October	November	December	January	Total
Accounts receivable cash inflows:					
26% in 31-60 days	$390				$390
17% in 61-90 days	$221	$255			$476
11% in 91-120 days	$143	$143	$165		$451
5% in 120+ days	$55	$65	$65	$75	$260
AR Total on September 30th, 20X0	$809	$463	$230	$75	$1,577
AR December 31st 20X0	October	November	December	January	
Source of AR cash inflows:					
26% in 31-60 days	September				
17% in 61-90 days	August	September			
11% in 91-120 days	July	August	September		
5% in 120+ days	June	July	August	September	

Note that September is highlighted so that you might see the pattern.

Initial, relevant beginning and ending balance sheet, income statement, and cash flow measures, all developed from the sales budget and shaded components of the above table, follow:

Beginning & Pro Forma Balance Sheet	9/30/20X0		12/31/20X0	
Accounts receivable	$1,577		$853	
Pro Forma Income Statement				4th Quarter
Sales				$2,400
Bad Debts				$72
Cash Budget	October	November	December	4th Quarter
Cash inflows	$1,189	$1,027	$836	$3,052

STEP 2

Unit Production Budget
Direct Material and Direct Labor are purely Variable Cost, directly associated with unit sales. Therefore, to develop these components of Cost of Goods Sold, the unit production budget must be developed. This budget is a forecast of the number of units we expect to produce within the time frame.

First, recall the unit sales schedule, introduced earlier in this chapter, as follows:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	20X0
Unit sales	5	5	6	8	10	11	13	13	15	10	8	6	110

Second, recall that we are making the simplifying assumption that the same seasonal unit sales pattern will occur for 20X1.

We want to develop a schedule that shows how many units of Raw Material inputs must be purchased for each month during the 4th quarter so that we might develop measures of cash outflows for Direct Material, Direct Labor and Overhead. Since unit sales are matched with Cost of Goods Sold under accrual accounting, think of unit sales as being equivalent to units for Cost of Goods Sold in the below framework, where the Cost of Goods Sold measures have been filled in, as follows:

		October	November	December	4th Quarter
	BI	?	?	?	?
add:	Purchases	?	?	?	?
equals:	Available	?	?	?	?
less:	EI	?	?	?	?
equals:	CGS	10	8	6	24

Our focus will be on the purchases measure, as we will begin by developing a cash outflows budget for the cash purchase of the Raw Material component of Cost of Goods Sold. Some assumptions must be made.

Assume that we must maintain 20% (rounded up to whole units) of the next month's unit sales for the current month's Ending Inventory. This provides sufficient information to develop both Beginning Inventory and Ending Inventory measures from the above table, and we can plug the remaining measures, as follows:

		October	November	December	4th Quarter
	BI	2	2	2	2
add:	Purchases	10	8	5	23
equals:	Available	12	10	7	25
less:	EI	2	2	1	1
equals:	CGS (#)	10	8	6	24
multiply by:	$10 per unit				$10
equals:	CGS ($)				$240

Note that Beginning Inventory is 2 units ($20) and Ending Inventory is 1 unit ($10).

Some texts rearrange these measures to provide for a required production (purchases) measure at the bottom of the table, as follows:

		October	November	December	4th Quarter
	CGS	10	8	6	24
add:	EI	2	2	1	1
equals:	Needed	12	10	7	25
less:	BI	2	2	2	2
equals:	Purchases	10	8	5	23

Use whichever of the above 2 table formats that works best for you.

Some simplifying assumptions will be made, including $-0- Beginning Inventory Work-in-Process, Ending Inventory Work-in-Process, Beginning Inventory Finished Goods, and Ending Inventory Finished Goods. Additional, relevant beginning and ending Balance Sheet and Income Statement measures, all developed from the purchases budget and shaded components of the above tables, follow:

Beginning & Pro Forma Balance Sheet	9/30/20X0	12/31/20X0	
Raw materials inventory	$20	$10	
Work in process inventory	$-0-	$-0-	
Finished goods inventory	$-0-	$-0-	
Pro Forma Income Statement			**4th Quarter**
Direct materials			$240

STEP 3

Direct Materials, Accounts Payable and Cash Outflows

Direct material is a pure variable cost. Assume that raw material (RM) inputs cost $10 per unit of finished goods. Further assume that 50% of this cost is paid in the month of purchase and the remaining 50% is paid in the month following purchase. Below are the cash outflows, monthly, and for the entire 4th quarter, where the January balance is also provided:

	October	November	December	4th Quarter	January
RM Input Purchases	10	8	5	23	
Per Unit Cost of RM	$10	$10	$10	$10	
Cost of RM to Purchase	$100	$80	$50	$230	
AP September 30th, 20X0	$75			$75	
October Purchases	$50	$50		$100	
November Purchases		$40	$40	$80	
December Purchases			$25	$25	$25
AP Total on December 31st, 20X0	$125	$90	$65	$280	$25

NOTE: RM Input Purchases might be referred to as "Units to Produce."

Additional, relevant beginning and ending balance sheet and cash flow measures, all developed from the direct material budget and shaded components of the above tables, follow:

Beginning & Pro Forma Balance Sheet	9/30/20X0		12/31/20X0	
Accounts payable	$75		$25	
Cash Budget	**October**	**November**	**December**	**4th Quarter**
Cash outflows-Direct materials	-$125	-$90	-$65	-$280

STEP 4

Direct Labor and Cash Outflows

Direct labor (DL) is also a purely variable cost. Assume that direct labor costs per unit of finished good approximate $15, as follows:

	October	November	December	4th Quarter
RM Input Purchases	10	8	5	23
Per Unit Cost of DL	$15	$15	$15	$15
Cost and Cash Flows for DL Purchased	$150	$120	$75	$345

NOTE: RM Input Purchases might also be referred to as "Units to Produce."

Additional, relevant cash budget measures, all developed from the DL budget and shaded components of the above tables, follow:

Cash Budget	October	November	December	4th Quarter
Cash outflows-Direct labor	-$150	-$120	-$75	-$345

STEP 5

Property, Plant & Equipment Cash Outflows

Any additional property, plant & equipment (PP&E) purchases may be required and scheduled during the 4th quarter. Assume that additional PP&E is scheduled to be purchased and placed in service at the beginning of November, at a cost of $500, as follows:

	October	November	December	4th Quarter
Cash Outflow: PP&E	$ -0-	$ 500	$ -0-	$ 500

Beginning and ending PP&E, *prior* to the purchase of additional PP&E in November, above, follows:

Property, plant & equipment:	9/30/20X0	12/31/20X0
Land	$10,000	$10,000
Buildings & equipment	$50,000	$50,000
Accumulated depreciation	-$11,000	-$12,050
Property, plant & equipment (net)	$49,000	$47,950

Assume that additional depreciation expense for the purchase of the additional PP&E for November and December is $5 per month, is now reflected. Buildings & equipment increases from $50,000 to $50,500,

ending accumulated depreciation increases from $12,050 to $12, 060, and ending PP&E (net) increases from $47,950 to $48,440, as follows:

Beginning & Pro Forma Balance Sheet	9/30/20X0	12/31/20X0
Property, plant & equipment:		
Land	$10,000	$10,000
Buildings & equipment	$50,000	$50,500
Accumulated depreciation	-$11,000	-$12,060
Property, plant & equipment (net)	$49,000	$48,440

Additional, relevant beginning and ending balance sheet and cash budget measures, all developed from the PP&E budget and shaded components of the above tables, follow:

Beginning & Pro Forma Balance Sheet	9/30/20X0		12/31/20X0	
Land	$10,000		$10,000	
Buildings & equipment	$50,000		$50,500	
Accumulated depreciation	-$11,000		-$12,060	
Property, plant & equipment (net)	$49,000		$48,440	
Cash Budget	October	November	December	4th Quarter
Cash outflows-PP&E	$-0-	-$500	$-0-	-$500

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STEP 6

Manufacturing Overhead and Cash Outflows

OH is a MC, so a cost equation must be developed, if it is desirable to separate OH into their FC and VC components. Recall the likely costs associated with OH (see Chapter 2), as follows:

OH	IM	$XX
	IL	XX
	Rent	XX
	Utilities	XX
	Property Taxes	XX
	Property Insurance	XX
	Supplies	XX
	Depreciation	XX
	Total OH	$XX

Assume that utilities traceable to the manufacturing facility represent a mixed cost (MC), where the application of regression (see Chapter 4) resulted in the following cost equation:

TC = FC + VC or TC = $5 + $8X, where X = unit sales

	October	November	December	4th Quarter
Unit sales	10	8	6	24
Utilities VC per unit	$8	$8	$8	$8
Utilities VC	$80	$64	$48	$192
Utilities FC	$5	$5	$5	$15
Utilities TC	$85	$69	$53	$207

Also recall that depreciation expense, normally viewed as a period cost is, in the case of overhead or OH, converted to an inventoriable product cost. Depreciation expense is also associated with non-product costs that are traceable to general, selling & administrative (GS&A) or operating (OPER) expenses. Therefore, the change in accumulated depreciation or AD reflecting depreciation expense for the 4th quarter, includes depreciation expense associated with both product cost of goods sold (CGS) and non-product (SG&A or OPER) costs.

Assume that no PP&E was sold during the period. Further assume that $910 of the 4th quarter depreciation expense is traceable to product costs and the remaining balance of $150 for the 4th quarter is traceable to non-product costs, as follows:

	Ending AD	$12,060
less:	Beginning AD	$11,000
equals:	Change in AD to account for	$1,060
	Depreciation expense for product costs	$910
add:	Depreciation expense for non-product costs	$150
equals:	Total depreciation expense accounted for	$1,060

The monthly sources of depreciation expense and a further reconciliation of accumulated depreciation (AD) are developed and provided below:

		October	November	December	4th Quarter
OH	From existing PP&E	$300	$300	$300	$900
	From November PP&E	$-0-	$5	$5	$10
	From OH PP&E	$300	$305	$305	$910
SG&A	From SG&A	$50	$50	$50	$150
	Total depreciation expense	$350	$355	$355	$1,060

For simplicity, the above tables are extended to include utilities, depreciation expense, and other overhead (OH) costs, as follows:

	October	November	December	4th Quarter
Utilities	$85	$69	$53	$207
Depreciation	$300	$305	$305	$910
Other OH	$20	$20	$20	$60
Total OH expense	$405	$394	$378	$1,177
less: Depreciation	$300	$305	$305	$910
Total OH Cash Outflow	$105	$89	$73	$267

Additional, relevant beginning and ending balance sheet, income statement, and cash flow measures developed from the direct material, direct labor and property, plant & equipment related measures follow:

Pro Forma Income Statement				4th Quarter
Manufacturing overhead				$1,177
Depreciation				$150
Cash Budget	October	November	December	4th Quarter
Cash outflows-Manufacturing overhead	-$105	-$89	-$73	-$267

Beginning & Pro Forma Balance Sheet	9/30/20X0		12/31/20X0	
Common stock	$45,000		$45,000	
Retained earnings	$9,925		$10,214	
Cash Budget	October	November	December	4th Quarter
Dividends	-$10	$-0-	$-0-	-$10

STEP 7

Financing-Related Cash Outflows

Any working capital shortfalls must result in arrangements for short-term working capital financing for the 4th quarter, complete with repayment plans. Assume the beginning cash balance for the 4th quarter is $4,403, and that beginning total assets are $55,000. This would provide for an ending cash balance of $5,936. None of these measures consider the impact of income taxes (T).

The Cash Budget

Beginning & Pro Forma Balance Sheet	9/30/20X0		12/31/20X0	
Cash	$4,403		$5,936	
Cash Budget	October	November	December	4th Quarter
Beginning cash	$4,403	$5,167	$5,356	$4,403
Cash inflows	$1,189	$1,027	$836	$3,052
Cash outflows:				
Direct materials	-$125	-$90	-$65	-$280
Direct labor	-$150	-$120	-$75	-$345
Manufacturing overhead	-$95	-$89	-$83	-$267
OPER or SG&A	-$45	-$39	-$33	-$117
PP&E	$-0-	-$500	$-0-	-$500
Dividends	-$10	$-0-	$-0-	-$10
Ending cash	$5,167	$5,356	$5,936	$5,936

Pro Forma Financials

Pro Forma Income Statement		
		4th Quarter
Sales (STEP 1)		$2,400
Cost of goods sold		
Direct materials (STEP 2)	$240	
Direct labor (STEP 4)	$345	
Manufacturing overhead (STEP 6)	$1,177	$1,762
Gross margin		$638
General, selling & administrative		$339
Net operating income		$299
Other income & expense		$-0-
Net income before tax		$299

Pro Forma Retained Earnings	
Beginning retained earnings	$9,925
Net income before tax	$299
Dividends	-$10
Ending retained earnings	$10,214

Beginning & Pro Forma Balance Sheets				
	9/30/20X0		12/31/20X0	
Current assets:				
Cash (STEP 7)		$4,403		$5,936
Accounts receivable (STEP 1)		$1,577		$853
Inventory:				
Raw materials inventory (STEP 2)	$20		$10	
Work in process inventory (STEP 2)	$-0-		$-0-	
Finished goods inventory (STEP 2)	$-0-		$-0-	
Total inventory		$20		$10
Total current assets		$6,000		$6,799
Property, plant & equipment:				
Land (STEP 5)	$10,000		$10,000	
Buildings & equipment (STEP 5)	$50,000		$50,500	
Accumulated depreciation (STEP 5)	-$11,000		-$12,060	
Property, plant & equipment (net)		$49,000		$48,440
Total assets		$55,000		$55,239
Current liabilities:				
Accounts payable (STEP 3)	$75		$25	
Taxes payable	$-0-		$-0-	
Total current liabilities		$75		$25
Total liabilities		$75		$25
Stockholders' equity:				
Common stock (STEP 6)	$45,000		$45,000	
Retained earnings (STEP 6)	$9,925		$10,214	
Total stockholders' equity		$54,925		$55,214
Total liabilities & stockholders' equity		$55,000		$55,239

Tax-Based Cash Outflows

Tax-based cash outflows represent a complex topic, so the vast majority of introductory managerial accounting texts simply choose to ignore or incorrectly apply tax law for the computation of these significant cash outflows (see Appendix 10A).

All for-profit firms must pay income taxes, usually on a pay-as-you-go or PAYGO schedule. These estimated tax payments must be made by firms, just as individual taxpayers must have their employer withhold estimated federal and state income tax amounts from their gross pay.

In the case of this calendar year corporation, estimated tax payments must be made on the 15th day of the 4th (April 15th), 6th (June 15th), 9th (September 15th), and

12th months (December 15th), with any final or remaining income tax balance due on the 3rd month (March 15th) the end of the tax or calendar year end. Therefore, for the case used in this chapter, 20X0 federal income taxes must be paid, in the form of estimated tax payments, on April 15th, June 15th, September 15th, and December 15th of 20X0, with any remaining balance paid on or before the March 15th, 20X1 corporate tax return filing or due date.

This raises a question: How can any taxpaying entity pay 20X0 taxes, <u>during</u> the 20X0 tax year and calendar year, as this calendar year progresses? This issue is resolved through what are referred to as *safe harbors*.

Safe harbors apply to both individuals and corporations. Safe harbors are rules that, if followed, will assist the taxpaying entity in avoiding late payment penalties and interest. The penalties and interest for late payments increase the cost associated with borrowing from the government and provide an economic incentive for taxpaying entities to seek other, less costly and deductible forms of financing.

In very broad terms, there are two commonly applied safe harbors for corporations. While exceptions apply, corporations must pay the lesser of:

1. 100% of the prior year's tax or
2. 100% of the current year's tax

Tax and estimated tax payments represent a cash outflow and a reduction of CA and WC, so corporations would prefer to elect to make the smallest, legally possible cash payment, to avoid any nondeductible penalties or interest for underpayments.

- If a corporation had a net operating loss (NOL) in the prior year, they need not make any estimated tax payments (1 above).
- If a corporation had NOI in the prior year, but anticipates a NOL for the current year, they will not make estimated tax payments (2 above)
- If a corporation had NOI in the prior year, but anticipates a higher NOI for the current year, they will make estimated tax payments based on the NOI for the prior year (1 above).
- If a corporation had NOI in the prior year, but anticipates a lower NOI for the current year, they will make estimated tax payments based on the NOI for the prior year (1 above, but 2 would result in lower cash outflows).

Horizontal and Vertical Analyses

Generally, horizontal and vertical analyses are topics covered in financial accounting texts, where horizontal analysis refers to the percentage analysis of financial statements in a left to right or right to left fashion (think in terms of a "horizon") and vertical analysis refers to the percentage analysis of financial statements in a up and down or down and up fashion (think in terms of "vertigo" and heights and/or a fear of heights). This topic is not covered in any depth in this text at this time.

Zero-Based Budgeting

Zero-based budgeting (ZBB) might best be characterized as a fad that appeared and very quickly disappeared in the early 1990s. It merely represents a system where prior budget period amounts do not represent the *base* or starting point. As the name suggests, instead, the *base* (or starting point) is *zero*. (One firm used a term to refer to their system of *modified* zero base budgeting. The budget is either zero-based or not zero-based.)

Review

- Explain how revenues and expenses impact cash flows.
- List expenses that have no direct impact on cash flows.
- Provide an illustration of the mechanics of cash flows and how they are used to develop pro forma income statements and balance sheets.

True/False Questions

1. Revenues are a term used for accrual accounting, but generate cash inflows.
2. Expenses are a term used for accrual accounting, but generate cash outflows.
3. Credit sales might be matched to the current period under accrual accounting, but cash flows may occur in different periods.
4. Credit purchases might be matched to the current period under accrual accounting, but cash outflows may occur in different periods.
5. Depreciation is a non-cash charge and has no direct impact on cash inflows or outflows.
6. Amortization is a non-cash charge and has no direct impact on cash inflows or outflows.
7. The cash budget produces the means by which a firm might manage cash and includes the impact of cash inflows and outflows occurring from credit sales and credit purchases, respectively.
8. The cash budget is useful in developing accrual-based receivable and payable measures for pro forma balance sheet development.
9. Revenues result in cash inflows and expenses result in cash outflows.
10. The journal entry to record bad debt expense does not involve cash.

Appendix A

Coverage of Estimated Tax Payments (Cash Outflows) in 12 Selected Texts

Only one of the 12 texts reviewed provides technically correct (cost/managerial accounting is, after all, a "technical" topic) coverage of estimated tax payments (cash outflows). Many texts choose to simply ignore estimated tax payments (e.g., not applicable or NA in the below table), but still refer to the so-called *Income Statement* measure as *Net Income*, rather than *Net Income Before Tax*, another technical error. Others provide for some tax-related cash outflows, but ignore the existence of accruals (e.g., no beginning taxes payable or Beg TP in the below table and no ending taxes payable or End TP in the below table).

1st Prd	2nd Prd	3rd Prd	4th Prd	Total	Beg T/P	End T/P	Text
$15,975	$29,790	$56,680	NA	$102,445	$-0-	$102,445	BCCL: 296 & 298
NA	NA	NA	NA	NA	NA	NA	BGN: 307 & 309-11
NA	NA	NA	NA	NA	NA	NA	GN: 394
$100,000	*$120,460*	*$100,000*	*$100,000*	*$440,075*	*$20,460*	*$40,075*	*HDF: 196-199*
NA	NA	NA	NA	NA	NA	NA	H: 366; 368-369
$-0-	$-0-	$-0-	$600	$600	$-0-	$-0-	HM: 292
NA	NA	NA	NA	NA	NA	NA	HMS: 622-623
NA	NA	NA	NA	$128,000	$156	$32	M: 518 & 523
$22,000	$22,000	$22,000	$11,200	$77,200	$-0-	$-0-	MDH: 489
$5,363	$5,363	$5,363	$5,364	$21,453	$-0-	$-0-	NC: 271 & 275
NA	NA	NA	NA	$600,000	$-0-	$-0-	WRF: 192 & 195
$50,947	$50,947	$50,947	$50,947	$203,787	NA	NA	Z: 293

NA = not applicable, Prd = a month or quarter or year and TP = taxes payable balances in the beginning and/or ending balance sheets.

Forecasting: The Product Life Cycle

The product life cycle and its relation and integration into other economics concepts, include substitutes, complements, elasticities, and economies of scale. All have implications for forecasting.

The product life-cycle is, typically, a topic covered in marketing coursework, though it originates from economics. Some additional terms and relevant concepts are included in the below.

Target costing and *life-cycle* or *product life-cycle costing* and *cost leadership* are terms associated with the managerial, management or cost accountant's role in forecasting revenues, expenses, cash flows and working capital needs throughout the life of a product or product line. To be effective, accounting and finance professionals must understand that cost behavior tends to shift from variable to fixed and that revenues tend to decline over a product life-cycle, maturation and decline.

Cost leadership refers to successful cost reduction strategies, typically in the early stages of the product life-cycle, that lead to this market share leadership, further cost reductions or cost leadership, and so on. Common cost leadership successes are achieved by automating labor intensive activities (e.g., a move from direct and indirect labor (variable costs) to machinery or manufacturing overhead (fixed costs) or higher operating leverage. Outsourcing to lower cost geographical locations or emerging markets, where labor costs and regulatory costs are lower have also proved to be very effective in achieving cost leadership.

Industries also have life-cycles. For example, the maturation of an industry from pure competition to oligopoly or the move from a "Big 10" to a "Big 8" and to a "Big 5" public accounting firms may represent part of the natural maturation process for an industry.

Targets are established to achieve cost reductions and remain viable or competitive. For example, it was common (and may still be common) for automobile manufacturers to impose cost reduction targets or target costs on suppliers to retain contracts with the manufacturer (e.g., General Motors, Chrysler and Ford).

In another case or example, high-definition television was, initially, very expensive and purchased by "early adopters." The same might be said for video cassette recorders, DVD players, CD burners on computers, microwave ovens, a variety of cell phones and related features, and so on. It is, for this reason, that accounting majors in college must understand and are required to complete courses in marketing, economics, and other business disciplines. The integration of these disciplines should better enable the accounting professional to think *strategically*.

Stages or Phases of the Product Life Cycle

There are four phases or stages to the product life cycle, following product <u>development</u>. During the <u>introduction</u> or introductory phase, there are many new competitors entering the market and competition is fierce for positioning to achieve market share and economies of scale. During the <u>growth</u> phase, some competitors are already opting out of the market or industry, unable to keep up with technological or cost-cutting and market share gains successfully achieved by competitors.

From a financial accounting perspective, this stage or phase may result in gains or losses from *discontinued operations*.

Market share leaders are emerging and this move from pure competition environment to one with few competitors (and even an industry characterized as an oligopoly) continues through the <u>maturity</u> phase or stage, where the product life is either extended through innovation or begins to <u>decline</u>, as some alternative good, product, or service takes its place. Typical characteristics of these stages are summarized, below:
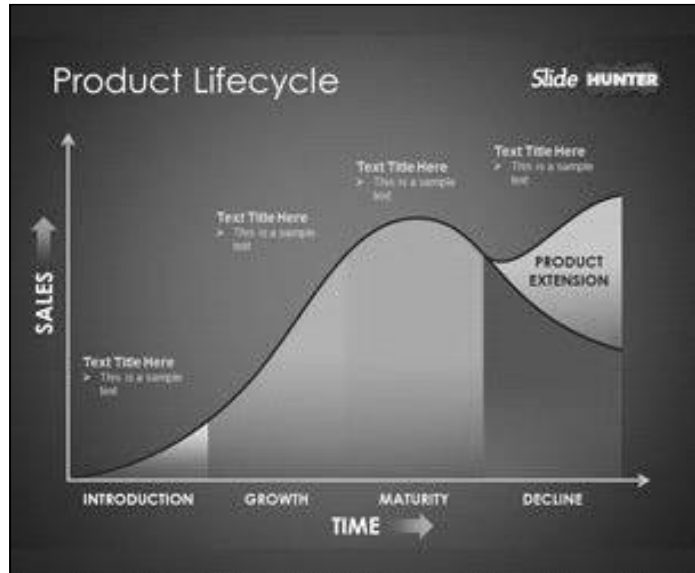
- Development – the development stage is that stage where research and development costs are incurred and accumulated.

- Introduction – sales price per unit and unit costs are high; very little competition; sales volume is low, as unit sales are, initially, driven by *early adopters*; there is little or no competition and unit and sales demand must be generated, often through high advertising and branding costs to prompt consumers (or buyers) to try the product; profits are low or losses are anticipated; and the variety of features available for the basic product are limited.

- Growth – sales rise, but competition increases; costs are reduced as production volume increases and fixed costs per unit decline; economies of scale are within reach or achieved; profitability is achieved and rises; public demand and awareness increases; increased competition leads to additional pressures to lower costs to reduce price and gain market share.

- Maturity – sales may continue to increase, as learning and technology curves lead to additional cost reductions, as volume continues to increase; market saturation is achieved; competition is maximized; branding and product differentiation (including feature diversification) may be used to extend the product life cycle; profits begin to stabilize or even decline.
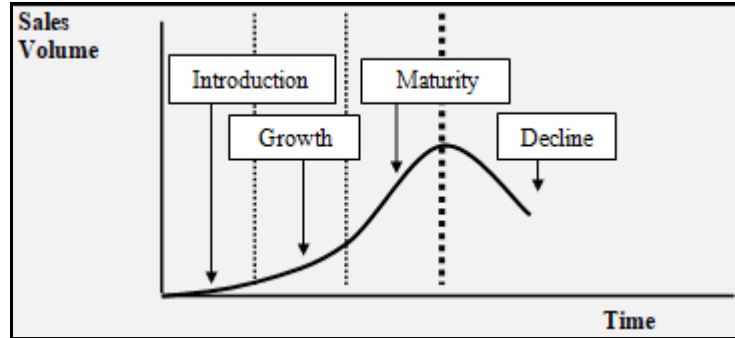
- Decline – sales volume stabilizes or decreases and continued profitability is achieved through increased market share, as many competitors exit the market to divert economic resources to other products, perhaps in the introductory phase of their life cycle; this decline may be avoided or the maturity phase extended through innovation (e.g., advertising of zero or reduced *trans-fats* in the case of some food products).

When thinking of the product life cycle, it is very helpful to view products (and services) in terms of their status as *substitute* or *complimentary* goods or services. While this is not an economics text, historical of data from recent historical substitutes and complements might be useful for unit- and price-related demand forecasting. These forecasts for both price and quantity, ultimately, result in pro forma cash budgets, income statements, and balance sheets. A brief review of substitutes, complements and elasticity follows:

Substitutes
Substitutes are simply those goods (or services) that might, at least partly, satisfy the same needs and may, therefore, be used to replace one another. (The classic example used in texts is the demand for Coca-Cola and Pepsi-Cola.) A very simple example, that ties-in nicely with the product life cycle, follows:

- Radio
- Black & White TV
- Color TV

The black and white television (TV) replaced the radio, but remains a substitute (in some form). (On one dimension, the introduction of the television resulted in the radio being classified as an inferior good, relative to the TV (i.e., normal good). The color TV replaced the black and white TV, where the latter might also be viewed as an *inferior* good. Similarly, the color, picture tube TV has been replaced by big-screen, flat screen, and high definition TVs.

There are many related products. For example, the video cassette recorder (VCR) complemented the TV, when introduced, but also represented a substitute for going to the drive-in or indoor theater. Similarly, the digital video disc (DVD) replaced the VCR, where the latter might also be viewed as an *inferior* good.
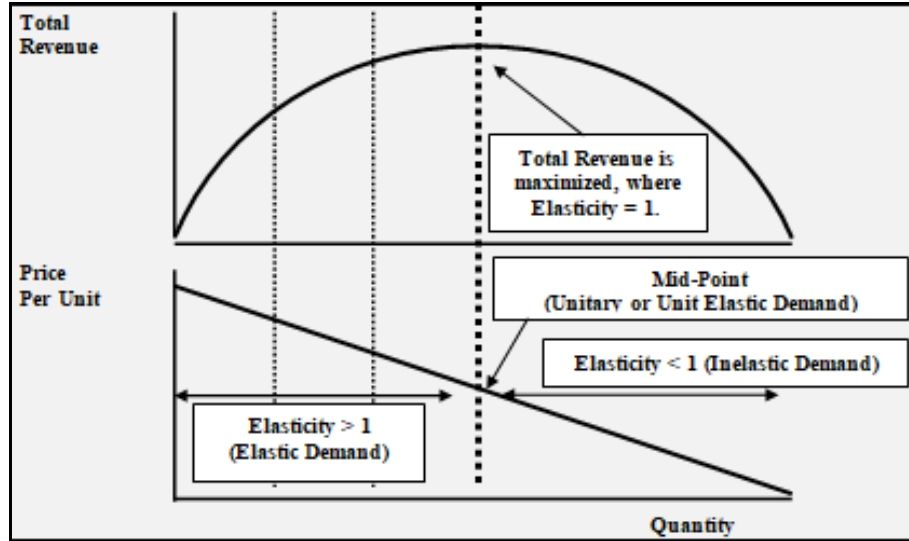
Complements

Complements are those goods (or services) interrelated with an associated or paired good, where the demand for one generates demand for the other. The classic example used in texts is the demand for tires, associated with the demand for automobiles. This might include the purchase of a personal or home surround sound system, the demand for which increases, as the number of homes with cable or satellite TV systems increase.

Substitutes, Complements and Elasticity

These relations may become complex, as some goods may represent both substitutes and complements and marketing may play a significant role in driving consumer demand for a product previously not perceived to be necessary or desirable. Regardless of this complexity, these economic concepts may prove to be quite useful for forecasting through the product life cycle, as is elasticity.

Questions to ask about the product under development:

- Is the product a substitute and\or a complement?
- Is the product likely to convert a normal good to inferior good status?
- At what stage are substitutes and complements in the product life cycle?
- Is there historical data on existing products, likely to be of assistance in determining the likely product life cycle for a 5-year forecast for the product under development?

The product life cycle peaks at that point where industry revenues are maximized and economies of scale are achieved, typically, for the market share leaders. The below removes some of the details, focusing on the alignment of revenue maximization with profit maximization, as fixed costs per unit are minimized at the peak of the product or service life cycle.

From a forecasting perspective, the chief financial officer or controller must understand the above, so that he or she might integrate these disciplines and produce the cash budget and forecast that best facilitates the overall, organizational strategy, which is to maintain a diversified portfolio of products or services, at various stages of the product life cycle. If all products or

services provided by a firm were in the decline stage, for example, the firm would have a limited life.
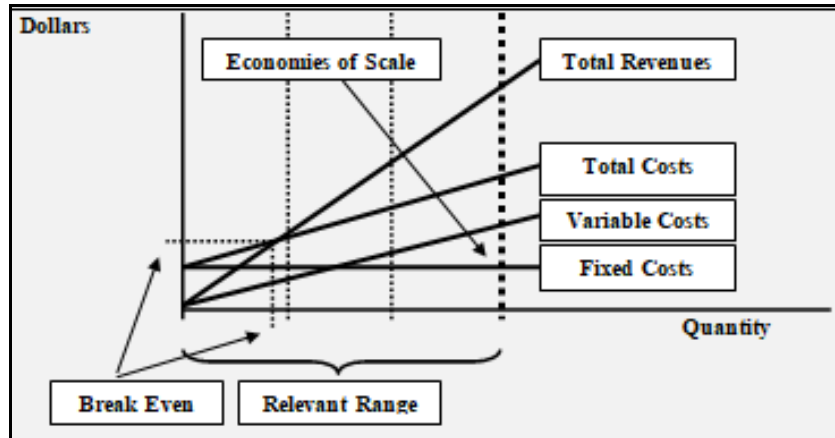
The Public Accounting Firm
The public accounting (or CPA) firm may also be used as an example to illustrate the product life cycle. In this case, consider a public accounting firm's portfolio of services. Typically, public accounting firms make markets in auditing and taxation. But consider the CPA firm with a high-volume, low price per unit tax practice. The portfolio of services is not diversified.

As software prices decline for use for individual income tax return preparation, and costs for the software declines, the use of personal computers also increases, as does the percentage of homes using the internet and making online purchases for a variety of goods and services. Effectively, a CPA firm making a market in the high-volume, low price per unit tax return preparation services gains an increasing share of a declining market. Fortunately, over a similar, multi-decade period, the growth in forensic accounting (i.e., litigation support services) is increasing, and the firm may choose to enter and develop or diversify the practice in this direction.

Terms Used & Associated with the Product Life Cycle
A variety of terms are used and associated with the *product life cycle*. Just as the *sales life cycle* focuses on quantities of unit sales and the price per unit to arrive at cash inflows forecasts, the *cost life cycle* focuses on total costs and component fixed and variable costs per unit and per period to arrive at cash outflows forecasts. Both are necessary to develop the long-term cash budget.

Target costing can best be summarized, as follows:

Target cost = Competitive or market price – Target profit

Target costs are achieved in a variety of fashions, and are industry-dependent. For example, in the automobile industry, suppliers have, historically, simply been "told" to reduce their costs by some specified percentage. While the automobile manufacturers may provide engineering and other expertise to assist suppliers in achieving these target costs, it is difficult for a supplier

deriving, for example, 80% of their revenues from a single automobile manufacturer to simply refuse to accept the "customer's" demand for some specified target cost.

While target costs are a function of sales prices and contribution and gross margin maintenance, accounting and financial professionals must work closely with marketing, engineering and production personnel and managers, where the constantly changing focus includes customers, competitors and costs throughout the product life cycle. This includes formal definition of the value chain, the costs associated with components in the value chain, and the elimination of non-value added activities identified in the value chain.

NOTE: The establishment of different prices offered to different customers may become subject to US Antitrust laws, price discrimination and predatory pricing. Price discrimination is permitted when costs differ, but is illegal if the intent is to lessen or prevent competition (i.e., not in the best interest of the consuming public). Predatory pricing occurs when a firm charges a price below some undefined, appropriate measure of its cost, and has a reasonable prospect of future recovery via increased market share or higher, future prices. Collusion or collusive prices represent conspiratorial activities and are also illegal in the US. Dumping is used in the context of international competition, where the country dumping has some comparative advantage (e.g., low labor cost), relative to the targeted country where the product or service is sold.

Statement of Cash Flows

Learning Objectives
- Understand the balance sheet changes in terms of sources and uses of cash.
- Classify sources and uses of cash in terms of operating, investing, or financing activities.
- Prepare a statement of cash flows using the indirect method.
- Understand the basic differences between the indirect method and the direct method used to produce the statement of cash flows.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.
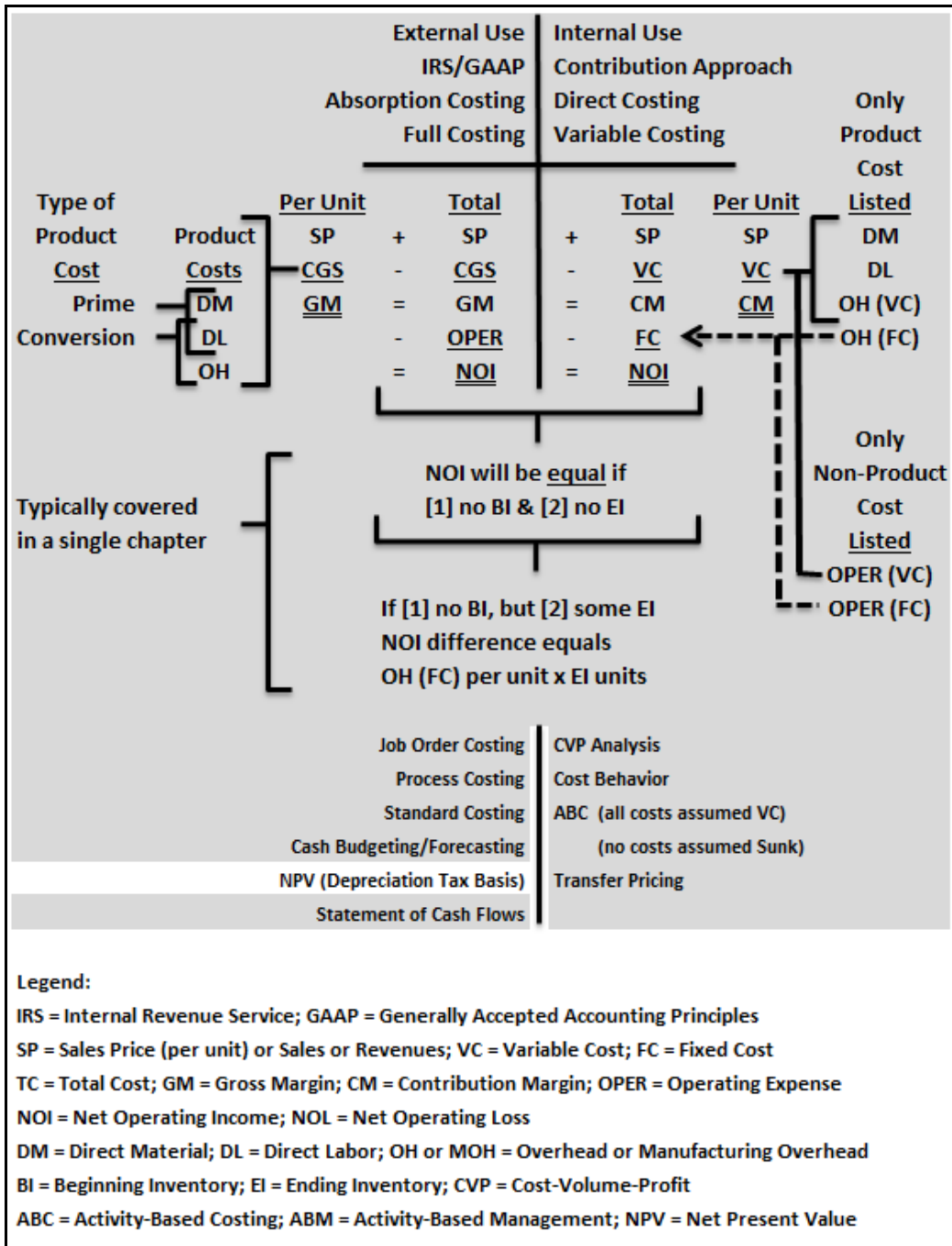
To prepare a statement of cash flows (CFs) (<u>period</u> of time), you need

- The balance sheet (BS) for the <u>beginning</u> of the period (<u>point</u> in time),
- The BS for the <u>end</u> of the period (<u>point</u> in time), and
- The income statement (IS) for the period (<u>period</u> of time), as follows:

<div align="center">

IS & CFs

Beginning BS ←————————————————→ Ending BS

</div>
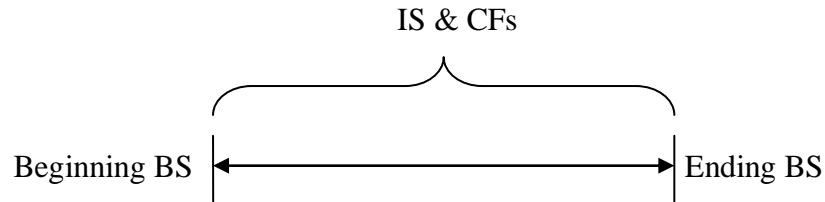
The BSs and IS are prepared on an <u>accrual</u> basis, using accruals (e.g., accounts receivable and accounts payable). Therefore, to prepare the statement of CFs, you must convert these financial statements from <u>accrual</u> basis back to a <u>cash</u> basis.

The completed statement of cash flows allows the stakeholder or interested user of the firm's financial statements to see what activities consumed cash (<u>use</u> of cash) and what activities produced or generated cash (<u>source</u> of cash) during the period. To assist users of the firm's financial statements, sources and uses of cash during the period are classified as cash flows from

- Operating activities (net income (NI) or net loss (NL), current assets (CA) and current liabilities (CL)),
- Investing activities (Non-current assets (CA)), and
- Financing activities (Non-current liabilities (CL) and owners' equity (OE)), as follows:

	BS	IS
Operating	CA & CL	NI or NL
Investing	Non-CA	
Financing	Non-CL & OE	

- Cash flows from operating activities for the period are generated (or consumed) from operating net income (or net loss) and changes in current assets and current liabilities (working capital) (i.e., all activities that are not classified as investing or financing activities).
- Cash flows from investing activities for the period are generated or consumed from transactions involving Non-current assets (e.g., property, plant and equipment or fixed asset sales and purchases).
- Cash flows from financing activities for the period are generated or consumed from transactions involving Non-current liabilities and owners' equity, since all assets are financed with either debt or equity (A=L+OE) (e.g., bonds payable, common or preferred stock dividends and other related transactions).

Effectively, you can use T-accounts to quickly determine whether a change in a balance sheet account balance during the period resulted in an increase (source) or decrease (use) of cash. A few examples follow:

Example 1: Accounts receivable (AR) increased from $100 to $110 during the period. The 2 accounts involved in the transaction's conversion from accrual to cash basis are Cash and AR. The T-accounts for Cash and AR are provided below.

- A debit (DR) to cash would increase (+) cash flow and/or represent a source of cash.
- A credit (CR) to cash would decrease (-) cash flow and/or represent a use of cash.
- Set up the T-accounts for cash and AR, along with the beginning and ending balances for AR and **PLUG** AR with the offsetting DR or CR to cash (i.e., DRs must equal CRs), which is $10.
- The increase in the firm's AR balance for the period resulted in a decrease or use of cash.

	CASH			AR	
	DR INCREASE SOURCE (+)		CR DECREASE USE (-)	DR	CR
Beginning Balance				$100	
PLUG			$10	$10	
Ending Balance				$110	

The above could also be done in journal entry form.

An alternative approach might be to simply place yourself in the firm's position, assuming that the firm's checking account is also your checking account. If you allowed accounts receivable (the amount owed to you) to increase by $10 during a period, did this result in an increase or a decrease in your checking account (cash) balance? By increasing the amount of trade accounts receivable you are financing by an additional $10, you have decreased or used cash that would otherwise have been available to you and included in your checking account balance.

Example 2: Accounts payable (AP) increased from $100 to $110 during the period. The 2 accounts involved in the transaction's conversion from accrual to cash basis are cash and AP. The T-accounts for cash and AP are provided, below.

- A DR to cash would increase (+) cash flow and/or represent a source of cash.
- A CR to cash would decrease (-) cash flow and/or represent a use of cash.
- Set up the T-accounts for cash and AP, along with the beginning and ending balances for AP and **PLUG** AP with the offsetting DR or CR to cash (i.e., DRs must equal CRs), which is $10.
- The increase in the firm's AP balance for the period resulted in an increase or source of cash.

	CASH			AP	
	DR	CR	DR		CR
	INCREASE	DECREASE			
	SOURCE	USE			
	(+)	(-)			
Beginning Balance					$100
PLUG	$10				$10
Ending Balance					$110

The above could also be done in journal entry form.

Again, an alternative approach might be to simply place yourself in the firm's position, assuming that the firm's checking account is also your checking account. If you allowed accounts payable (the amount you owed) to increase by $10 during a period, did this result in an increase or a decrease in your checking account (cash) balance? By increasing the amount of trade accounts payable you are financing by an additional $10, you have increased or identified a source of cash that would otherwise not have been available to you and would not, presently, be included in your checking account balance.

This T-account approach does not work with non-cash (typically, contra) accounts (e.g., allowance for doubtful accounts, depreciation, depletion and amortization, including amortization of bond premium or discount), since these accounts are usually adjusted without offsetting DRs and CRs to the cash account and these transactions do not affect cash.

Two Formats for the Statement of Cash Flows
There are two formats for the statement of cash flows or CFs:

(1) Direct method and
(2) Indirect method.

These methods produce differences in the operating section, but not in the investing and financing sections of the statement of cash flows. The operating section in the statement of cash flows under the direct method comes "directly" from the income statement or income statement format (hence the name). A simplified comparison (or reconciliation) between the direct and indirect methods is provided below.

The basic income statement format is Revenue – Cost of Goods Sold – General, Selling & Administrative – Tax = Net Income/(Loss). Notice that the direct method takes its form directly from the income statement, beginning with the accrual measures for Revenue, Cost of Goods Sold, General, Selling & Administrative, Tax, Net Income/(Loss).

Alternatively, the indirect method develops operating cash flows by beginning with net income or net loss, adding depreciation (and other noncash charges), and making adjustments for all working capital items (e.g., current assets and current liabilities).

Income	Direct			Indirect
Statement	Method			Method
Revenues	*Revenues*			+/- NI/(L) (a)
	AR (c) adj	Adj Revenue		+ Depreciation (b)
CGS	*CGS*			+/- AR (c)
	Inventory (d) adj			+/- Inventory (d)
	AP (f) adj	Adj CGS		+/- Prepaid Exp (e)
S&A Exp	*S&A Exp*			+/- AP (f)
	Prepaid Exp (e) adj			+/- Accrued Liability (g)
	Accrued Liability (g) adj			+/- T/P (h)
	Depreciation (b)	Adj S&A		+/- Deferred Tax (i)
Tax Exp	*Tax Exp*			- Gains/+ Losses
	T/P (h)			
	Deferred Tax (i)	Adj Tax		
NI/(L)	NI/(L) (a)	Net Cash		

Again, the ***direct*** method takes its form ***directly*** from the income statement format, beginning with the accrual measures for R, CGS, S&A, Tax and NI. R is adjusted (adj) for AR (c), CGS is adjusted for inventory (d) and AP (f), S&A is adjusted for prepaid expenses (e) and accrued liabilities (g), and tax is adjusted for taxes payable (T/P) (h) and deferred tax (i).

Alternatively, the ***indirect*** method develops operating cash flows by beginning with NI or NL, adding depreciation (and other noncash charges) to NI or NL, and making adjustments for all working capital items (e.g., current assets and current liabilities). Nonrecurring gains and losses would also require adjustment in the operating section of the statement of cash flows, as these amounts are not recurring, operating events, and where gains would be deducted and losses would be added back into net income measures in the operations section of the statement of cash flows.

A Basic Example – Indirect Method
Below are a balance sheet and income statement. Headings have not been included, so these financial statements are not in *good form*, as we focus on the preparation of the statement of cash flows using the indirect method.

Beginning and ending balance sheet account balances are provided. A change column is also provided for the balance sheet components. Since DRs must equal CRs, mechanically, the changes columns must also be equal for the balance sheet components (e.g., A=L+OE or DR=CR). The income statement includes a nonoperating gain on the sale of investments and a nonoperating loss on the sale of property, plant & equipment.

During the period, the company discarded (i.e., removed from service) equipment (PP&E) with a cost of $9 and accumulated depreciation (AD) of $6. This piece of equipment was obsolete and had no market value. In addition, long-term (LT) investments that cost $5 were sold for $10. Dividends of $9 were paid during the period.

Balance Sheet & Income Statement	Ending	Beginning	Change
Cash	$15	$13	$2
Accounts Receivable	$20	$21	-$1
Inventory	$25	$22	$3
Prepaid Expenses	$10	$14	-$4
Property, Plant & Equipment	$220	$199	$21
Accumulated Depreciation	-$15	-$14	-$1
Long-Term Investments	$45	$40	$5
TOTAL ASSETS	$320	$295	$25
Accounts Payable	$35	$29	$6
Accrued Liabilities	$30	$20	$10
Bonds Payable	$65	$60	$5
Deferred Income Tax	$5	$9	-$4
Common Stock	$75	$78	-$3
Retained Earnings	$110	$99	$11
TOTAL LIABILITIES & OWNERS' EQUITY	$320	$295	$25
Sales		$500	
Cost of Goods Sold		$350	
Gross Margin		$150	
Selling & Administrative Expenses		$120	
Net Operating Income		$30	
Nonoperating Items:			
Gain on Sale of Investments	$5		
Loss on Sale of Equipment	$3	$2	
Net Income Before Taxes		$32	
Income Taxes		$12	
Net Income		$20	

Cash Flows from Operating Activities

Beginning with the operating section of the statement of cash flows, notice that you start with net income and that any nonoperating gains and losses are removed from the operating section, as follows:

Operating Activities:	
Net Income	$20
Gain on sale of investments	-$5
Loss on sale of equipment	$3

Recall that the journal entry for depreciation expense does not involve cash, so depreciation expense must be added back to net income to arrive at cash flows from operations, as follows:

Operating Activities:	
Adjustments to convert net income to a cash basis:	
Depreciation	$7

Working capital consists of current assets and current liabilities. Working capital is used for operations, therefore, changes in the beginning and ending balances for current assets and current liabilities must be made in the operating section of the statement of cash flows, as follows:

Operating Activities:	
Decrease in accounts receivable	$1
Increase in inventory	-$3
Decrease in prepaid expenses	$4
Increase in accounts payable	$6
Increase in accrued liabilities	$10
Decrease in deferred income tax	-$4

The mechanics of deferred income tax is complex, with an entire chapter devoted to this topic in the last semester of an intermediate financial accounting course. For now, simply treat deferred income tax, which may be an asset or a liability, as you would any other accrual.

The computation of depreciation expense is aided by using T-accounts for the property, plant & equipment (PP&E) and related accumulated depreciation accounts. We know that the beginning and ending PP&E account balances were $199 and $220, respectively, for a $21 net change.

However, we also know that we had a $3 loss on the sale of equipment, and this loss was based on the sales price less book value (BV). BV is the cost of the fixed assets (FA) less AD. It will be helpful to examine the PP&E and related AD accounts, in T-account form simultaneously, as follows:

		PP&E			AD	
Beginning Balance	$199					$14
PP&E Removed from service			$9	$6		
Ending Balance	$220					$15

The BV for the FA removed from service as obsolete was $3 (i.e., $9 cost less $6 AD). This information was provided. The loss on sale of equipment for this FA is also $3 (see income statement). With this information, we can PLUG the depreciation expense (and PP&E purchases during the period), as follows:

		PP&E			AD	
Beginning Balance	$199					$14
PP&E Removed from service			$9	$6		
PLUG	$30					$7
Ending Balance	$220					$15

We know that PP&E purchases of $30 were made during the period. We will use this information to complete the investing activities section of the statement of cash flows. The depreciation expense for the period was $7, as follows:

Operating Activities:	
Depreciation	$7

The completed operating activities section of the statement of cash flows shows that positive cash flows were generated from operations, as follows:

Operating Activities:		
Net Income		$20
Adjustments to convert net income to a cash basis:		
Depreciation	$7	
Decrease in accounts receivable	$1	
Increase in inventory	-$3	
Decrease in prepaid expenses	$4	
Increase in accounts payable	$6	
Increase in accrued liabilities	$10	
Decrease in deferred income tax	-$4	
Gain on sale of investments	-$5	
Loss on sale of equipment	$3	$19
Net cash provided by operating activities		$39

Cash Flows from Investing Activities

The investing activities section of the statement of cash flows focuses on non-current assets. We already know, from our development of the depreciation expense measure for the period, that $30 of additions was made to PP&E during the period, as follows:

Investing Activities:	
Additions to property, plant & equipment	-$30

The equipment removed from service during the period did not generate any revenues, as follows:

Sales Price		$0	
Cost	$9		
AD	$6	$3	BV
Gain/(Loss)		-$3	

If the firm had been able to sell this equipment, the sales price for the equipment would be included in the investing activities section as a source of cash flow.

We also know that long-term or LT investments with a cost or book value or BV of $5 were sold for $10 during the period, for a gain of $5 (see the income statement). However, LT investments increased from $40 to $45 during the period. Again, it is helpful to examine the T-account, as follows:

		LT Investments	
Beginning Balance	$40		
LT Investments Sold			$5
PLUG	$10		
Ending Balance	$45		

The firm purchased an additional $10 in LT investments during the period, presented in the statement of cash flows as a use of cash, as follows:

Investing Activities:	
Additions to long-term investments	-$10

Recall that the gain on sale of investments was removed from net income, as a nonoperating item, in the operating section of the statement of cash flows. The gain on the LT investments sold can be developed, as follows:

Sale	$10	
Cost	$5	BV
Gain/(Loss)	$5	

The proceeds from the sale of LT investments are presented below:

Investing Activities:	
Proceeds from sale of long-term	$10

The completed investing activities section of the statement of cash flows shows that negative cash flows (net use of cash) were generated from additional investments in the firm during the period, as follows:

Investing Activities:		
Additions to property, plant & equipment	-$30	
Additions to long-term investments	-$10	
Proceeds from sale of long-term investments	$10	
Net cash provided by investing activities		-$30

Cash Flows from Financing Activities
All assets are financed with debt or equity (A=L+OE). Recall that the financing activities section of the statement of cash flows focuses on non-current liabilities and owners' equity.

The firm issued an additional $5 in bonds, for cash, during the period:

Financing Activities:	
Increase in bonds payable	$5

The firm reduced outstanding common stock by purchasing $3 in shares, for cash, during the period:

Financing Activities:	
Decrease in common stock	-$3

Finally, the firm paid $9 in cash dividends during the period:

Financing Activities:	
Cash dividends paid	-$9

The completed financing activities section of the statement of cash flows follows, where financing activities resulted in the net use of cash flow:

Financing Activities:		
Increase in bonds payable	$5	
Decrease in common stock	-$3	
Cash dividends paid	-$9	
Net cash provided by financing activities		-$7

Reconciling Beginning and Ending Cash and Summary

Beginning cash was $13 and ending cash was $15, so the $2 increase in cash during the period is reflected in the reconciliation at the bottom of the statement of cash flows:

Net increase in cash and cash equivalents	$2
Cash and cash equivalents at the beginning of the year	$13
Cash and cash equivalents at the end of the year	$15

The $2 increase in cash during the period was the net result of a $39 increase in cash flow, produced from operating activities and the use of cash flows of $30 and $7 for investing and financing activities, respectively.

The completed statement of cash flows, without a heading, but otherwise in *good form*, follows:

Statement of Cash Flows – Indirect Method		
Operating Activities:		
Net Income		$20
Adjustments to convert net income to a cash basis:		
Depreciation	$7	
Decrease in accounts receivable	$1	
Increase in inventory	-$3	
Decrease in prepaid expenses	$4	
Increase in accounts payable	$6	
Increase in accrued liabilities	$10	
Decrease in deferred income tax	-$4	
Gain on sale of investments	-$5	
Loss on sale of equipment	$3	$19
Net cash provided by operating activities		$39
Investing Activities:		
Additions to property, plant & equipment	-$30	
Additions to long-term investments	-$10	
Proceeds from sale of long-term investments	$10	
Net cash provided by investing activities		-$30
Financing Activities:		
Increase in bonds payable	$5	
Decrease in common stock	-$3	
Cash dividends paid	-$9	
Net cash provided by financing activities		-$7
Net increase in cash and cash equivalents		$2
Cash and cash equivalents at the beginning of the year		$13
Cash and cash equivalents at the end of the year		$15

Review

- Describe the 3 classifications of the statement of cash flows in the context of classified balance sheet components.
- Provide an example of a transaction involving debt and equity, but no cash, and how it is accounted for and\or presented in the statement of cash flows.
- Describe how do "sources" and "uses" of cash flows relate to cash inflows and cash outflows.
- List accounting items likely to be presented in each of the 3 sections of the statement of cash flows.

True/False Questions

1. The 3 classifications of the statement of cash flows are [1] operating, [2] investing, and [3] profit-generating.
2. The operation section of the statement of cash flows adjusts operations for gains and losses.
3. The investing section of the statement of cash flows is restricted to investments in debt and equity securities.
4. The exchange of common stock for property, plant & equipment is disclosed in the equity section of the statement of cash flows.
5. Depreciation is a non-cash charge and is not disclosed in the statement of cash flows.
6. The sale of stock for cash used in operations is a "use" of cash flows.
7. Accumulated depreciation is a "source" of cash in the investing section of cash flows.
8. An increase in accounts payable increases cash flow in the operating section of the statement of cash flows.
9. The sale of property, plant and equipment is recorded, at the cash sales price, in the investing section of the statement of cash flows
10. The issuance of corporate bonds and the cash received increases cash flow in the investing section of the statement of cash flows.

Appendix A

The Importance of a Book Value Focus for Selected Transactions and Affecting Presentation in the Statement of Cash Flows

This appendix uses several variations of this fact pattern to illustrate how PP&E affects both the operating activities and investing activities sections of the statement of cash flows. It is very helpful to focus on book value (BV) to proof your work and properly present this information.

Recall the fact pattern surrounding PP&E and presented in Chapter 11. The equipment removed from service during the period did not generate any revenues, as follows:

Sales Price		$0	
Cost	$9		
AD	$6	$3	BV
Gain/(Loss)		-$3	

There were zero proceeds from the equipment removed from service. To better illustrate the importance of a focus on BV, an additional line – the zero sales price for this piece of equipment – has been added to the investing activities section in this appendix. Note that $3 plus $0 equals $3 (net), which is the BV (see above) or the carrying value or amount reflected in the books of the firm:

Statement of Cash Flows – Indirect Method

Operating Activities:	
Loss on sale of equipment	$3
Investing Activities:	
Proceeds from sale of property, plant & equipment	$0

Variation 1: Changing the Sales Price for the Equipment from $0 to $1
Change the fact pattern so that the equipment is sold for $1, which results in a loss of only $2. Notice how these computations and related components of the statement of cash flows changes. Statement of cash flows components equal (or net to) the BV measure:

Sales Price		$1	
Cost	$9		
AD	$6	$3	BV
Gain/(Loss)		-$2	

Statement of Cash Flows – Indirect Method

Operating Activities:	
Loss on sale of equipment	$2
Investing Activities:	
Proceeds from sale of property, plant & equipment	$1

Variation 2: Changing Accumulated Depreciation for the Equipment from $6 to $5

Referring to the original fact pattern presented in Chapter 11, assume that the AD for the equipment was $6 instead of $5, resulting in a loss of $4. These computations and related components of the statement of cash flows change, but the statement of cash flows components equal (or net to) the BV measure:

Sales Price		$0	
Cost	$9		
AD	$5	$4	BV
Gain/(Loss)		-$4	

Statement of Cash Flows – Indirect Method

Operating Activities:	
Loss on sale of equipment	$4
Investing Activities:	
Proceeds from sale of property, plant & equipment	$0

Variation 3: Changing Cost for the Equipment from $9 to $10

Again, referring to the original fact pattern presented in Chapter 11, assume that the cost of the equipment removed from service was $10 instead of $9, which again results in a loss of $4. While computations and related components of the statement of cash flows change, the statement of cash flows components equal (or net to) the BV measure:

Sales Price		$0	
Cost	$10		
AD	$6	$4	BV
Gain/(Loss)		-$4	

Statement of Cash Flows – Indirect Method

Operating Activities:	
Loss on sale of equipment	$4
Investing Activities:	
Proceeds from sale of property, plant & equipment	$0

Variation 4: Changing Sales Price for the Equipment from $0 to $1, Changing Accumulated Depreciation for the Equipment from $6 to $5, and Changing Cost for the Equipment from $9 to $10.

This time, make all 3 of the above changes, simultaneously. The sum of the $4 loss in the operating activities section and the $1 in proceeds in the investing activities sections of the statement of cash flows continues to sum or net to the BV:

Sales Price		$1	
Cost	$10		
AD	$5	$5	BV
Gain/(Loss)		-$4	

Statement of Cash Flows – Indirect Method

Operating Activities:	
Loss on sale of equipment	$4
Investing Activities:	
Proceeds from sale of property, plant & equipment	$1

The same pattern persists for LT investments, which is an easier case, as no contra asset account is involved. A BV of $5 is the net result of relevant components in the operating and investing activities sections of the statement of cash flows, as follows:

Balance Sheet and Income Statement

	Ending	Beginning	Change
Long-Term Investments	$45	$40	$5

Sale	$10	
Cost	$5	BV
Gain/(Loss)	$5	

Statement of Cash Flows – Indirect Method

Operating Activities:	
Gain on sale of investments	-$5
Investing Activities:	
Proceeds from sale of long-term investments	$10

Chapter 12
Capital Budgeting

Learning Objectives
- Define the payback period method.
- Compute the payback period for an investment.
- Describe the advantages and disadvantages of the payback period method.
- Decide if an investment project is or is not acceptable, based on the net present value (NPV) method.
- Decide if an investment project is or is not acceptable, based on the internal rate of return (IRR) method.
- Decide if an investment project is or is not acceptable when it has uncertain cash flows.
- Rank investment projects in order of preference.
- Compute the simple rate of return for an investment project.

A COMMON TEMPLATE

Below is a common template to assist you in organizing your thoughts as you progress. You will see it at the beginning of each chapter, where the areas covered in that chapter and prior chapters are highlighted, cumulatively. This is a novel feature that is unique to this text and I hope it is helpful in organizing your thoughts as your progress through the text.

	External Use IRS/GAAP Absorption Costing Full Costing	Internal Use Contribution Approach Direct Costing Variable Costing		
				Only Product Cost Listed

Type of Product Cost

Prime — DM
Conversion — DL
          OH

Product Costs

Per Unit		Total		Total	Per Unit	Listed
SP	+	SP	+	SP	SP	DM
CGS	-	CGS	-	VC	VC	DL
GM	=	GM	=	CM	CM	OH (VC)
	-	OPER	-	FC	←	OH (FC)
	=	NOI	=	NOI		

Typically covered in a single chapter

NOI will be equal if
[1] no BI & [2] no EI

Only
Non-Product
Cost
Listed
— OPER (VC)
--- OPER (FC)

If [1] no BI, but [2] some EI
NOI difference equals
OH (FC) per unit x EI units

Job Order Costing	CVP Analysis
Process Costing	Cost Behavior
Standard Costing	ABC (all costs assumed VC)
Cash Budgeting/Forecasting	(no costs assumed Sunk)
NPV (Depreciation Tax Basis)	Transfer Pricing
Statement of Cash Flows	

Legend:
IRS = Internal Revenue Service; GAAP = Generally Accepted Accounting Principles
SP = Sales Price (per unit) or Sales or Revenues; VC = Variable Cost; FC = Fixed Cost
TC = Total Cost; GM = Gross Margin; CM = Contribution Margin; OPER = Operating Expense
NOI = Net Operating Income; NOL = Net Operating Loss
DM = Direct Material; DL = Direct Labor; OH or MOH = Overhead or Manufacturing Overhead
BI = Beginning Inventory; EI = Ending Inventory; CVP = Cost-Volume-Profit
ABC = Activity-Based Costing; ABM = Activity-Based Management; NPV = Net Present Value

There are several methods used to examine the profitability or rate or return likely to be generated from an investment. Investments might include machinery and equipment to replace labor cost-effectively and\or to improve consistency and quality. This chapter several traditional methods used to make decisions on the capital investment or budgeting alternatives.

The Payback Period Method
The payback period method, as the name suggests, focuses on nothing more than the length of time required in recovering the initial cost or cash outflow for an investment. This method is particularly useful for very, very short-term investments or investment periods (e.g., 2 to 3 years) and/or during periods when inflation is very, very low or even zero. The presumption is that investments with very fast paybacks are more favorable and/or less risky. The payback period is computed, as follows:

Payback Period = Investment Required ÷ Annual Net Cash Inflow

Assume, for example, that a firm is considering an investment in two alternatives. Alternative A requires an initial investment of $15,000 and will generate a return or cost savings of $4,000 per year for 10 years, as follows:

Payback in 3.75 Years for Alternative A = $15,000 ÷ $4,000

Assume, further, that the firm has another option. Alternative B requires an initial investment of $12,000 and will generate a return or cost savings of $4,500 per year for 5 years.

Payback in 2.67 Years for Alternative B = $12,000 ÷ $4,500

Alternative A has a payback in 3.75 years; Alternative B has a payback in 2.67 years. However, while the payout occurs over a much longer period, Alternative A does appear to generate more than two times the returns from Alternative B, as follows:

Time Period	Alternative A	Alternative B
0	($15,000)	($12,000)
1	$4,000	$4,500
2	$4,000	$4,500
3	$4,000	$4,500
4	$4,000	$4,500
5	$4,000	$4,500
6	$4,000	$-0-
7	$4,000	$-0-
8	$4,000	$-0-
9	$4,000	$-0-
10	$4,000	$-0-
	$25,000	$10,500

Note that even if the net payout from Alternative B was doubled (i.e., $10,500 x 2 = $21,000), it would be less than the 10 year net payout from Alternative A (i.e., $25,000 > $21,000). While Alternative B at $12,000 requires a lower initial investment when compared to Alternative A at

$15,000, the payback method focuses only on the speed with which the return of the investment is achieved, and nothing more. This is not likely to be the best measure of the best investment alternative, since all cash flows generated <u>after</u> the payback period is ignored.

The Payback Period Method – An Extension

The payback period method requires some additional, detailed measures in cases where (1) new equipment is replacing old equipment, (2) there is salvage value to be associated with the disposal of old equipment, and (3) depreciation (a non-cash charge), deducted from generating any net operating income measures, must be added back to arrive at expected annual net cash inflows.

Assume, for example, that a firm is considering replacing a less efficient, old piece of equipment, with a new, more efficient piece of equipment, at a cost of $100,000, and financed at 8% for 10 years. The monthly payments or cash outflows for both principal and interest amount to $1,213.27 (rounded to $1,215), for annual cash outflows at $14,559.24 (rounded to $14,560). The new equipment will be depreciated using the straight-line method over a 10 year period and with no salvage value. The old equipment has a salvage value of $5,000. Additional revenues and some additional fixed and variable costs or cash flows, including some repair and maintenance costs, will result from the transition from the older (less efficient) to the newer (more efficient) equipment. This and other information, resulting in a payback period of 1.9 years, follows:
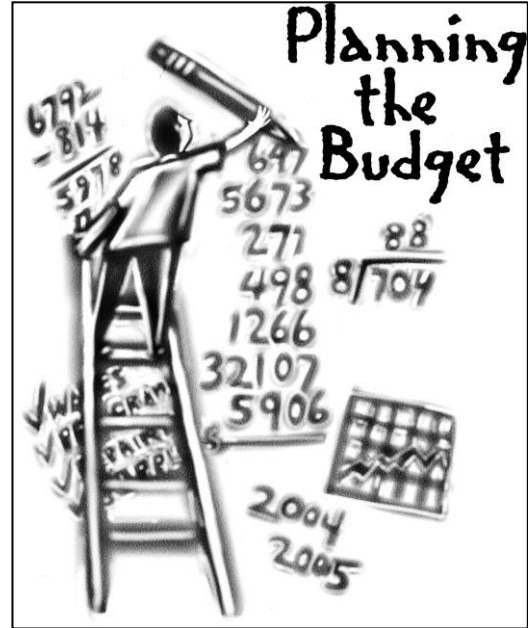
	Revenues		$100,000
less:	Variable expenses		$25,000
equals:	Contribution margin		$75,000
less:	Fixed expenses:		
	Payments for principal & interest	$14,560	
	Repair & maintenance & other	$10,440	
	Depreciation ($100,000÷10years)	$10,000	$35,000
equals:	Net operating income		$40,000

	Net operating income	$40,000
plus:	Depreciation (a non-cash charge)	$10,000
equals:	Net cash inflows (annual)	$50,000

Net operating income requires the additional of non-cash charges (e.g., depreciation, depletion and amortization) to get some approximation of annual net cash inflows.

	Cost of new equipment	$100,000
less:	Salvage value of old equipment	$5,000
equals:	Investment required	$95,000

Payback in 1.9 Years for Alternative B = $95,000 ÷ $50,000

There is some imprecision in these early examples, as cash flows are not the same as accrual-based measures, and tax effects have not been taken into consideration for either depreciation expense or interest on the debt. More fully developed measures are used in later examples or fact patterns and intermediate or advanced courses.

The Payback Period Method – A Case of Uneven Cash Flows
The payback period method, and all capital budgeting and forecasting methods, can be further developed to take uneven cash flows into consideration. For example, assume the following fact pattern:

Time Period	Gross Cash Outflow or Investment	Gross Cash Inflow or Recovery	Cumulative Net Unrecovered Cash Flows
0	$8,000	$-0-	($8,000)
1	$6,000	$5,000	($9,000)
2	$4,000	$4,000	($9,000)
3	$2,000	$3,000	($8,000)
4		$3,000	($5,000)
5		$3,000	($2,000)
6	$2,000	$3,000	($1,000)
7		$2,500	$1,500
8		$2,500	$4,000
9	$1,000	$2,500	$5,500
10		$2,500	$8,000

In the above case, there is an initial cash outflow of $8,000 at time period zero or when the initial investment is made. There is an additional net cash outflow of $1,000 by the end of the first period, with equivalent net cash inflows and outflows by the end of time period 2. The payback period is between period 6 and 7 (see above chart).

In today's world, it is probably preferable and more precise to simply produce a cash budget including these alternatives in a detailed Excel spreadsheet, but we continue to teach these "short cut" methods.

The Net Present Value Method
Capital budgeting decisions include those associated with investments that lead to overall cost reduction; lease, make or buy, and expansion decisions. While there are several capital budgeting techniques, those which take the *time value of money* into consideration are preferred.

These include net present value (NPV) and internal rate of return (IRR) techniques. In these cases, the focus is on the present value (PV) of after-tax (AT) cash flows (CFs) or PVATCFs. Less preferred techniques or those more frequently associated with short-term (ST) investments or decisions fail to take the *time value of money* into consideration. These methods include the payback and simple or accounting rate of return techniques (ARR).

Time Value of Money
Would you prefer to have $1 today or $1 one year from today? You would prefer to have $1 today. This would allow you to earn "rent" or interest on the $1. If you would prefer to have $1 one

year from today you are, effectively, saying that you are willing to provide someone else with interest-free use of your money.

The Impact of Marginal Tax Rates

The US has a *progressive* system of federal income taxation for both individuals and corporations. You should be familiar with *regressive*, *flat* and *progressive* tax rates from your macroeconomics course. These concepts and mechanics are also likely to be covered in your corporate finance and tax courses.

Generally, assume that we are looking at alternative investment or capital budgeting problems for Internal Revenue Service (IRS) subchapter C (tax-paying corporations, like those listed or traded on US exchanges). However, these techniques may also be applied to individuals, sole proprietors, partnerships, limited liability companies.

Most texts tend to use marginal tax rates of 40 percent in their examples. This is a "blended" tax rate, presumed to include both (US) federal and state corporate income taxes (generally 35 percent federal and 5 percent state income tax rates, where 35 percent plus 5 percent equals 40 percent). These cases also tend to use a blended marginal tax rate of 40 percent. Therefore, the tax rate or T equals 40 percent, as follows:

T = 40% or 0.40

The after-tax (AT) rate equals (1 – T), as follows:

1 – T = 100% - 40% = 1.00 – 0.40 = 60% or 0.60

This is changing, of course, with the new Trump tax legislation, but you can always adjust this rate, as all texts will have to do, using the above formula.

Consider how knowledge of the marginal tax rate (T) allows a firm to determine the impact of an increase in revenues or expenses on the firm's "bottom line" or net income, as follows:

		Constant or Original	Cash Increase Revenue Of $100	Cash Increase Expense Of $100	Non-Cash Increase Deprecation Of $100
Revenues	(1-T)	$600	$700	$600	$600
Expenses	(1-T)	$300	$300	$400	$300
NIBT & Deprecation	(1-T)	$300	$400	$200	$300
Depreciation	(T)	$100	$100	$100	$200
NIBT	100%	$200	$300	$100	$100
TAX	40%	$80	$120	$40	$40
NI	60%	$120	$180	$60	$60

- An increase in revenue at $100 – A before-tax (BT) increase in R of $100 (from $600 to $700 in the above example) equals an <u>increase</u> in ATCFs of $60 NIBT increases by $100 and NI or ATCFs increases by $60, as follows:

$$\textbf{\$100 (1 – T) = \$100 (100\% - 40\%) = \$100 (1.00 – 0.40) = \$100 - \$40 = \$60}$$

Think in terms of the mechanics of the journal entry, where additional revenue is the result of a credit sale or a cash sale. Pay particular attention to the debit (DR) to <u>cash</u> in the journal entry (JE) that follows:

Accounts receivable	$100	
Revenues		$100
Cash	$100	
Accounts receivable		$100

- An increase in expenses (E) at $100 – A before tax (BT) increase in E of $100 (from $300 to $400 in the above example) equals a <u>decrease</u> in net income (NI) or after- tax cash flows (ATCFs) of $60, as follows:

$$\textbf{-\$100 (1 – T) = -\$100 (100\% - 40\%) = -\$100 (1.00 – 0.40) = (-\$100) – (-\$40) = (-\$60)}$$

Think in terms of the mechanics of the journal entry, where additional expense (other than depreciation) is the result of a credit purchase or a cash purchase. Pay particular attention to the credit (CR) to <u>cash</u> in the below journal entry:

Expense (other than depreciation)	$100	
Accounts payable		$100
Accounts payable	$100	
Cash		$100

- An increase in depreciation at $100 - An increase in depreciation, a noncash charge or expense similar to amortization or depletion, of $100 (from $100 to $200 in the above example) equals an <u>increase</u> in NI or ATCFs of $40, as follows:

$$\textbf{T = 40\% = 0.40 = \$40}$$

Think in terms of the mechanics of the journal entry where depreciation (as well as amortization and depletion) does <u>not</u> involve cash. Therefore, the increase in ATCFs, in the case of depreciation and other noncash charges or expenses is due solely from the reduction in tax-related cash outflows. This is referred to as a *depreciation tax shield*, since this noncash charge *shields* the taxpaying entity from tax:

Depreciation expense	$100	
Accumulated Depreciation		$100

A Framework for Organization and Analysis – Table 1

The below table provides a commonly used framework for organizing and analyzing capital budgeting proposals and their net present value (NPV). This table uses the above fact pattern, where a project

- Increases revenue by $100 and
- Increases expense by $100

This initial table does not include above depreciation example, but the table that follows will include the impact of depreciation expense.

Description	Period(s)	Before-Tax Cash Flow	Tax Impact	After-Tax Cash Flow
Revenue increase	1	$100	100%-40%	$60
Expense increase	1	($100)	100%-40%	($60)
After-Tax Cash Flow				$-0-

In the above, oversimplified example, the ATCF impact is zero ($-0-). This first table assumes that the revenue and expense increases are precisely the same and for a single year. Depreciation and the life of the project will be modified in the next table, after providing some background on tax-based depreciation.

Modified Accelerated Cost-Recovery System

The modified accelerated cost-recovery system (MACRS) is applied to long-lived assets placed in service after December 31, 1986 (1987-). Modified ACRS was preceded by ACRS (1982-1986), which provided for shorter depreciable lives. As the name suggests, MACRS provides for "cost recovery" (the "CR" in MACRS). Therefore, there is a zero salvage assumption under MACRS.

Under the new Trump tax law, there will be some immediate expensing of long-lived or fixed assets. You can adjust all of these tables for these new assumptions, just as all texts will be doing this in the future.

The elimination of the use of salvage value under ACRS eliminated disagreements between the IRS and the taxpayer on this matter, as it was not uncommon for IRS auditors and taxpayers to disagree on estimated salvage value when the long-lived asset was placed in service. A smaller salvage value results in a larger depreciable base (and a larger depreciation expense, lower taxable income and tax each year); whereas a larger salvage value results in a smaller depreciable base (and a smaller depreciation expense, taxable income and tax each year).

Generally, disputes between the IRS and taxpayers occurred because the IRS argued for a larger salvage value while the taxpayer attempted to minimize salvage value in order to maximize the depreciation expense deduction and minimize taxable income and tax and related cash outflows.

As the name suggests, MACRS is an "accelerated" (the "A" in MACRS) method of depreciation. Generally, MACRS is double-declining balance (DDB), but with a *first year, half year modifying convention* that results in an additional year of depreciation (e.g., 6 years to depreciate a 5-year asset). A brief summary of selected MACRS "cost recovery" is provided in the table below:

Year	3 years	5 years	7 years	10 years
1	33.33%	20.00%	14.29%	10.00%
2	44.45%	32.00%	24.49%	18.00%
3	14.81%	19.20%	17.49%	14.40%
4	7.41%	11.52%	12.49%	11.52%
5		11.52%	8.93%	9.22%
6		5.76%	8.92%	7.37%
7			8.93%	6.55%
8			4.46%	6.55%
9				6.56%
10				6.55%
11				3.28%
Totals	100.00%	100.00%	100.00%	100.00%

Using this table, a $500, 5-year asset, would be depreciated over 6 years at $100 ($500 multiplied by 20%) the first year, $160 ($500 multiplied by 32%) the second year, and so on. Appendix 12A provides a very simple example of MACRS and how it is related to the DDB technique, using an asset with a 3-year estimated useful life.

A Framework for Organization and Analysis – Table 2
The below table extends the commonly used framework for organizing and analyzing capital budgeting proposals and their NPV. This table continues to use the initial fact pattern, where a project

- Increases R by $100,
- Increases E by $100, and
- Increases depreciation expense by $100.

Description	Period(s)	BTCF	Tax Impact	ATCF
Revenue increase	1	$100	100%-40%	$60
Expense increase	1	($100)	100%-40%	($60)
Depreciation	1	-0-	40%	$40
After-tax cash flow (ATCF)				$40

A Framework for Organization and Analysis – Table 3
The above example suggests that the ATCF is positive, so far, at least for the first year, but the table really needs some additional columns to take the depreciation tax shield into consideration. The above table is expanded, but only for the first period or year, as follows:

Description	Period(s)	BTCF	Depreciation	Tax Impact	ATCF
Revenue increase	1	$100		100%-40%	$60
Expense increase	1	$(100)		100%-40%	$(60)
Depreciation	1	-0-	$500 * 20%	40%	$40
After-tax cash flow (ATCF)					$40

A Framework for Organization and Analysis – Table 4
The above example provides a column to compute the depreciation expense and related ATCF from what is referred to as the *depreciation tax shield*, but only for the first or initial year of the 7

year project. The next tables expand this framework for the entire 7 year project period, as follows:

Description	Period(s)	Before-Tax Cash Flow	Depreciation	Tax Impact	After-Tax Cash Flow
Revenues	1-7	$100		100%-40%	$420.00
Expenses	1-7	$(100)		100%-40%	$(420.00)
Depreciation	1	-0-	$500 * 20.00%	40%	$40.00
Depreciation	2	-0-	$500 * 32.00%	40%	$64.00
Depreciation	3	-0-	$500 * 19.20%	40%	$38.40
Depreciation	4	-0-	$500 * 11.52%	40%	$23.04
Depreciation	5	-0-	$500 * 11.52%	40%	$23.04
Depreciation	6	-0-	$500 * 5.76%	40%	$11.52
After-Tax Cash Flow					$200.00

Table 4 (above) includes some modest formatting changes and includes both revenues and expenses for the entire 7 year period for the project (e.g., 1-7) and the ATCFs for each of the separate depreciation expense-based depreciation tax shields for the entire depreciable life of this 5 year, $500 long-lived or depreciable asset. Notice that $500 multiplied by the 40% marginal tax rate (T=40%) equals $200.

An adjustment for the ATCFs needs to be made for the time value of money consideration. In its present form, for example, the above table treats the depreciation tax shield ATCFs for period or year 1 ($40) as equivalent, in terms of purchasing power, to the ATCFs for period or year 2 ($64). The same may be said for the revenue and expense measures, where $60 per year multiplied by 7 years equals $420 for both.

A discount or hurdle rate must be selected to discount the purchasing power associated with the ATCFs for all of the above measures. Appendix 12B provides an explanation of how a firm approaches the development of this "factor." For simplicity, the next table will use a 10% factor or discount rate or hurdle rate to discount ATCFs to their PV. Again, some modifications will be made to the form of the table.

A Framework for Organization and Analysis – Table 5
The below table deletes the depreciation computation column and inserts two columns used to compute the PV of ATCFs and, for the first time in this chapter, the NPV. This example uses a 10% discount rate or hurdle rate or factor, from Appendix C (PV of $1) and Appendix D (PV of an Annuity of $1 in Arrears), as follows:

Description	Period(s)	BTCF	Tax Impact	ATCF	10% Factor	PVATCFs
Revenue	1-7	$100	100%-40%	$420.00	4.86842	$2,044.74
Expense	1-7	$(100)	100%-40%	$(420.00)	4.86842	$(2,044.74)
Depreciation	1	-0-	40%	$40.00	0.90909	$36.36
Depreciation	2	-0-	40%	$64.00	0.82645	$52.89
Depreciation	3	-0-	40%	$38.40	0.75131	$28.85
Depreciation	4	-0-	40%	$23.04	0.68301	$15.74
Depreciation	5	-0-	40%	$23.04	0.62092	$14.31
Depreciation	6	-0-	40%	$11.52	0.56447	$6.50
ATCF				$200.00		
NPV						$154.65

The above table, now, include PV of a $1 (Appendix 12C) and PV of an Annuity of $1 in Arrears (Appendix 12D) factors at a discount rate of 10%.

For example and beginning with the depreciation tax shield, the PV of a $1, discounted at 10% per period for 1 period is $0.90909 or about $0.91 (see Appendix 12C). Illustrations of just how these computations are made are provided in Appendix 12C. Therefore, for each separate period or year, the PV of $1 table is used.

The PV of an Annuity of $1 in Arrears table was used for the revenue and expense factors.

For example, the PV of $1, discounted at 10% per period for all seven periods is 4.86842 (i.e., 0.90909 + 0.82645 + 0.75131 + 0.68301 + 0.62092 + 0.56447) or 4.87 (rounded). Again, illustrations of relations between Appendix 12C and Appendix 12D are made in Appendix 12C and should be reviewed until completely understood.

Note that the NPV of the project is positive at $154.65. This positive NPV is due, entirely, to the depreciation tax shield. However, some additional variables warrant still further expansion of the above table. Specifically, the $500 long-lived asset that is being depreciated over a 5 year MACRS life was, in some way, financed (e.g., A = L + OE).

A Framework for Organization and Analysis – Table 6
The below table includes the assumption that $500 in working capital (WC) will be used to finance the capital project (e.g., the financing of the long-lived depreciable asset). WC does not require an adjustment for the marginal tax rate (T), since WC is already in AT dollars.

The below table deletes all of the details for the depreciation tax shield and the ATCF row to focus on the impact of WC on the NPV for this simplified capital budgeting fact pattern. It includes

- The use of WC to finance the project at the beginning of the project and
- The return of this same amount of WC at the end of the life of the project, both at $500, as follows:

Description	Period(s)	BTCF	Tax Impact	ATCF	10% Factor	PVATCFs
Working capital	0	$(500)	NA	$(500.00)	1.00000	$(500.00)
Revenues	1-7	$100	100%-40%	$420.00	4.86842	$2,044.74
Expenses	1-7	$(100)	100%-40%	$(420.00)	4.86842	$(2,044.74)
Depreciation	1-7	-0-	40%	$200.00	various	$154.65
Working capital	7	$500	NA	$500.00	0.51316	$265.58
Net present value						$(79.77)

Note that the project, now, has a negative NPV. The PV of $1 table (Appendix C) provided the source for the 10% factor for 7 years, discounted at 10% per year, at 0.51316. Effectively, the use of the firm's WC to finance this project results in a failure of this project to produce the minimum desired return of 10%. This project should be rejected.

Illustration of How Working Capital is Already in After-Tax Dollars?

Working capital (WC) consumed at the beginning of a project life and released at the end of a project life are both in after-tax (AT) dollars. This will be illustrated using two, separate examples, as follows:

Example 1 – Your personal experience may provide for the most direct illustration of WC and it's AT nature. Assume that you have a job and your salary for the month is $1,000 gross pay. Federal income tax (FIT at 28%), state income tax (SIT at 3.07% for Pennsylvania), a Social Security or Federal Insurance and Contributions Act (FICA at 7.65%)/Social Security (SS) tax, at a minimum, are withheld to arrive at your net pay, as follows:

Gross Pay	$1,000.00
FIT	-$280.00
SIT	-$30.70
FICA	-$76.50
Net Pay	$612.80

Your net pay at $612.80 is a current asset (CA). The US *pay-as-you-go system* of taxation resulted in an employer withholding of the approximate amount of FIT and SIT from your paycheck. Effectively, your FIT and SIT withholding were "matched" to the gross pay, in arriving at your net pay.

If you deposited your net pay into your checking account to purchase items for consumption of long-lived assets, this net pay is already in AT dollars and is part of your personal CA and, ultimately, WC.

Example 2 – Similarly, accrual-based accounting results in an application of the "matching principle" for businesses and corporations, required to also pay-as-you-go, but in the form of estimated tax payments, as follows:

Cash	$600	AP	$575
AR	$150	TP	$125
Inventory	$200	Other CL	$225
Total CA	$950	Total CL	$925
Other A	$250	OE	$275
Total A	$1,200	Total L & OE	$1,200

The above is a simplified balance sheet, designed only to illustrate that the cash in the firm's balance sheet is "matched" against the taxes payable (TP) under the "accrual" system of accounting. Therefore, any cash on the firm's balance sheet is already in after-tax dollars and does not require any adjustment for the 40% marginal tax rate (T) in the above capital budgeting problem and fact pattern.

The Accounting Rate of Return Method

The accounting rate of return (ARR) method, with some variations, is illustrated below:

ARR = Average Net Income ÷ Average Investment

The ARR method, again, as the name suggests, merely averages net income measures from the firm's pro forma income statement and divides this measure from the average "investment" developed from a pro forma balance sheet.

NOTE: When thinking of the term, **investment**, it may be helpful to think in terms of initial cash outflows or even think in terms of long-term or noncurrent assets, such as property, plant and equipment of fixed assets, just as you might associate the term, investment, with one of the three classifications of the statement of cash flows (e.g., cash flows from operating activities, investing activities and financing activities).

Review

- Describe the payback method, its strengths and its weaknesses.
- Explain the value of a project using the net present value method when the net present value of a project is [1] negative, [2] zero, and [3] positive.
- Explain why a project with a net present value of zero is acceptable.
- Compare and contrast the net present value and internal rate of return methods.

True/False Questions

1. The payback method uses time value of money.
2. A project with a net present value of zero is break-even.
3. A project with a net present value of zero is profitable.
4. A project with a net present value of zero is not profitable
5. A project with a net present value of zero failed to use the appropriate discount rate.
6. A project valued with a net present value of zero is acceptable and presumed to have included a profit component in the discount rate.
7. A project valued with a net present value that is a tiny bit negative may still be profitable, but not as profitable as preferred.
8. A change in tax law and related depreciable lives will change the net present value of a project.
9. Allowing expensing instead of depreciation with increase the net present value of a project.
10. The internal rate of return and net present value methods will result in the same decision with respect to an investment.

How is MACRS Computed? Or Double-Declining Balance with a Tax-Based Modifying Convention

MACRS is modified ACRS. ACRS is accelerated cost-recovery system.

ACRS was the method of deprecation used in the early 1980s, modified in the 1986 tax act for post-1986 tax years. MACRS is taught in cost and managerial accounting, corporate finance and other business courses, particularly those courses where time value of money concepts and mechanics, including net present value (NPV).

All of these texts will have to be modified for the new Trump tax law.

The tables that follow illustrate the conversion from double-declining balance (DDB) to MACRS for a 3 year asset. First, note that a 3 year asset is really depreciated over 4 years, a 5 year asset is really depreciated over 6 years, and so on. This is because of the first year, half year modifying convention. Effectively, this convention provides for one-half of the first year's DDB-computed depreciation expense in the first year.

In the example below, $100 has been selected as the cost of the depreciable asset and dollar amounts and percentages are used interchangeably.

Year 1
Using DDB for a 3 year asset, take the straight-line (S/L) percentage (100% divided by 3 years for 33.33% per year) and double it (the "double" in DDB) to 66.67%. MACRS requires application of a *first year, half-year modifying convention*, so split this amount in half and depreciate half in year 1 (33.33%) and half in year 2 (33.34%, rounded by the IRS in this case).

Year	Depreciable Base	DDB	MACRS
1	$100.00	66.67%	33.33%
2			33.34%

Year 2

Again, using DDB for a 3 year asset, multiply the remaining depreciable base of $33.33 by 66.67% to arrive at $22.22. Again, this measure must be split between the two years, due to the *first year, half-year modifying convention*. Therefore, $11.11 is added to the $33.34 for year 2 and the remaining $11.11 would normally be assigned to year 3. However, at the mid-point of the asset life, we must switch to the S/L method. The mid-point, in this case, is 1½ years, so the latter half of the $22.22 remains in the depreciable base.

Normalized car depreciation over 20 years
average of 15% per year
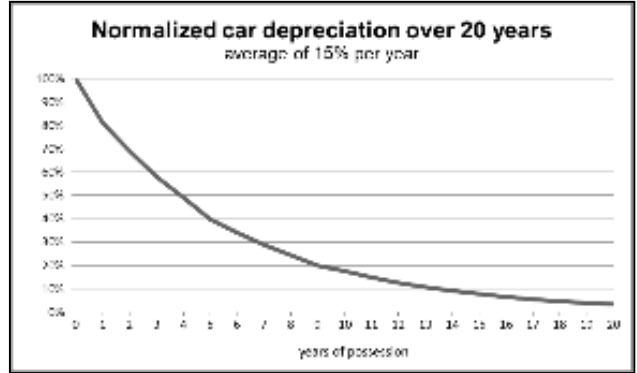
Year	Depreciable Base	DDB	MACRS
1	$100.00	66.67%	33.33%
1st half of year 2 (see above table)			33.34%
2nd half of year 2	$33.33	22.22%	11.11%
2			44.45%
Switch to S/L		11.11%	
Remaining Depreciable Base		22.22%	

Years 3 & 4

At the end of year 2, the firm has depreciated 50 percent of 1½ years of the 3 year life of this asset. The remaining 22.22% is depreciated, using S/L depreciation, over the remaining 1½ years. Therefore, ⅔ of the 22.22% (14.81%) will be depreciated in year 3 and ⅓ of the 22.22% (7.41%) will be depreciated in year 4, as follows:

Year	Depreciable Base	DDB	MACRS
1	$100.00	66.67%	33.33%
1st half of year 2			33.34%
2nd half of year 2	$33.33	22.22%	11.11%
2			44.45%
Switch to S/L		11.11%	
Remaining Depreciable Base		22.22%	
3	$22.22	NA; S/L	14.81%
4	$7.41	NA; S/L	7.41%

Therefore, for the 4 years, depreciation expense follows:

33.33% + 44.45% + 14.81% + 7.41% = 100%

Again, this pattern is replicated for all MACRS asset classes. A so-called 3-year asset is actually depreciated over 4 years, a 5-year asset over 6 years, a 7-year asset over 8 years, and so on. This is due to the *first year, half-year modifying convention*.

Zero Net Present Value is <u>NOT</u> Break-Even!
Or
Where Did the Discount Rate or Required Rate of Return Come From?

A capital investment project with a net present value (NPV) of zero must contain a profit component for the firm. The example below shows how nominal rates of interest might derived and presented for credit card (unsecured) and home mortgage (secured by real property) debt. Do not focus on the merits of the specific measures – relevant points are:

- The nominal rate contains a profit rate or component and
- Unlike a vacation or meal charged to your credit card, real property and mortgage payment default may result in foreclosure, repossession, and partial or full recovery by the creditor.

This explains the lower risk rate component.

Interest Rate Components	Credit Card	Home Mortgage
Profit Rate	2%	2%
Anticipated Inflation Rate	4%	4%
Risk Rate	12%	2%
Nominal Rate	18%	8%

Most cost or managerial accounting texts provide a discount rate or required rate of return and explain that a NPV of zero (or greater than zero) for a capital budgeting project represents an acceptable investment for the firm. Very few explain where this discount rate or required rate of return is derived.

Some students will confuse a zero NPV with break-even, where the above, clearly illustrates that a nominal rate includes a profit rate component. Would you invest in a risky project for a break-even return on your investment? If not, the discount rate, hurdle rate or required rate of return, like the nominal rate in the above table, must contain a profit rate or component.

Recall that all assets are financed with debt or equity (A=L+OE), where the weighted average cost of capital (WACC) is the discount rate or required rate of return, as follows:

Assets (A) = L (Liabilities) + OE (Owners' Equity)

A	=	L	+	OE
100%	=	40%	+	60%
WACC	=	(L/A) x R_L x (1-T)	+	(OE/A) x R_{OE}
		0.4 x 0.0775 x 0.6		0.6 x 0.1
0.0786	=	0.0186	+	0.06

Focusing on Assets Financed with Debt

In the above example, **40%** of Assets are financed with debt (L) and 60% of assets are financed with owners' equity (OE). Interest on debt is tax deductible, where the weighted average (R_L) after-tax (T = the tax rate = 40% and **1-T** = 100% - 40% = **60%**) cost of interest expense is the relevant measure used to arrive at the after-tax cost of debt, computed as follows:
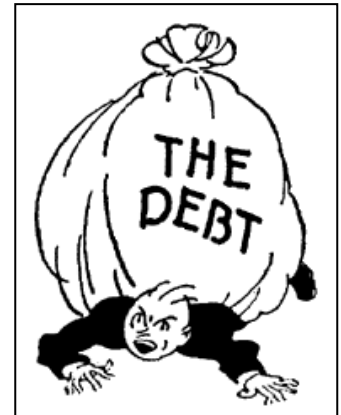
Weighting	Nominal Rate	Weighted Average Rate
10 ÷ 40 = 25.0%	10%	0.0250
15 ÷ 40 = 37.5%	8%	0.0300
15 ÷ 40 = 37.5%	6%	0.0225
40 ÷ 40 = 100.0%		0.0775

Focusing on Assets Financed with Equity.

In the below example, the above table is replicated, but colors have been removed so that the same colors might be reassigned to illustrate the OE component of the WACC.

Assets (A) = L (Liabilities) + OE (Owners' Equity)

A	=	L	+	OE
100%	=	40%	+	60%
WACC	=	(L/A) x R_L x (1-T)	+	(OE/A) x R_{OE}
		0.4 x 0.0775 x 0.6		0.6 x 0.1
0.0786	=	0.0186	+	0.06

Again, in the above example, 40% of Assets are financed with debt (L) and **60%** of assets are financed with equity (OE). R_{OE} is the return on OE, where $R_{OE} = R_f + [R_m - R_f] \times \beta$ and R_f is the risk-free rate of interest (e.g., Treasury or T-securities); R_m is the market rate of interest (e.g., the rate for a comparable security, investment or asset class); and β is Beta, a measure of risk ($\beta>1$ is more volatile, β=equal to, and $\beta<1$ is less volatile than the market). All of these represent oversimplifications, as this material is covered in greater depth in your *Corporate Finance* coursework.

Assume that R_f is 6%, R_m is 10%, and β is 1.0, for an **R_{OE}** = 6% + [10% - 6%] x 1.0 or an R_{OE} of 10 percent (or 0.1 in the above example). The firm's discount rate or required rate of return is

7.86%. Note that R_{OE} includes OE, where Retained Earnings is increased by Net Income (PROFIT!).

Assets (A) = L (Liabilities) + OE (Owners' Equity)

A	=	L	+	OE
100%	=	40%	+	60%
WACC	=	(L/A) x R_L x (1-T)	+	(OE/A) x R_{OE}
		0.4 x 0.0775 x 0.6		0.6 x 0.1
0.0786	=	0.0186	+	0.06

The Completed Weighted-Average Cost of Capital

Once the separate after-tax cost measures have been developed for debt (L) and owners' equity (OE) components, the overall weighted-average cost of capital can be identified. In the above case, the WACC is **7.86 percent** (i.e., **1.86 percent** for debt plus **6 percent** for equity).
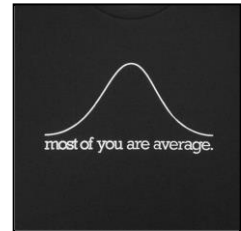
This case illustrates a single WACC model. *Corporate Finance* courses tend to expose you to 2 or 3 of the many that are appropriate under a variety of fact patterns (e.g., what if the firm is <u>NOT</u> profitable?). This latter point is likely to be covered in advanced or graduate level portfolio management, financial analysis or real estate appraisal courses, where, perhaps seventy different techniques focus in a variety of ways on the "bands on investment" or the debt and equity components analyzed to develop an appropriate discount or hurdle rate to be used to develop NPV measures.

Appendix C
Present Value of a $1

Present Value (PV) of $1 = 1 \div (1 + r)^n$, where r = discount rate & n = number of periods.

How to use the table and communicate the results – Example 1

As the below table suggests, *the present value of the right to receive $1.00, 1 period from today, discounted at 1% per period is $0.99010.* Alternatively, *$0.99010 invested today, and generating a return of 1% per period, and invested for 1 period, will be worth $1.00* (i.e., future value), or $0.99010 x $(1.01)^1$ = $1.00

PV of a $1

Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.99010	0.98039	0.97087	0.96154	0.96154	0.94340	0.93458	0.92593	0.91743	0.90909

`	$0.99010
multiplied by:	1.01
equals:	$1.00000

How to use the table and communicate the results – Example 2

As the below table suggests, *the present value of the right to receive $1.00, 10 periods from today, discounted at 10% per period is $0.38554.* Alternatively, *$0.38554 invested today, and generating a return of 10% per period, and invested for 10 periods, will be worth $1.00* (i.e., future value), or $0.38554 x $(1.1)^{10}$ = $1.00

PV of a $1

Periods	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
10	0.90529	0.82035	0.74409	0.67556	0.61982	0.55839	0.50835	0.46319	0.42241	0.38554

	$0.38554	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
multiplied by:	1.10	
equals:	$0.99999	(round to $1.00)

PV of a $1

Prd	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.99010	0.98039	0.97087	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909
2	0.98030	0.96117	0.94260	0.92456	0.90703	0.89000	0.87344	0.85734	0.84168	0.82645
3	0.97059	0.94232	0.91514	0.88900	0.86384	0.83962	0.81630	0.79383	0.77218	0.75131
4	0.96098	0.92385	0.88849	0.85480	0.82270	0.79209	0.76290	0.73503	0.70843	0.68301
5	0.95147	0.90573	0.86261	0.82193	0.78353	0.74726	0.71299	0.68058	0.64993	0.62092
6	0.94205	0.88797	0.83748	0.79031	0.74622	0.70496	0.66634	0.63017	0.59627	0.56447
7	0.93272	0.87056	0.81309	0.75992	0.71068	0.66506	0.62275	0.58349	0.54703	0.51316
8	0.92348	0.85349	0.78941	0.73069	0.67684	0.62741	0.58201	0.54027	0.50187	0.46651
9	0.91434	0.83676	0.76642	0.70259	0.64461	0.59190	0.54393	0.50025	0.46043	0.42410
10	0.90529	0.82035	0.74409	0.67556	0.61391	0.55839	0.50835	0.46319	0.42241	0.38554
11	0.89632	0.80426	0.72242	0.64958	0.58468	0.52679	0.47509	0.42888	0.38753	0.35049
12	0.88745	0.78849	0.70138	0.62460	0.55684	0.49697	0.44401	0.39711	0.35553	0.31863
13	0.87866	0.77303	0.68095	0.60057	0.53032	0.46884	0.41496	0.36770	0.32618	0.28966
14	0.86996	0.75788	0.66112	0.57748	0.50507	0.44230	0.38782	0.34046	0.29925	0.26333
15	0.86135	0.74301	0.64186	0.55526	0.48102	0.41727	0.36245	0.31524	0.27454	0.23939
16	0.85282	0.72845	0.62317	0.53391	0.45811	0.39365	0.33873	0.29189	0.25187	0.21763
17	0.84438	0.71416	0.60502	0.51337	0.43630	0.37136	0.31657	0.27027	0.23107	0.19784
18	0.83602	0.70016	0.58739	0.49363	0.41552	0.35034	0.29586	0.25025	0.21199	0.17986
19	0.82774	0.68643	0.57029	0.47464	0.39573	0.33051	0.27651	0.23171	0.19449	0.16351
20	0.81954	0.67297	0.55368	0.45639	0.37689	0.31180	0.25842	0.21455	0.17843	0.14864
21	0.81143	0.65978	0.53755	0.43883	0.35894	0.29416	0.24151	0.19866	0.16370	0.13513
22	0.80340	0.64684	0.52189	0.42196	0.34185	0.27751	0.22571	0.18394	0.15018	0.12285
23	0.79544	0.63416	0.50669	0.40573	0.32557	0.26180	0.21095	0.17032	0.13778	0.11168
24	0.78757	0.62172	0.49193	0.39012	0.31007	0.24698	0.19715	0.15770	0.12640	0.10153
25	0.77977	0.60953	0.47761	0.37512	0.29530	0.23300	0.18425	0.14602	0.11597	0.09230
26	0.77205	0.59758	0.46369	0.36069	0.28124	0.21981	0.17220	0.13520	0.10639	0.08391
27	0.76440	0.58586	0.45019	0.34682	0.26785	0.20737	0.16093	0.12519	0.09761	0.07628
28	0.75684	0.57437	0.43708	0.33348	0.25509	0.19563	0.15040	0.11591	0.08955	0.06934
29	0.74934	0.56311	0.42435	0.32065	0.24295	0.18456	0.14056	0.10733	0.08215	0.06304
30	0.74192	0.55207	0.41199	0.30832	0.23138	0.17411	0.13137	0.09938	0.07537	0.05731
31	0.73458	0.54125	0.39999	0.29646	0.22036	0.16425	0.12277	0.09202	0.06915	0.05210
32	0.72730	0.53063	0.38834	0.28506	0.20987	0.15496	0.11474	0.08520	0.06344	0.04736
33	0.72010	0.52023	0.37703	0.27409	0.19987	0.14619	0.10723	0.07889	0.05820	0.04306
34	0.71297	0.51003	0.36604	0.26355	0.19035	0.13791	0.10022	0.07305	0.05339	0.03914
35	0.70591	0.50003	0.35538	0.25342	0.18129	0.13011	0.09366	0.06763	0.04899	0.03558
36	0.69892	0.49022	0.34503	0.24367	0.17266	0.12274	0.08754	0.06262	0.04494	0.03235
37	0.69200	0.48061	0.33498	0.23430	0.16444	0.11579	0.08181	0.05799	0.04123	0.02941
38	0.68515	0.47119	0.32523	0.22529	0.15661	0.10924	0.07646	0.05369	0.03783	0.02673
39	0.67837	0.46195	0.31575	0.21662	0.14915	0.10306	0.07146	0.04971	0.03470	0.02430
40	0.67165	0.45289	0.30656	0.20829	0.14205	0.09722	0.06678	0.04603	0.03184	0.02209

PV of a $1 (continued)

Prd	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.90090	0.89286	0.88496	0.87719	0.86957	0.86207	0.85470	0.84746	0.84034	0.83333
2	0.81162	0.79719	0.78315	0.76947	0.75614	0.74316	0.73051	0.71818	0.70616	0.69444
3	0.73119	0.71178	0.69305	0.67497	0.65752	0.64066	0.62437	0.60863	0.59342	0.57870
4	0.65873	0.63552	0.61332	0.59208	0.57175	0.55229	0.53365	0.51579	0.49867	0.48225
5	0.59345	0.56743	0.54276	0.51937	0.49718	0.47611	0.45611	0.43711	0.41905	0.40188
6	0.53464	0.50663	0.48032	0.45559	0.43233	0.41044	0.38984	0.37043	0.35214	0.33490
7	0.48166	0.45235	0.42506	0.39964	0.37594	0.35383	0.33320	0.31393	0.29592	0.27908
8	0.43393	0.40388	0.37616	0.35056	0.32690	0.30503	0.28478	0.26604	0.24867	0.23257
9	0.39092	0.36061	0.33288	0.30751	0.28426	0.26295	0.24340	0.22546	0.20897	0.19381
10	0.35218	0.32197	0.29459	0.26974	0.24718	0.22668	0.20804	0.19106	0.17560	0.16151
11	0.31728	0.28748	0.26070	0.23662	0.21494	0.19542	0.17781	0.16192	0.14757	0.13459
12	0.28584	0.25668	0.23071	0.20756	0.18691	0.16846	0.15197	0.13722	0.12400	0.11216
13	0.25751	0.22917	0.20416	0.18207	0.16253	0.14523	0.12989	0.11629	0.10421	0.09346
14	0.23199	0.20462	0.18068	0.15971	0.14133	0.12520	0.11102	0.09855	0.08757	0.07789
15	0.20900	0.18270	0.15989	0.14010	0.12289	0.10793	0.09489	0.08352	0.07359	0.06491
16	0.18829	0.16312	0.14150	0.12289	0.10686	0.09304	0.08110	0.07078	0.06184	0.05409
17	0.16963	0.14564	0.12522	0.10780	0.09293	0.08021	0.06932	0.05998	0.05196	0.04507
18	0.15282	0.13004	0.11081	0.09456	0.08081	0.06914	0.05925	0.05083	0.04367	0.03756
19	0.13768	0.11611	0.09806	0.08295	0.07027	0.05961	0.05064	0.04308	0.03670	0.03130
20	0.12403	0.10367	0.08678	0.07276	0.06110	0.05139	0.04328	0.03651	0.03084	0.02608
21	0.11174	0.09256	0.07680	0.06383	0.05313	0.04430	0.03699	0.03094	0.02591	0.02174
22	0.10067	0.08264	0.06796	0.05599	0.04620	0.03819	0.03162	0.02622	0.02178	0.01811
23	0.09069	0.07379	0.06014	0.04911	0.04017	0.03292	0.02702	0.02222	0.01830	0.01509
24	0.08170	0.06588	0.05323	0.04308	0.03493	0.02838	0.02310	0.01883	0.01538	0.01258
25	0.07361	0.05882	0.04710	0.03779	0.03038	0.02447	0.01974	0.01596	0.01292	0.01048
26	0.06631	0.05252	0.04168	0.03315	0.02642	0.02109	0.01687	0.01352	0.01086	0.00874
27	0.05974	0.04689	0.03689	0.02908	0.02297	0.01818	0.01442	0.01146	0.00912	0.00728
28	0.05382	0.04187	0.03264	0.02551	0.01997	0.01567	0.01233	0.00971	0.00767	0.00607
29	0.04849	0.03738	0.02889	0.02237	0.01737	0.01351	0.01053	0.00823	0.00644	0.00506
30	0.04368	0.03338	0.02557	0.01963	0.01510	0.01165	0.00900	0.00697	0.00541	0.00421
31	0.03935	0.02980	0.02262	0.01722	0.01313	0.01004	0.00770	0.00591	0.00455	0.00351
32	0.03545	0.02661	0.02002	0.01510	0.01142	0.00866	0.00658	0.00501	0.00382	0.00293
33	0.03194	0.02376	0.01772	0.01325	0.00993	0.00746	0.00562	0.00425	0.00321	0.00244
34	0.02878	0.02121	0.01568	0.01162	0.00864	0.00643	0.00480	0.00360	0.00270	0.00203
35	0.02592	0.01894	0.01388	0.01019	0.00751	0.00555	0.00411	0.00305	0.00227	0.00169
36	0.02335	0.01691	0.01228	0.00894	0.00653	0.00478	0.00351	0.00258	0.00191	0.00141
37	0.02104	0.01510	0.01087	0.00784	0.00568	0.00412	0.00300	0.00219	0.00160	0.00118
38	0.01896	0.01348	0.00962	0.00688	0.00494	0.00355	0.00256	0.00186	0.00135	0.00098
39	0.01708	0.01204	0.00851	0.00604	0.00429	0.00306	0.00219	0.00157	0.00113	0.00082
40	0.01538	0.01075	0.00753	0.00529	0.00373	0.00264	0.00187	0.00133	0.00095	0.00068

Present Value (PV) of an Annuity of $1 in Arrears = $(1 \div r) [1 - (1 \div (1 + r)^n)]$, where r = the discount rate and n = the number of periods.

PV of an Annuity of $1 in Arrears

Prd	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.99010	0.98039	0.97087	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909
2	1.97040	1.94156	1.91347	1.88609	1.85941	1.83339	1.80802	1.78326	1.75911	1.73554
3	2.94099	2.88388	2.82861	2.77509	2.72325	2.67301	2.62432	2.57710	2.53129	2.48685
4	3.90197	3.80773	3.71710	3.62990	3.54595	3.46511	3.38721	3.31213	3.23972	3.16987
5	4.85343	4.71346	4.57971	4.45182	4.32948	4.21236	4.10020	3.99271	3.88965	3.79079
6	5.79548	5.60143	5.41719	5.24214	5.07569	4.91732	4.76654	4.62288	4.48592	4.35526
7	6.72819	6.47199	6.23028	6.00205	5.78637	5.58238	5.38929	5.20637	5.03295	4.86842
8	7.65168	7.32548	7.01969	6.73274	6.46321	6.20979	5.97130	5.74664	5.53482	5.33493
9	8.56602	8.16224	7.78611	7.43533	7.10782	6.80169	6.51523	6.24689	5.99525	5.75902
10	9.47130	8.98259	8.53020	8.11090	7.72173	7.36009	7.02358	6.71008	6.41766	6.14457
11	10.36763	9.78685	9.25262	8.76048	8.30641	7.88687	7.49867	7.13896	6.80519	6.49506
12	11.25508	10.57534	9.95400	9.38507	8.86325	8.38384	7.94269	7.53608	7.16073	6.81369
13	12.13374	11.34837	10.63496	9.98565	9.39357	8.85268	8.35765	7.90378	7.48690	7.10336
14	13.00370	12.10625	11.29607	10.56312	9.89864	9.29498	8.74547	8.24424	7.78615	7.36669
15	13.86505	12.84926	11.93794	11.11839	10.37966	9.71225	9.10791	8.55948	8.06069	7.60608
16	14.71787	13.57771	12.56110	11.65230	10.83777	10.10590	9.44665	8.85137	8.31256	7.82371
17	15.56225	14.29187	13.16612	12.16567	11.27407	10.47726	9.76322	9.12164	8.54363	8.02155
18	16.39827	14.99203	13.75351	12.65930	11.68959	10.82760	10.05909	9.37189	8.75563	8.20141
19	17.22601	15.67846	14.32380	13.13394	12.08532	11.15812	10.33560	9.60360	8.95011	8.36492
20	18.04555	16.35143	14.87747	13.59033	12.46221	11.46992	10.59401	9.81815	9.12855	8.51356
21	18.85698	17.01121	15.41502	14.02916	12.82115	11.76408	10.83553	10.01680	9.29224	8.64869
22	19.66038	17.65805	15.93692	14.45112	13.16300	12.04158	11.06124	10.20074	9.44243	8.77154
23	20.45582	18.29220	16.44361	14.85684	13.48857	12.30338	11.27219	10.37106	9.58021	8.88322
24	21.24339	18.91393	16.93554	15.24696	13.79864	12.55036	11.46933	10.52876	9.70661	8.98474
25	22.02316	19.52346	17.41315	15.62208	14.09394	12.78336	11.65358	10.67478	9.82258	9.07704
26	22.79520	20.12104	17.87684	15.98277	14.37519	13.00317	11.82578	10.80998	9.92897	9.16095
27	23.55961	20.70690	18.32703	16.32959	14.64303	13.21053	11.98671	10.93516	10.02658	9.23722
28	24.31644	21.28127	18.76411	16.66306	14.89813	13.40616	12.13711	11.05108	10.11613	9.30657
29	25.06579	21.84438	19.18845	16.98371	15.14107	13.59072	12.27767	11.15841	10.19828	9.36961
30	25.80771	22.39646	19.60044	17.29203	15.37245	13.76483	12.40904	11.25778	10.27365	9.42691
31	26.54229	22.93770	20.00043	17.58849	15.59281	13.92909	12.53181	11.34980	10.34280	9.47901
32	27.26959	23.46833	20.38877	17.87355	15.80268	14.08404	12.64656	11.43500	10.40624	9.52638
33	27.98969	23.98856	20.76579	18.14765	16.00255	14.23023	12.75379	11.51389	10.46444	9.56943
34	28.70267	24.49859	21.13184	18.41120	16.19290	14.36814	12.85401	11.58693	10.51784	9.60857
35	29.40858	24.99862	21.48722	18.66461	16.37419	14.49825	12.94767	11.65457	10.56682	9.64416
36	30.10751	25.48884	21.83225	18.90828	16.54685	14.62099	13.03521	11.71719	10.61176	9.67651
37	30.79951	25.96945	22.16724	19.14258	16.71129	14.73678	13.11702	11.77518	10.65299	9.70592
38	31.48466	26.44064	22.49246	19.36786	16.86789	14.84602	13.19347	11.82887	10.69082	9.73265
39	32.16303	26.90259	22.80822	19.58448	17.01704	14.94907	13.26493	11.87858	10.72552	9.75696
40	32.83469	27.35548	23.11477	19.79277	17.15909	15.04630	13.33171	11.92461	10.75736	9.77905

PV of an Annuity of $1 in Arrears (continued)

Prd	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.90090	0.89286	0.88496	0.87719	0.86957	0.86207	0.85470	0.84746	0.84034	0.83333
2	1.71252	1.69005	1.66810	1.64666	1.62571	1.60523	1.58521	1.56564	1.54650	1.52778
3	2.44371	2.40183	2.36115	2.32163	2.28323	2.24589	2.20958	2.17427	2.13992	2.10648
4	3.10245	3.03735	2.97447	2.91371	2.85498	2.79818	2.74324	2.69006	2.63859	2.58873
5	3.69590	3.60478	3.51723	3.43308	3.35216	3.27429	3.19935	3.12717	3.05763	2.99061
6	4.23054	4.11141	3.99755	3.88867	3.78448	3.68474	3.58918	3.49760	3.40978	3.32551
7	4.71220	4.56376	4.42261	4.28830	4.16042	4.03857	3.92238	3.81153	3.70570	3.60459
8	5.14612	4.96764	4.79877	4.63886	4.48732	4.34359	4.20716	4.07757	3.95437	3.83716
9	5.53705	5.32825	5.13166	4.94637	4.77158	4.60654	4.45057	4.30302	4.16333	4.03097
10	5.88923	5.65022	5.42624	5.21612	5.01877	4.83323	4.65860	4.49409	4.33893	4.19247
11	6.20652	5.93770	5.68694	5.45273	5.23371	5.02864	4.83641	4.65601	4.48650	4.32706
12	6.49236	6.19437	5.91765	5.66029	5.42062	5.19711	4.98839	4.79322	4.61050	4.43922
13	6.74987	6.42355	6.12181	5.84236	5.58315	5.34233	5.11828	4.90951	4.71471	4.53268
14	6.98187	6.62817	6.30249	6.00207	5.72448	5.46753	5.22930	5.00806	4.80228	4.61057
15	7.19087	6.81086	6.46238	6.14217	5.84737	5.57546	5.32419	5.09158	4.87586	4.67547
16	7.37916	6.97399	6.60388	6.26506	5.95423	5.66850	5.40529	5.16235	4.93770	4.72956
17	7.54879	7.11963	6.72909	6.37286	6.04716	5.74870	5.47461	5.22233	4.98966	4.77463
18	7.70162	7.24967	6.83991	6.46742	6.12797	5.81785	5.53385	5.27316	5.03333	4.81219
19	7.83929	7.36578	6.93797	6.55037	6.19823	5.87746	5.58449	5.31624	5.07003	4.84350
20	7.96333	7.46944	7.02475	6.62313	6.25933	5.92884	5.62777	5.35275	5.10086	4.86958
21	8.07507	7.56200	7.10155	6.68696	6.31246	5.97314	5.66476	5.38368	5.12677	4.89132
22	8.17574	7.64465	7.16951	6.74294	6.35866	6.01133	5.69637	5.40990	5.14855	4.90943
23	8.26643	7.71843	7.22966	6.79206	6.39884	6.04425	5.72340	5.43212	5.16685	4.92453
24	8.34814	7.78432	7.28288	6.83514	6.43377	6.07263	5.74649	5.45095	5.18223	4.93710
25	8.42174	7.84314	7.32998	6.87293	6.46415	6.09709	5.76623	5.46691	5.19515	4.94759
26	8.48806	7.89566	7.37167	6.90608	6.49056	6.11818	5.78311	5.48043	5.20601	4.95632
27	8.54780	7.94255	7.40856	6.93515	6.51353	6.13636	5.79753	5.49189	5.21513	4.96360
28	8.60162	7.98442	7.44120	6.96066	6.53351	6.15204	5.80985	5.50160	5.22280	4.96967
29	8.65011	8.02181	7.47009	6.98304	6.55088	6.16555	5.82039	5.50983	5.22924	4.97472
30	8.69379	8.05518	7.49565	7.00266	6.56598	6.17720	5.82939	5.51681	5.23466	4.97894
31	8.73315	8.08499	7.51828	7.01988	6.57911	6.18724	5.83709	5.52272	5.23921	4.98245
32	8.76860	8.11159	7.53830	7.03498	6.59053	6.19590	5.84366	5.52773	5.24303	4.98537
33	8.80054	8.13535	7.55602	7.04823	6.60046	6.20336	5.84928	5.53197	5.24625	4.98781
34	8.82932	8.15656	7.57170	7.05985	6.60910	6.20979	5.85409	5.53557	5.24895	4.98984
35	8.85524	8.17550	7.58557	7.07005	6.61661	6.21534	5.85820	5.53862	5.25122	4.99154
36	8.87859	8.19241	7.59785	7.07899	6.62314	6.22012	5.86171	5.54120	5.25312	4.99295
37	8.89963	8.20751	7.60872	7.08683	6.62881	6.22424	5.86471	5.54339	5.25472	4.99412
38	8.91859	8.22099	7.61833	7.09371	6.63375	6.22779	5.86727	5.54525	5.25607	4.99510
39	8.93567	8.23303	7.62684	7.09975	6.63805	6.23086	5.86946	5.54682	5.25720	4.99592
40	8.95105	8.24378	7.63438	7.10504	6.64178	6.23350	5.87133	5.54815	5.25815	4.99660

ANSWERS TO TRUE/FALSE QUESTIONS

Chapter 1
1 T, 2 T, 3 T, 4 F, 5 F, 6 F, 7 T, 8 F, 9 F, 10 F

Chapter 2
1 F, 2 F, 3 F, 4 F, 5 F, 6 F, 7 T, 8 T, 9 F, 10 F

Chapter 3
1 F, 2 T, 3 T, 4 T, 5 F, 6 F, 7 F, 8 T, 9 F, 10 T

Chapter 4
1 F, 2 F, 3 F, 4 T, 5 T, 6 F, 7 F, 8 T, 9 F, 10 T

Chapter 5
1 F, 2 F, 3 F, 4 F, 5 T, 6 F, 7 T, 8 T, 9 F, 10 T

Chapter 6
1 F, 2 F, 3 T, 4 F, 5 T, 6 F, 7 T, 8 F, 9 F, 10 T

Chapter 7
1 F, 2 F, 3 F, 4 F, 5 F, 6 T, 7 F, 8 F, 9 T, 10 F

Chapter 8
1 F, 2 T, 3 T, 4 F, 5 F, 6 F, 7 F, 8 T, 9 T, 10 F

Chapter 9
1 T, 2 T, 3 T, 4 T, 5 F, 6 F, 7 T, 8 T, 9 T, 10 F

Chapter 10
1 T, 2 T, 3 T, 4 T, 5 T, 6 T, 7 T, 8 T, 9 T, 10 T

Chapter 11
1 F, 2 T, 3 F, 4 F, 5 F, 6 F, 7 F, 8 T, 9 T, 10 T

Chapter 12
1,F, 2 F,3 T, 4 F, 5 F, 6 T, 7 T, 8 T, 9 T, 10 F