FUNDAMENTALS OF MANAGEMENT ACCOUNTING

VISSNU POOMMIPANIT

Fundamentals of Management Accounting
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"Education is the most effective means to liberate man from ignorance and poverty."
Inscription a scribed to President Emeritus, Assumption University
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Preface

It was ever-since fifteenth century that Van Luca Pacioli, joined the Franciscan monastery and was called “The Father of Accounting”, described double-entry accounting to be known as Venetian method. Over 75 years that accounting has been used effectively as a tool for presenting the performance and financial status of the organization. Therefore, management needs to see through the importance of accounting as an art of the process to report the financial information to the decision makers.

James O. McKinsey has stated that “The teaching of accounting is no longer designed to train professional accountants only. With the growing complexity of business and the constantly increasing difficulty of the problems of management, it has become essential that everyone who aspires to position of responsibility should have a knowledge of the fundamental principles of accounting”, this drives me to come up with this accounting text book. Its objective is to provide the knowledge in fundamentals of management accounting to the business students who have a little background in accounting, with the informational contents of financial statements. Topics covered in this text book mainly related to management accounting but the presentation of all topics are very simple and ease of understanding to all readers.

My primary intention is to assign this text book to be used with the BA6601 Managerial Accounting course at the Graduate School of Business, Assumption University. I do, however, hope this text book will also provide the principles knowledge in management accounting to others in order to guide them at work and save them from any dangerous matters arose from the improper decision.

Lastly, I would like to express my sincere thanks to all people who have helped me to complete this text. Special thanks to my family and friends who have encouraged and supported me in this endeavor.

Vissnu Poommipanit
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CHAPTER 1
MANAGEMENT ACCOUNTING: AN OVERVIEW

LEARNING OBJECTIVES
After studying this chapter, you should be able to:

1. Describe the nature, scope, and objective of management accounting as well as its responsibilities.
2. Identify the major differences, similarities and relationship among financial accounting, cost accounting and management accounting.
3. Describe the organization aspect of management accounting.
4. Discuss controllership; explain the qualifications and functions of the controller.
5. Compare the controller’s function and treasurer’s function.
6. Be familiar with codes of conduct and know the typical ethical challenges.
7. Understand the expanding role of management accounting.
8. Be familiar with the major contemporary management techniques such as
   a. Just-in-Time
   b. Total Quality Management
   c. Process Reengineering
   d. Mass Customization
   e. Balanced Scorecard
   f. Activity-based Costing and Management
   g. Theory of Constraints
   h. Life Cycle Costing
   i. Target Costing
CHAPTER 1
MANAGEMENT ACCOUNTING: AN OVERVIEW

Management Accounting
Management Accounting involves the application of appropriate techniques and concepts to economic data so as to assist management in establishing plans for reasonable economic objectives and in the making of rational decisions with a view towards achieving these objectives.

Therefore, management accounting can be defined as the process of identifying, measuring, accumulating, analyzing, preparing, interpreting, and communicating of financial information, which is used by management to plan, evaluate and control activities within an organization. It also comprises the preparation of financial reports for non-management groups such as shareholders, creditors, regulatory agencies and tax authorities.

Objective and Scope
Management accountants are concerned with providing information to managers who direct and control the operations. They provide a variety of reports. Some of them focus on how well managers and business units have performed while other reports provide timely and frequent updates on key performance indicators (KPI), analysis of business situation or opportunity and analytical reports that are needed to investigate some specific problems.

Management accountants at appropriate levels are involved actively in the process of managing the entity. The process includes making strategic, tactical and operating decisions and helping to coordinate the efforts of the entire organization. The management accountant participates, as part of management, in assuring that the organization operates as a unified whole in its long-term, intermediate term and short-term best interests.
Management accounting is concerned primarily with providing information to internal managers who are responsible for planning and controlling the operations of the firm and making a variety of management decisions. Generally, management accountants do the following task:

(a) Scorekeeping or data accumulating which enables both internal and external parties to evaluate organizational performance and financial position.

(b) Interpreting and reporting of information that helps manager to focus on operating problems, opportunities as well as inefficiencies. This is commonly associated with current planning, controlling, analyzing, and investigating of routine internal accounting reports in order to take any required actions.

(c) Problem-solving or quantifying the relative merits possible courses of action as well as recommending the best procedure. This is commonly associated with non-recurring decisions.

Specifically, the management accountant provides a system which allows management to receive the necessary information used in performing its administrative functions of planning which involves setting of goals for the firm. His function also involves evaluating the various ways to meet the goals and picking out what appears to be the best way to meet the goals. As a part of the organization he also does the controlling function which involves the evaluation of whether actual performance conforms with planned goals. Lastly, management accountant must do the decision making which involves determination of predictive information (e.g. relevant costs) for making important business decisions.

Planning

A key activity for all companies is planning for the future. Planning involves identifying alternatives and selecting a course of action, as well as specifying how the action will be implemented to further the organization’s objectives.
The plan communicates a company's objectives and visions to employees. It specifies the resources needed to achieve them. The plans of management are often expressed formally in terms of number in budgets, such as Cash budgets, capital budgets, and projected balance sheets. Accounting can make in resource planning while break — even analysis, projected income statements are examples of useful tools in profit planning.

**Controlling**

Control of organizations is achieved by evaluating the performance of managers and the operations for which they are responsible. The distinction between managers are the results of their evaluation to determine how their performance should be rewarded or punished, which in turn motivates them to perform to the best of their abilities. Based on an evaluation indicating good performance, a manager might receive substantial bonus compensation. An evaluation indicating a manager performed poorly might lead to the manager being fired. In part because evaluations of managers are typically tied to compensation and promotion opportunities, managers work hard to ensure that they will receive favorable evaluations.

Manufacturing cost variance analysis, financial statements analysis are some of the accounting control reports used to inform managers when activities which are part of their responsibility are deviating from the plan. The reports used evaluate the performance of manager and the operations they control are referred to as **performance reports**.

Although there is no specific method of preparing a performance report, such reports frequently involve a comparison of current period performance with performance in a prior period or with planned (budgeted) performance. Performance reports may not provide definitive answers, but they are still extremely useful. Manager can use them to “flag” areas that need closer attention and to avoid areas that are under control. It would not seem necessary, for example, to investigate labor, rent, depreciation, or other costs, because these costs are either equal to or relatively close to the planned level of cost. Typically, managers follow the principle of management by exception when using performance reports. This means that managers investigate departures from the plan
that appear to be exceptional; they do not investigate minor departures from the plan.

Operations are evaluated to provide information as to whether or not they should be change (i.e., expanded, contracted, or modified in some way). An evaluation of an operation can be negative even when the evaluation of the manager responsible for the operation is basically positive.

Company plans often play an important role in the control process. Managers can compare actual results with planned results and decide if corrective action is necessary. If actual results differ from the plan, the plan may not have been followed properly, the plan may have not been well thought out, or changing circumstances may have made the plan out of date.

**Figure 1.1 Planning and Control Process**
Figure 1.1 presents the major steps in the planning and control process. Once a plan has been made, actions are taken to implement it. These actions lead to results, which are compared with the original plan. Based on this evaluation, managers are rewarded (e.g., given substantial bonuses or promoted if performance is judged to be good) or punished (e.g., given only a small bonus, given no bonus, or even fired if performance is judged to be poor). Also, based on the evaluation process, operations may be changed. Changes may consist of expanding (e.g., adding a second shift), contracting (e.g., closing a production plant), or improving operations (e.g., training employees to do a better job answering customer product inquiries). Changes may also consist of revising an unrealistic plan.

Thus, accounting serves management at all stages of the management process, from the formulation of objectives and so on up the feedback of performance information which in turn helps in the reformulation of objectives.

Decision making

As indicated in Figure 1.1, decision making is an integral part of the planning and control process – decisions are made to reward or punish managers, and decisions are made to change operations or revise plans. Should a firm add a new product? Should it drop an existing product? Should it manufacture a component used in assembling its major product or contract with another company to produce the component? What price should a firm charge for a new product? These questions indicate just a few of the key decisions that confront companies. And how well they make these decisions will determine future profitability and, possibly, the survival of the company.

Financial Accounting and Management Accounting

Financial accounting involves the systematic recording of business transactions, governed by a body of international financial reporting standards (IFRS) leading to the preparation of financial statements for the use of various interested parties, internal as well as external. Management accounting is concerned with providing financial information to persons within the organization to enable them to make informed judgments and effective decisions which further the
organization’s goals. The summary of the difference between financial and management accounting is shown in **Figure 1.2**

The specific differences between Financial Accounting (FA) and Management Accounting (MA) can be expressed in the following viewpoints:

1. Their objective
2. International Financial Reporting Standards (IFRS)
3. Future emphasize
4. Relevance and flexibility of data
5. Precision and timeliness of report
6. Requirements of an organization
7. Compliance with law and regulation

As to objective, Financial accounting provides data for both internal (management) and external users (e.g. creditors, owners, government, etc.). Management accounting provides data only for internal users within the business organization. Financial accounting is aimed primarily at external users of accounting information, whereas managerial accounting is aimed primarily at internal users. External users includes investors, creditors, and government agencies, which need information to make investment, lending and regulation decisions. Their information needs differ from those of internal managers, who need information for planning, control, and decision making.

As to compliance with International Financial Reporting Standards (IFRS), Financial data, in financial accounting, should be recorded and presented in accordance with IFRS to be able to present more useful data to management. Much of financial accounting information is required. The Securities and Exchange Commission (SEC) requires large, publicly traded companies to prepare report in accordance with international financial reporting standards (IFRS). Even companies that are not under the jurisdiction of the SEC prepare financial accounting information in accordance with IFRS to satisfy creditors. Managerial accounting, on the other hand, is completely optional. It stresses information that is useful to internal managers for planning, control and decision making. If a managerial accountant believes that deviating from IFRS will provide more useful information to internal manager, IFRS need not be followed.
Figure 1.2 Financial Accounting and Management Accounting Compared

Financial Accounting (FA)

- Recording
- Organizing
- Summarizing
- Reporting

Financial and Operational Data

Management Accounting (MA)

- Report to managers within the organization for:
  - Planning
  - Directing and motivating
  - Controlling
  - Performance evaluation

- Emphasis is on future-oriented data needed in decision-making

- Relevance is emphasized.

- Timeliness of information is required.

- Detailed segment reports about departments, products, customers, and employees are prepared.

- Need not follow IFRS.

- Not mandatory.

Management Accounting (MA)

- Report to various interested parties (external and internal):
  - Owners
  - Lenders
  - Tax authorities
  - Regulators
  - Managers

- Emphasis is on summaries of financial consequences of past activities.

- Objectivity and verifiability of data are emphasized.

- Precision of information is required.

- Only summarized data for the entire organization are prepared.

- Must follow IFRS.

- Mandatory for external reports.
Chapter 1 Management Accounting: An Overview

As to emphasis on the future, financial accounting primarily provides summaries of past financial transaction while management accounting has a strong future orientation. Financial accounting is primarily concerned with presenting the results of past transactions. Managerial accounting, on the other hand, places considerable emphasis on the future. As indicated, previously, one of the primary purposes of managerial accounting is planning. Thus, managerial accounting information often involves estimates of the costs and benefits of future transactions.

As to the relevance and flexibility of data, financial accounting prepares all-purpose reports with historical data are prepared for use of different parties. But management accounting prepares special reports containing both historical and projected data are prepared to meet the needs of specific users. They contain information, quantitative and qualitative, that are relevant for a particular decision. Both managerial and financial accounting reports generally contain monetary information (information expressed in pesos such as revenue and expense). But, managerial accounting reports can also contain a substantial amount of nonmonetary information. The quantity of material consumed in production, the number of hours worked by the office staff, and the number of product defects are examples of important nonmonetary data that appear in managerial accounting reports. Also, financial accounting presents information in a highly summarized form. Net income, for example, is presented for the company as a whole. To run a company, however, managers need more detailed information- for example, information about the cost of operating individual departments in addition to the cost of operating the company as a whole.

As to emphasis on precision and timeliness of report, financial accounting reports are still useful even if submitted late and show summaries of financial consequences of actual and past activities where precision is required. In management accounting, timeliness is often more important than precision to managers. Prompt submission of the report is necessary to preserve its usefulness and good estimates may be enough to make good decisions.

As to reporting requirements of an organization, financial accounting primarily concerned with reporting for the company as a whole, while
management accounting focuses reporting on the parts or segments (i.e., product line, sales, territories, divisions, departments) of the company.

As to requirement for compliance with law regulation, financial accounting is required by law as exemplified by the report requirements of the revenue department, stock exchange commission and other governmental entities. All these are not mandatory for management accounting.

**Similarities Between Financial and Management Accounting**

The differences between financial accounting and managerial accounting in terms of their respective user groups should not be overstated. Financial accounting reports are aimed primarily at external users, and managerial accounting reports are aimed primarily at internal users. However, managers also make significant use of financial accounting reports, and external users occasionally request financial information that is generally considered appropriate for internal users. For example, creditors may ask management to provide them with detailed cash-flow projections. A comparison of financial and management accounting is shown in Figure 1.2.

**Relationship between Management Accounting and Cost Accounting**

Cost accounting is a systematic set of procedures for recording and reporting measurements of the cost of manufacturing goods and performing services in the aggregate and in detail. It includes methods for recognizing, classifying, allocating, aggregating and reporting such costs and comparing them with standard costs.

Management accounting is a newer interest of cost accounting. Its purpose is to provide managers with information which aids decision. There are no generally accepted principles which specify how management accounting information is to be reported. While systems such as direct costing and standard costing exist in management accounting, each accounting report should be tailored to the needs of the
decision and the decision maker. The most effective systems result when the manager-decision maker and the accountant work together until the accountant understands the decision to be made and the manager understands the source of information that the accountant will report.

Activities of Management Accountants

Managers of line functions are concerned with the primary operating activities of the organization-manufacturing (or buying) and selling a physical product or performing a service. A staff manager manages a department that serves other departments. For example, financial managers obtain the cash to keep operations running smoothly. The manager of the legal department advises other managers regarding the legal ramifications of actions.

Accounting is a staff function, with management accountants providing information to other managers. Information can relate to financial statement, tax problems, dealings with governmental authorities, and other matters. The management accountant, like other staff managers, often recommends courses of action to those using the information. But neither the management accountant, nor any other staff manager, can impose recommendations on line managers. Nevertheless, because of their expertise, staff managers can influence decisions. Staff managers, like all managers, also manage their own departments.

Management accountants discharge their responsibilities and achieve their objective by organizing and implementing activities in following categories:

1. **Planning** – This involves quantifying and interpreting the effects on the organization of planned transaction and other economic events. The planning responsibility, which includes strategic, tactical and operating aspects, requires that the accountant provide quantitative historical and prospective information to facilitate planning. It includes participation in developing the planning system, setting obtainable goals, and choosing appropriate means of monitoring the progress toward the goals.

2. **Reporting** – Reporting relates to both internal and external needs for information about past or future events and circumstances.
Management accountants make available to managers timely reports that provide information and perspective necessary for them to make decisions in a goal-congruent manner. The reports may concern financial, physical, and human resources and the markets and regulatory environments in which entities operate. In addition to reporting internally, management accountants make appropriate information available to shareholders, creditors, and governmental regulatory agencies and tax authorities.

3. **Controlling** – Management accountants interpret all forms of internal and external information pertinent to the various segments of the organization and communicate the implications of the information being reviewed, including its relevance and reliability. Management accountants thus must understand both the sources and uses of the information. This also involves judging implications of historical and expected events and helping to choose the optimum course of action. Evaluating includes translating data into trends and relationships. Management accountants must communicate effectively and promptly the conclusions derived from the analyses. The management accountant assures the integrity of financial information concerning an organization’s activities and resources; monitoring and measuring performance and inducing any corrective actions required to return the activity to its intended course. Management accountants provide information to executives operating in functional areas who can make use of it to achieve desirable performance.

4. **Resource Management**—This involves implementing a system of reporting that is aligned with organizational responsibilities. This reporting system will contribute to the effective use of resources and measurement of management performance. The transmission of management’s goals and objectives throughout the organization in the form of assigned responsibilities is a basis for identifying accountability. Management accountants must provide an accounting and reporting system that will accumulate and report appropriate revenues, expenses, assets, liabilities, and related quantitative information to managers. Managers then will have better control over these elements. Management
accountants must establish systems which facilitate planning and control of the organization's resources to ensure that their use is consistent with established policies. These systems also should meet the needs of management, investors, creditors, and other interested parties. Some of these needs are:

- Custody and management of working capital, including credit and collections and inventory management.
- Creating and maintaining the most appropriate debt and equity capital structure
- Developing and implementing a system to control plant, property, and equipment
- Administering a pension or similar plan
- Tax planning and compliance
- Insurance management
- Creating and operating a system of internal accounting control that can detect misuses of assets, taking into account the cost/benefit aspects of the control system

5. **Information Systems Development** – The information system must meet the needs of all people who require information to perform their jobs. Managers responsible for sales of a particular product might need weekly sales reports for each territory. Their supervisor, who also supervises other sales managers, might need only a weekly report for a group (or line) of products. The chief sales executive might want only monthly, not weekly, reports of sales by product groups and sales territories. Management accountants must ensure that the system meets these varying needs. Design and development of the overall management information system implies:

- Determining the output required by users
- Specifying the data inputs needed to obtain the required output
- Developing the requirements for a processing system that converts input to output
- Managing and securing the data bases.
6. **Technological Implementation** – Modern equipment and techniques should be employed to facilitate the selection, accumulation, transmission, analysis, and safeguarding of information. Management accountants therefore should be familiar with current technology relative to information processing and the accounting techniques appropriate to controlling and using the information. Some examples are:

- Computer applications
  - Basic accounting functions and data-base management
  - Techniques in financial planning and decision making, such as models for optimizing asset utilization and resource allocation

- Network and communications systems

Computers usually record transactions in journals and ledgers. Accountants are responsible for supervising the gathering of data and for monitoring the systems, making sure it functions as intended and is used appropriately. Regular, periodic reporting is the heart of management accountants' work in many organizations. One of the challenges here is ensuring that other managers receive relevant information and are not overwhelmed by irrelevant information. For some years, many people believed that managers should receive all of the information that could possibly be relevant. This view no longer prevails; managers' time is too valuable to spend sifting through material until they find what they need.

7. **Verification** - Management accountants assure the accuracy and reliability of information derived from the accounting system or related sources that is used throughout the organization. They also must be satisfied that actions taking place throughout the entity are consistent with policies of the organization. Both of these activities use the internal control system and are reviewed by internal audit.

8. **Administration** - Administration includes development and maintenance of an effective and efficient management accounting
organization. This organization addresses and resolves issues relevant to the accounting and financial structure such as:

- Assignment of management accounting responsibilities
- Interface between accounting and other operations
- Delegation of authority and determinations relevant to centralization or decentralization
- Recruiting, training, and developing personnel in the various areas of responsibility
- Separation of duties

Other important administrative activities performed by management accountants include the development and maintenance of:

- Accounting policy and procedure manuals
- A cost-effective records management program
- Records adequate to meet the requirements of tax laws, other laws and regulatory agencies, and independent auditors

Operation Processes

The operation processes that are inherent throughout the range of activities described above include identification, measurement, accumulation, analysis, preparation and interpretation, and communication.

Identification emphasizes on the recognition and evaluation of business transactions and other economic events for appropriate accounting action. Measurement is required to quantify business transactions or other economic events that have occur. Accumulation relates to discipline and consistent approaches to recording and classifying appropriate business transactions and other economic events. Analysis is about the determination of the reasons for the reported activity and its relationship with other economic events and circumstances. Preparation and Interpretation result to the meaningful coordination of accounting and/or planning data to provide information,
presented logically, and including, if appropriate, the conclusions drawn from those data. And communication is to report pertinent information to management and others for internal and external uses.

Organization Structure and the Management Accountant

Many of the activities constituting the field of management accounting are interrelated and thus must be coordinated, ranked and implemented by the management accountant in such a fashion as to meet the objectives of the organization as perceived by him or her. A major function of the management accountant is that of tailoring the application of the process to the organization so that the organization’s objectives are achieved effectively.

Management accounting is intended to include persons involved in such functions as controllership, treasury, financial analysis, planning, and budgeting, cost accounting, internal audit, system, and general accounting. Management accountants thus may have titles as financial director, chief financial officer, vice president of finance, controller, treasurer, budget analyst, cost analyst, and accountant, among others.

Line and Staff Relationship

Line authority is the authority to command action or give orders to subordinates. Line managers are directly responsible for attaining the objectives of the business firm as efficiently as possible. Sales and production managers typically have line authority. Staff authority is the authority to advise but not command others; it is exercised laterally or upward. Staff managers give support, advice and service to line departments. Examples of staff authority are found in personnel, purchasing, engineering and finance.

The accounting function is usually “staff”, with responsibility for providing line managers and also other staff manager, with specialized services. This includes advice and help in the areas of budgeting, controlling, pricing and special decisions.
Except for exercising line authority over his department, the chief accounting officer usually the controller generally fills the staff role in his company as contrasted with the line roles of sales and production executives. Theoretically, the controller transmits the best accounting procedures to be followed by the line people to the president who will communicate such through a manual of instructions. In practice however, the controller holds delegated authority from top line management to direct the line people how to apply these procedures. This is known as functional authority which is the right to command action laterally or downward with regard to a specific function or specialty.

The Chief Financial Officer (CFO) and the Controller

The chief financial officer (CFO) – also called the finance director in many countries – is the executive responsible for overseeing the financial operations of an organization. The responsibilities of the CFO vary among organizations, but they usually include the following areas:

- Controllership – includes providing financial information for reports to managers and reports to shareholders and overseeing the overall operations of the accounting system.
- Treasury- includes banking and short- and long-term financing, investments, and management of cash.
- Risk management – includes managing the financial risk of interest-rate and exchange-rate changes and derivatives management.
- Taxation – includes income taxes, sales taxes, and international tax planning.
- Internal audit – includes reviewing and analyzing, financial and other records to attest to the integrity of the organization’s financial reports and to adherence to its policies and procedures.

In some organizations, the CFO is also responsible for information systems. In other organization, and officer of equivalent rank to the CFO – called the chief information officer – is responsible for information systems.
The controller (also called the chief accounting officer) is the financial executive primarily responsible for management accounting and financial accounting. This book focuses on the controller as the chief management accounting executive. Modern controllers do not do any controlling in terms of line authority except over their own departments. Yet, the modern concept of controllership maintains that the controller does control in a special sense. That is, by reporting and interpreting relevant data (problem-solving and attention-directing roles), the controller exerts a force or influence that impels management toward making better-informed decisions.

Controllership

Controllership is the practice of the established science of control which is the process by which management assures itself that the resources are procured and utilized according to plans in order to achieve the company’s objectives.

The Controller as the Top Management Accountant

In most organizations, the top managerial accounting position is held by the controller. The controller provides reports for planning and evaluating company activities (e.g., budgets and performance reports) and provides the information needed to make management decision (e.g., decisions related to construction of a new factory or decisions related to adding or dropping a product). The controller also has responsibility for all financial accounting reports and tax filings with the Bureau of Internal Revenue and other taxing agencies, as well as coordinating the activities of the firm’s external auditors.

A simplified illustration of the organization chart for the controller’s office is shown in Figure 1.3. Note that one of the areas reporting to the controller is cost accounting. Most medium-sized and large manufacturing companies have such a department. Cost accountants estimate costs to facilitate management decisions and develop cost information for purposes of valuing inventory.
The controller is an integral part of the top management team. If one wants a high-level career in management accounting, he/she will need not only strong accounting skills but also skills required of all high-level executives. These skills include excellent written and oral communication skills, solid interpersonal skills and a deep knowledge of the industry in which the firm competes.

In addition to the position of the controller, many companies have a position called treasurer. The treasurer has custody of cash and funds invested in various marketable securities. In addition to money management duties, the treasurer is generally responsible for maintaining relationships with investors, banks, and other creditors. Thus, the treasurer plays a major role in managing cash and marketable securities, preparing cash forecasts and obtaining financing from banks and other lenders. Both the controller and the treasurer report to the chief financial officer (CFO) who is the senior executive responsible for both accounting and financial operations.

The controller’s authority is basically staff authority in that the controller’s office gives advice and service to other departments. However, in his own department, he has line authority. In the modern concept of controllership, it is maintained that the controller does control
in a special sense. That is, by reporting and interpreting relevant data, the controller exerts a force or influence that impels management toward logical decisions consistent with objectives.

Basic Functions of Controllership

The basic principal functional responsibilities and activities of controllership may be categorized as follows:

1. **Planning.** Establish and maintain an integrated plan of operation consistent with the company's goals and objectives, both short and long term, analyzed and revised, as required, communicated to all levels of management, with appropriate systems and procedures installed.

2. **Controlling.** Develop and revise standards against which to measure performance and provide guidance and assistance to other members of management in insuring conformance of actual results to standards.

3. **Reporting.** Prepare, analyze, and interpret financial results for utilization by management in the decision-making process, evaluate the data with reference to company and unit objectives; prepare and file external reports as required to satisfy government regulatory bodies, shareholders, financial institution, customers, and the general public.

4. **Accounting, Design, establish, and maintain general and cost accounting systems at all company levels, including corporate, divisional, plant, and unit to properly record all financial transactions in the books of accounts and records is accordance with sound accounting principles with adequate internal control.

5. **Other Primary Responsibilities.** Manage and supervise such functions as taxes, including interface with the respective taxing authorities and agents; maintain appropriate relationships with internal and external auditors; institute insurance programs, coverage, records and provision; develop and maintain systems and procedures; develop record retention program; supervise assigned treasury functions; institute investor and financial public relations programs; office management; and direct other assigned functions.
As circumstances warrant, there may be many deviations from the basic functions just described. It should be pointed out that the controller's efforts should not be diluted and render him less effective by assigning to him unrelated functions of an operational nature. The financial planning and control functions are too important to the success of the business enterprise to burden the controller with activities that others can perform.

Qualifications of the Controller

The qualifications of an effective controller would include:
1. An excellent technical foundation in accounting and finance with an understanding and thorough knowledge of accounting principles.
2. An understanding of the principles of planning, organizing, and control.
3. A general understanding of the industry in which the company competes and the social, economic, and political forces involved.
4. A thorough understanding of the company, including its technologies, products, policies, objectives, history, organization, and environment.
5. The ability to communicate with all levels of management and a basic understanding of the other functional problems related to engineering production, procurement, industrial relations, and marketing.
6. The ability to express ideas clearly in writing or in making informative presentations.
7. The ability to motivate other to achieve positive action and results.

The controller may have the technical capability and be to lay out the assigned tasks as well as supervise and direct his personnel, but he must also have integrity and the ability to communicate if he is to succeed. He must be fair, reasonable, and sincere with all concerned if he is to be recognized for the importance of the controllership function.

As in any executive position the controller must be able to work with people all levels, have respect for the ideas and opinions of others, and have the resourcefulness, to meet all challenges.
Expanding Role of Management Accounting

The business environment in recent years has been characterized by increasing competition and relentless drive for continuous improvement. As businesses turned global and product lines expanded, operations have become more complex, forward-looking companies saw a tremendous need for management oriented data that was separate from financial – oriented data.

Corporate executives are now using cost data to chart successful futures for their companies. Adapting management accounting system to better meet management’s needs for information is crucial to an organization’s survival when competing in global markets. Global competitors now have relatively free access to markets around the world. As a result, domestic markets on virtually every country face greater challenges from foreign competition. With increased reliance on global markets, companies need not only respond quickly to changing market conditions but also tailor products to different consumer taste and demands and this has to be done at a level that assures profit and give satisfactory returns to shareholders.

In today’s automated environment management accountants use the management control systems to support and reinforce manufacturing and other operating strategies. It is in this light that one learns to appreciate the role of a management accountant which is more of an influencing role rather than just an informing role.

The change in the business environment in at least the last two decades where organization have to transform themselves to become more competitive, have profound effect in the practice of management accounting. While many of the major improvement tools used by managers overlap, they can be classified into major programs or approaches also referred to as contemporary management techniques:

1. Just-In-Time (JIT)

Just-In-Time (JIT) is the philosophy that activities are undertaken only as needed or demanded. JIT is a production system also known as pull-it-through approach, in which materials are purchased and units are produced only as needed to meet actual customer demand. In a JIT system, inventories are reduced to the minimum and in some cases, zero.
Chapter 1 Management Accounting: An Overview

The four characteristics of JIT are

1. Elimination of all activities that do not add value to the product or service
2. Commitment to a high level of quality
3. Commitment to continuous improvement in the efficiency of an activity
4. Emphasis on simplifications and increased visibility to identify activities that do not add value

The main benefits of JIT are as follows:

1. Working capital position is improved by recovery of funds that were tied up in inventories.
2. Throughput time is reduced, resulting in greater potential production and quicker response to customers.
3. Areas previously used to store inventories are released and are made available for other more productive uses.
4. Lesser waste and more customer satisfaction are achieved because of reduction in defect rates.

2 Total Quality Management

To survive in an increasingly competitive environment, firms realize that they must produce high-quality products. As a result, an increasing number of companies have instituted total quality management programs to ensure that their products are of the highest quality and that production processes are efficient.

Total quality management (TQM) is a technique in which management develops policies and practices to ensure that the firm’s products and service exceed customers’ expectations.

Currently, there is no generally agreed upon “perfect” way to institute a TQM program. But most companies with TQM develop a company that stresses listening to the needs of customers, making products right the first time, reducing defective products that must be reworked, and encouraging workers to continuously improve their production process. That is why some TQM programs are referred to as continuous quality improvement programs.
TQM affects product costing by reducing the need to track the cost of scrap and rework related to each job. If TQM is able to reduce these costs to a very low level, the benefit of tracking the costs is unlikely to exceed the cost to the accounting system.

Total Quality Management (TQM) is a formal effort to improve quality throughout an organization's value chain. The two major characteristics of TQM are

(1) A focus on serving customers, and
(2) Systematic problem-solving using teams made up of front-line workers.

3. Process Reengineering

Reengineering is a process for creating competitive advantage in which a firm reorganizes its operating and management functions, often with the result that jobs are modified, combined, or eliminated. It has been defined as the "fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed."

Process reengineering, a more radical approach to improvement than TQM, is an approach where a business process is diagrammed in detail, questioned and then completely redesigned in order to eliminate unnecessary steps, to reduce opportunities for errors and to reduce costs. A business process is any series of steps that are followed in order to carry out some task in a business.

The main objective of this approach is the simplification and elimination of wasted effort and the central idea is that all activities that do not add value to product or service should be eliminated. In its most simplified version, the steps used in process reengineering are

1. A business process is diagrammed in detail.
2. Every step in the business process must be analyzed and justified.
3. The process is redesigned to include only those steps that make the product or service more valuable.
This process can yield the following anticipated results:

1. Process is simplified
2. Process is completed in less time
3. Costs are reduced, and
4. Opportunities for errors are reduced.

Process reengineering has one basic recurrent problem that is employee resistance. As with other improvement projects, employees fear loss of jobs which may lead to lost morale and failure to improve the bottom line (i.e., profits). For the process to prosper and succeed, employees must be convinced that the end result of the improvement will be more secure, rather than less secure jobs. They can be made to understand that improving the processes; the company can generate more business, produce a better product at lower cost and will have the competitive strength to prosper.

4. Mass Customization

Many manufacturing and service firms increasingly find that customers expect products and services to be developed for each customer’s unique needs. And many firms have been successful with a strategy that targets customer’s unique needs.

Mass customization is a management technique in which marketing and production processes are designed to handle the increased variety that results from delivering customized products and services to customers.

The growth of mass customization is in effect another indication of the increased attention given to satisfying the customer.

5. Balanced Scorecard

The balanced scorecard is an accounting report that includes the firm's critical success factors in four areas

(a) Financial performance,
(b) Customer satisfaction
(c) Internal business process, and
(d) Innovation and learning.
Chapter 1 Management Accounting: An Overview

The concept of balance captions the intent of broad coverage, financial and nonfinancial of all the factors that contribute to the success of the firm in achieving its strategic goals. The use of the balanced scorecard is thus a critical ingredient of the overall approach that firms take to become and remain competitive.

6. Activity-based Costing and Management

Activity analysis is used to develop a detailed description of the specific activities performed in the operation of the firm. Many firms have found that they can improve planning, product costing, operational control, and management control by using activity analysis to develop a detailed description of the specific activities performed in the firm’s operations. The activity analysis provides the basis for activity-based costing and activity-based management. Activity-based costing (ABC) is used to improve the accuracy of cost analysis by improving the tracing of costs to products or to individual customers. Activity-based management (ABM) uses activity analysis to improve operational control and management control. ABC and ABM are key strategic tools for many firms, especially those with complex operations, or great diversity of products.

7. Theory of Constraints (TOC)

The Theory of Constraints is a sequential process of identifying and removing constraints in a system.

The Theory of Constraints emphasizes the importance of managing the organization’s constraints or barriers that hinder or impede progress toward an objective. Since the constraint is whatever is holding back the organization, improvement efforts usually must be focused on the constraint to be really effective.

The basic sequential steps followed in applying TOC are

1. Analyze all the factors of production (materials, labor, facilities, methods, etc.) required in the production chain.
2. Identify the weakest link, which is the constraint.
3. Focus improvement efforts on strengthening the weakest link.
4. If improvement efforts are successful, eventually the weakest link will improve to the point where it is no longer the weakest link.
5. At this point, a new weakest link (new constraint) must be identified and improvement efforts must be shifted over that link.

8. Life Cycle Costing

Life-cycle costing is a management technique to identify and monitor the costs of a product throughout its lifecycle. It consists of all steps from product design and purchase of raw material to delivery of and service of the finished product. The steps include

(1) Research and development
(2) Product design, including prototyping, target costing and testing
(3) Manufacturing, inspecting, packaging and warehousing
(4) Marketing, promotion and distribution
(5) Sales and service

Cost management traditionally has focused only on costs incurred up to the third step manufacturing. Management accountants now strategically manage the product's full life cycle of costs, including upstream and downstream costs as well as manufacturing costs.

9. Target Costing

Target costing involves the determination of the desired cost for a product or the basis of a given competitive price so that the product will earn a desired profit. The basic relationship that is observed in this approach is

\[
\text{Target cost} = \text{Market determined price} - \text{Desired profit}
\]

The entity using target costing must often adopt strict cost-reduction measures to meet the market price and remain profitable. This is a common strategic approach used by intensely competitive industries where even small price differences attract consumers to the lower-priced product.
SHORT QUESTIONS

1. Identify the nature, scope, and objective of management accounting.
2. What is/are the major differences, similarities and relationships among financial accounting, management accounting and cost accounting?
3. Explain the qualification and functions of the controller. What is the difference between controller and finance manager?
4. Describe the following term: Just in time, total quality management, reengineering process, and mass customization? What is/are the relationships among them?
5. Is balanced scorecard a process of performance measurement? Why or why not?
6. Briefly explain the life cycle costing and target costing.
7. Cross-functional teams and time-based competition are two themes of contemporary management accounting. Briefly explain these two concepts.
8. The competitive environment for both manufacturing and servicing firm has become far more challenging and demanding in the last two decades. Discuss the changes in competition and in the nature and type of the new requirements for management accounting information.
Chapter 1 Management Accounting: An Overview

EXERCISES

Problem 1
Financial accounting and managerial accounting are both concerned with the economic events of an enterprise. Similarities between financial and managerial accounting do exist, but they do have a different focus. Briefly distinguish between financial and managerial accounting as they relate to
1. the primary users
2. the type and frequency of reports
3. the purpose of reports, and
4. the content of reports.

Problem 2
Identify each of the following role of accounting activities belongs to
a) problem solving
b) scorekeeping
c) attention directing
d) planning
• Analyzing the impact of introducing a new product on production
• Comparing results between actual costs and budgeted costs for each step of manufacturing a product.
• Preparing a report that analyzes changes in cost resulting from reducing the number of tubing sizes used during production.
• Reporting sales by branch for the sales manager
• Preparing a master budget for the next accounting period
• Cumulating the actual cost of production for producing a product and calculating the cost per unit.

Problem 3
Classify each cost item into the functions of the value chain as follows: research and development, design, production, marketing, distribution, and customer service.
a) Cost of samples mailed to promote sales of a new product
b) Labor cost of workers in the manufacturing plant
c) Costs of purchasing material for production
d) Bonus paid to person with a 70 percent satisfaction rating in handling customers’ complaints.
e) Delivery costs for shipping the goods to outlet.
f) Logistic cost to receiving material from suppliers.
g) Cost of customer order forms
h) Cost of the material used in manufacturing of product.
i) Depreciation of trucks used to transport goods to customers

Problem 4
Identify the main role the accountant is performing – problem solving, scorekeeping, or attention directing; from each of the following activities.
a) Preparing a monthly statement of branch sales for the marketing vice president.
b) Interpretation differences between actual results and budgeted amount in a performance report for the customer warranty department of a company.
c) Preparing a schedule of depreciation for forklift trucks in the receiving department
d) Analyzing, for an international manufacturing manager, the desirability of having some auto part made in other country.
e) Interpreting why a distribution center did not adhere to its delivery cost budget.
f) Explaining the shipping department’s performance report.
g) Preparing the budget for the maintenance department of a hospital.
h) Analyzing, for a product designer, the impact on product costs of some new product.

Problem 5
Management accountants are actively involved in the process of managing the entity. This process includes making strategic, tactical, and operating decisions while helping to coordinate the efforts of the entire organization. To fulfill these objectives, the management accountant accepts certain responsibilities that can be identified as (1) planning, (2) controlling, (3) evaluating performance, (4) ensuring accountability of resources, and (5) external reporting

Required
Describe each of these responsibilities of the management accountant and identify examples of practices and techniques. (CMA Adapted)
Problem 6
Fashion.com sells fashionable clothes and products over the internet. During the past two years, the company had high revenue from sales but resulted the large losses. Income statement of the company was as follows:

<table>
<thead>
<tr>
<th></th>
<th>20x2</th>
<th>20x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$5,660,340</td>
<td>$1,393,500</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>4,568,421</td>
<td>1,165,274</td>
</tr>
<tr>
<td>Gross profit</td>
<td>1,291,919</td>
<td>228,253</td>
</tr>
<tr>
<td>Operating expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payroll and payroll taxes</td>
<td>945,672</td>
<td>654,783</td>
</tr>
<tr>
<td>Stock and option based compensation</td>
<td>485,622</td>
<td>125,367</td>
</tr>
<tr>
<td>Occupancy and office expenses</td>
<td>523,160</td>
<td>321,456</td>
</tr>
<tr>
<td>Contract services and professional fees</td>
<td>704,880</td>
<td>436,050</td>
</tr>
<tr>
<td>Internet servicing expenses</td>
<td>201,458</td>
<td>136,598</td>
</tr>
<tr>
<td>General and adm. expenses</td>
<td>687,482</td>
<td>359,657</td>
</tr>
<tr>
<td>Advertising and promotion</td>
<td>1,257,863</td>
<td>684,571</td>
</tr>
<tr>
<td>Depreciation and amortization</td>
<td>19,875</td>
<td>12,458</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>4,826,012</td>
<td>2,730,940</td>
</tr>
<tr>
<td>Net income or (Loss) from operation</td>
<td>$(3,534,093)</td>
<td>$(2,502,687)</td>
</tr>
</tbody>
</table>

Required
1. Assume you are a senior manager. What information would you like to see in addition to the income statement? Why?
2. For internal report purposes, the company has capitalized certain costs related to employee training and advertising. Management's view is that these costs have increased the value of an important asset — the brand name. Would this be allowed for external reporting purposes under the general accepted accounting principles? Explain your answer.
3. Is the information in the income statement adequate for management in decision making? Provide some examples of more detailed information that managers needed?
CHAPTER 2
MANAGEMENT ACCOUNTING
AND THE BUSINESS ENVIRONMENT

LEARNING OBJECTIVES
After studying this chapter, you should be able to:

1. Understand the expanding role of management accounting.
2. Be familiar with the major contemporary management techniques such as
   a. Just-in-Time
   b. Total Quality Management
   c. Process Reengineering
   d. Mass Customization
   e. Balanced Scorecard
   f. Activity-based Costing and Management
   g. Theory of Constraints
   h. Life Cycle Costing
   i. Target Costing
   j. Computer-aided Design and Manufacturing
   k. Automation
   l. E-commerce
3. Understand the changing world of the management accountant.
4. Identify the current focus of management accounting.
Expanding Role of Management Accounting

The business environment in recent years has been characterized by increasing competition and relentless drive for continuous improvement. As businesses turned global and product lines expanded, operations have become more complex, forward-looking companies saw a tremendous need for management oriented data that was separate from financial – oriented data.

Corporate executives are now using cost data to chart successful futures for their companies. Adapting management accounting system to better meet management’s needs for information is crucial to an organization’s survival when competing in global markets. Global competitors now have relatively free access to markets around the world. As a result, domestic markets on virtually every country face greater challenges from foreign competition. With increased reliance on global markets, companies need not only respond quickly to changing market conditions but also tailor products to different consumer taste and demands and this has to be done at a level that assures profit and give satisfactory returns to shareholders.

In today’s automated environment management accountants use the management control systems to support and reinforce manufacturing and other operating strategies. It is in this light that one learns to appreciate the role of a management accountant which is more of an influencing role rather than just an informing role.

The change in the business environment, especially during the past two decades, where organization have to transform themselves to become more competitive, have profound effect in the practice of management accounting. While many of the major improvement tools used by managers overlap, they can be classified into major programs or approaches also referred to as contemporary management techniques:
1. Just-In-Time (JIT)

Just-in-Time (JIT) is the philosophy that activities are undertaken only as needed or demanded. JIT is a production system also known as pull-it-through approach, in which materials are purchased and units are produced only as needed to meet actual customer demand. In a JIT system, inventories are reduced to the minimum and in some cases, zero.

JIT consists of four characteristics. The first is the elimination of all activities that do not add value to the product or service. The second one is the commitment to a high level of quality. The third characteristic is the commitment to continuous improvement in the efficiency of an activity. And the last characteristic is the emphasis on simplifications together with an increase in viability to identify activities that do not add value to product and service.

As the results, JIT must be able to generate the benefits to the organization. It can help improving working capital by recovery of fund that was tied up with inventories. JIT can also reduce the throughput time that can be resulted in greater potential production and quicker response to customers. It can also release the areas previously used to store inventory and make them available for other more productive uses. Besides, JIT can help reducing waste and increase customer satisfaction because of the reduction in defect rates.

2 Total Quality Management

To survive in an increasingly competitive environment, firms realize that they must produce high-quality products. As a result, an increasing number of companies have instituted total quality management programs to ensure that their products are of the highest quality and that production processes are efficient.

Total quality management (TQM) is a technique in which management develops policies and practices to ensure that the firm's products and service exceed customers' expectations.

Currently, there is no generally agreed upon “perfect” way to institute a TQM program. But most companies with TQM develop a company that stresses listening to the needs of customers, making products right the
first time, reducing defective products that must be reworked, and encouraging workers to continuously improve their production process. That is why some TQM programs are referred to as continuous quality improvement programs.

TQM affects product costing by reducing the need to track the cost of scrap and rework related to each job. If TQM is able to reduce these costs to a very low level, the benefit of tracking the costs is unlikely to exceed the cost to the accounting system.

Total Quality Management (TQM) is a formal effort to improve quality throughout an organization’s value chain. The two major characteristics of TQM are

(1) A focus on serving customers, and
(2) Systematic problem-solving using teams made up of front-line workers.

3. Process Reengineering

Reengineering is a process for creating competitive advantage in which a firm reorganizes its operating and management functions, often with the result that jobs are modified, combined, or eliminated. It has been defined as the “fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed.

Process reengineering, a more radical approach to improvement than TQM, is an approach where a business process is diagrammed in detail, questioned and then completely redesigned in order to eliminate unnecessary steps, to reduce opportunities for errors and to reduce costs. A business process is any series of steps that are followed in order to carry out some task in a business.

The main objective of this approach is the simplification and elimination of wasted effort and the central idea is that all activities that do not add value to product or service should be eliminated. In its most simplified version, the steps used in process reengineering are
Figure 2.1 Steps in process reengineering

Figure 2.1 presents the step used in process reengineering. It starts with the detailed diagram of an existing business process. Follow by analyzing and justifying every step in the business process. Finally, the redesign of the new process to include only those steps that make the product and service more valuable.

This process can yield the following anticipated results:

1. Process is simplified
2. Process is completed in less time
3. Costs are reduced, and
4. Opportunities for errors are reduced.

Process reengineering has one basic recurrent problem, that is employee resistance. As with other improvement projects, employees fear loss of jobs which may lead to lost morale and failure to improve the bottom line (i.e., profits). For the process to prosper and succeed, employees must be convinced that the end result of the improvement will be more secure, rather than less secure jobs. They can be made to understand that improving the processes, the company can generate more business, produce a better product at lower cost and will have the competitive strength to prosper.

1. Mass Customization

Many manufacturing and service firms increasingly find that customers expect products and services to be developed for each customer's
unique needs. And many firms have been successful with a strategy that targets customer’s unique needs.

Mass customization is a management technique in which marketing and production processes are designed to handle the increased variety that results from delivering customized products and services to customers.

The growth of mass customization is in effect another indication of the increased attention given to satisfying the customer.

2. Balanced Scorecard

The balanced scorecard is an accounting report that includes the firm’s critical success factors in four areas:

(a) Financial performance,
(b) Customer satisfaction
(c) Internal business process, and
(d) Innovation and learning.

The concept of balance captions the intent of broad coverage, financial and nonfinancial of all the factors that contribute to the success of the firm in achieving its strategic goals. The use of the balanced scorecard is thus a critical ingredient of the overall approach that firms take to become and remain competitive.

3. Activity-based Costing and Management

Activity analysis is used to develop a detailed description of the specific activities performed in the operation of the firm. Many firms have found that they can improve planning, product costing, operational control, and management control by using activity analysis to develop a detailed description of the specific activities performed in the firm’s operations. The activity analysis provides the basis for activity-based costing and activity-based management. Activity-based costing (ABC) is used to improve the accuracy of cost analysis by improving the tracing of costs to products or to individual customers. Activity-based management (ABM) uses activity analysis to improve operational control and management control. ABC and ABM are key
strategic tools for many firms, especially those with complex operations, or great diversity of products.

4. Theory of Constraints (TOC)

The Theory of Constraints is a sequential process of identifying and removing constraints in a system.

The Theory of Constraints emphasizes the importance of managing the organization's constraints or barriers that hinder or impede progress toward an objective. Since the constraint is whatever is holding back the organization, improvement efforts usually must be focused on the constraint to be really effective.

The basic sequential steps followed in applying TOC are

1. Analyze all the factors of production (materials, labor, facilities, methods, etc.) required in the production chain.
2. Identify the weakest link, which is the constraint.
3. Focus improvement efforts on strengthening the weakest link.
4. If improvement efforts are successful, eventually the weakest link will improve to the point where it is no longer the weakest link.
5. At this point, a new weakest link (new constraint) must be identified and improvement efforts must be shifted over that link.

5. Life Cycle Costing

Life-cycle costing is a management technique to identify and monitor the costs of a product throughout its lifecycle. It consists of all steps from product design and purchase of raw material to delivery of and service of the finished product. The steps include

(1) Research and development
(2) Product design, including prototyping, target costing and testing
(3) Manufacturing, inspecting, packaging and warehousing
(4) Marketing, promotion and distribution
(5) Sales and service

Cost management traditionally has focused only on costs incurred up to the third step manufacturing. Management accountants now strategically manage the product’s full life cycle of costs, including upstream and downstream costs as well as manufacturing costs.

6. Target Costing

Target costing involves the determination of the desired cost for a product or the basis of a given competitive price so that the product will earn a desired profit. The basic relationship that is observed in this approach is

\[
\text{Target cost} = \text{Market determined price} - \text{Desired profit}
\]

The entity using target costing must often adopt strict cost-reduction measures to meet the market price and remain profitable. This is a common strategic approach used by intensely competitive industries where even small price differences attract consumers to the lower-priced product.

7. Computer-Aided Design and Manufacturing

More companies are using computer-aided design (CAD) and computer-aided manufacturing (CAM) to respond to changing consumer tastes more quickly. These innovations allow companies to significantly reduce the time necessary to bring their products from the design process to the distribution stage.

Computer-aided design (CAD) is the use of computers in product development, analysis, and design modification to improve the quality and performance of the product. Computer-aided manufacturing (CAM) is the use of computers to plan, implement, and control production.

8. Automation

Automation involves and requires a relatively large investment in computers, computer programming, machines, and equipment. Many firms add automation gradually, one process at a time. To improve efficiency and effectiveness continuously, firms must integrate people
and equipment into the smoothly operating teams that have become a vital part of manufacturing strategy. Flexible manufacturing systems (FMS) and computer-integrated manufacturing (CIM) are two are two integration approaches.

A flexible manufacturing system (FMS) is a computerized network of automated equipment that produces one or more groups of parts or variations of product in a flexible manner. It users robots and computer-controlled materials-handling systems to link several stand-alone, computer-controlled machines in switching from one production run to another.

Computer-integrated manufacturing (CIM) is a manufacturing system that totally integrates all office and factory functions within a company via a computer-based information network to allow hour-by-hour manufacturing management.

The major characteristics of modern manufacturing companies that are adopting FMS and CIM are production of high-quality products and services, low inventories, high degrees of automation, quick cycle time, increased flexibility, and advanced information technology. These innovations shift the focus from large production volumes necessary to absorb fixed overhead to a new emphasis on marketing efforts, engineering and product design.

9. E-commerce

A number of internet-based companies have emerged and been proven successful in last decade. This E-commerce business model adopted by Amazon.com and eBay has also attracted many investors to pursue the use of Internet in conducting business. Established companies will undoubtedly continue to expand into cyberspace-both for business to business transactions and for retailing. The Internet has important advantages over more conventional marketplaces for some kinds of transaction such as mortgage banking. It is also very likely that a blockbuster business may be built around the concept of selling low value, low-margin and bulky items like groceries over the Internet.

When properly implemented, these approaches can (a) enhance quality, (b) reduce cost, (c) increase output, and (d) eliminate delays in
responding to customers. These techniques are introduced here and most are covered more fully in later Chapters.

The Changing World of the Management Accountant

Findings (Burns and Scapens, 2000) from the surveys and interviews with industry experts, consultants, specialists in information technology, major corporations and other professional organization conducted by the Institute of Management Accountants (IMA) to predict the major changes and skill required for professional management accountants revealed the following facts.

- More chief executive officers (CEO’s) and chief operating officers (COO’s) will have experience as management accountants.
- Management accountant will serve as internal consultants who create strategies and recommendations to guide management decisions.
- Management accountant will be key players in cross-functional teams (teams that span design, production, marketing, etc.)
- Management accountant will be actively involved in initiating and implementing new technology.
- Management accountant will need to adopt to an accelerating rate of change. This will involve lifelong learning.

Current Focus of Management Accounting

Impact on Organization Structure

A variety of works describing how to make organizations function better are contained in the business sections of bookstores. They speak in terms of benchmarking, empowerment, total quality management, reengineering, teaming, the virtual corporation, downsizing, just-in-time, corporate value and many more. Most of these prescriptions are not directed specifically at improving firm’s internal accounting system. However, if implemented, most of these organizational changes require significant changes in the accounting system because the accounting system is an integral part of most firm’s organizational structure.

The design of a management accounting system should be guided by the challengers facing managers. There are at least four themes common to many companies, namely:
(1) Customer focus theme,
(2) Value-chain and supply chain analysis,
(3) Key success factors (i.e., cost and efficiency, quality, time and innovation), and
(4) Continuous improvement and benchmarking.

FOCUS ON THE CUSTOMER

To succeed in this era, customer value is a key focus that businesses of all types must be concerned with.

The value of a product or service to the customer is affected by such diverse attributes as product price, quality, functionality, user-friendliness, customer service, warranty and maintenance costs. By managing activities that will increase customer value, the firms can establish a competitive advantage by creating better customer value for the same or lower cost than that of competitors. Cost information plays an important part in the process called strategic cost management. Generally, firms chose a strategic position corresponding to one of two general strategies:

(a) Cost leadership, and
(b) Superior product through differentiation.

A focus on customer value means that the management accounting system should produce information about both realization and sacrifice. The system should be able to measure various attributes of customer value.

Successful pursuit of cost leadership and/or differentiation strategic requires an understanding of a firm’s value chain (internal) and supply chain (external)

VALUE CHAIN AND SUPPLY CHAIN ANALYSIS

Value chain refers to the sequence of business functions in which usefulness is added to the products or services of a company. The term value refers to the increase in the usefulness of the product or service and as a result its value to the customer.
Internal value chain is the set of activities required to design, develop, produce, market and deliver products or services to customers. If customer values are emphasized, managers are forced to determine which activities in the value chain are important to customers. A management accounting system should track information about a wide variety of activities accounting system should track information about a wide variety of activities that span the internal value chain. Figure 2.2 shows the various business functions making up the value chain.

**Figure 2.2 Business Functions Making Up the Value Chain**

<table>
<thead>
<tr>
<th>Research and Development</th>
<th>Product Design</th>
<th>Manufacturing</th>
<th>Marketing</th>
<th>Distribution</th>
<th>Customer Service</th>
</tr>
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The costs assigned to a segment should include all costs attributable to that segment from the company's entire value chain. For financial reporting purposes, however, only manufacturing costs are included in product costs. Consequently, when trying to determine product only manufacturing costs from product revenues. As a result, such companies omit from their profitability analysis part or all of the “upstream” costs in the value chain, which consist of research and development and product design, and the “downstream” costs, which consist of marketing, distribution, and customer service. Yet these nonmanufacturing costs are just as essential in determining product profitability as are the manufacturing costs. These upstream and downstream costs, which are usually titled Selling, General, and administrative (SG & A) on the income statement, can represent half or more of the total costs of an organization. If either the upstream of downstream costs are omitted in profitability analysis, then the product is under-costed and management may unwittingly develop and maintain products that in the long run result in losses rather than profits for the company.
Industrial value chain is the linked set of value-creating activities from basic raw materials to the disposal of the final product by end-use customers.

illustrates a possible value chain for the fruit industry is shown on Figure 2.3

**Figure 2.3 Value Chain: Fruit Industry**
A given firm operating within the industry may not- and likely will not- span the entire value chain. The figure illustrates that different firms participate in different segments of the chain. Understanding the industrial value chain is critical to understanding a firm’s strategically important activities. Breaking down a firm’s value chain into its strategically important activities is basic to successful implementation of cost leadership and differentiation strategies. Fundamental to a value-chain framework is the recognition of existing complex linkages and interrelationships among activities both within and external to the firm. Thus, these are two types of linkages: internal and external. Internal linkages are relationships among activities that are performed within a firm’s portion of the industrial value chain (the internal value chain). External linkages are activity relationships between the firm and firm’s suppliers and customers. Thus, we can talk about supplier linkages and customer linkages. Using these linkages to bring about a win-win outcome for the firm, its suppliers, and its customers is the key to successful strategic cost management. The objective, of course, is to manage these linkages better than competitors, thus creating a competitive advantage.

KEY SUCCESS FACTORS

Cross – Functional Teams

In years past, managers tended to stick to their own turf. Production managers focused on how best to manufacture a product or produce a service. Marketing managers concentrated on selling the product or service. Design engineers often emphasized engineering elegance rather than designing a product for manufacturability. Managerial accounting provided information for decision making, planning, control and performance evaluation.

Today a cross-functional approach has replaced this narrow managerial perspective. A cross-functional managerial team brings together production and operations managers, marketing manager, Purchasing and material-handling specialists, design engineers, quality management personnel, and managerial accountants to focus their varied expertise and experience on virtually all management issues. If products are to be
designed and manufactured with the customers’ need in mind, a cross-functional approach is crucial. Marketing managers have the best feel for customer needs, and production managers are up on the latest in manufacturing technology. Design engineers know how to build the functionality into a product that customers demand, and purchasing managers can acquire the materials, parts, and services necessary to get the job done. Managerial accounting information is the glue that holds the cross-functional team together. The managerial accountant designs an information system and provides data ranging across all aspects of the organization’s internal operations and external environment. Then the managerial accountant works as an integral member of the cross-functional team, interpreting information and analyzing the implications of decision alternatives. Working together, the cross-functional team creates value for the organization by meeting the customer’s needs in the most effective manner possible.

Managing the value chain means that a management accountant must understand many functions of the business, from manufacturing to marketing to distribution to customer service. This need is magnified when the company is involved in international trade. We see this, for example, in the varying definitions of product cost. Activity-based management accounting has moved beyond the traditional manufacturing cost definition of product cost to more inclusive definitions. These contemporary approaches to product costing may include initial design and engineering costs, as well as manufacturing costs, and the costs of distribution, sales, and service. An individual well-schooled in the various definitions of product cost, who understands the shifting definitions of cost from the short-run to the long-run, can be invaluable in determining what information is relevant in decision making. For example, strategic decisions may require a product cost definition that assigns the costs of all value-chain activities, whereas a short-run decision that is concerned with whether a special order should be accepted or rejected may require a product cost that assigns only marginal or incremental costs. Information about the trade-offs between time and cost in all phases of a product’s development is particularly important.

Computer-Integrated Manufacturing

Manufacturing processes over a long period of time has evolved from labor intensive methods to more automated processes, in the work is
accomplished by machines. This trend continues today, as computer-integrated manufacturing (or CIM) systems become more common. A CIM process is fully automated, with computers controlling the entire production process. In CIM systems, the types of costs incurred by the manufacturer are quite different from those in traditional manufacturing environments. Using computers to control equipment, including robots, generally increases the flexibility and accuracy of the production process. However, the use of state-of-the-art equipment and computer control systems may help firms meet the challenge of global competition, but they also have a significant effect on the composition of product costs.

Recent studies indicate that, on average, product costs in recent years have consisted of 53 percent material, 15 percent direct labor, and 32 percent overhead. Some highly automated companies, however, report that direct labor accounts for as little as 3 percent of total production costs. Decreasing labor costs are causing many companies to reconsider their overhead allocation bases. Presently, the most commonly used allocation bases for assigning overhead to jobs are direct labor hours and direct labor cost. However, in highly mechanized companies where direct labor is a small part of total manufacturing costs, using labor as an allocation base is generally not appropriate.

Product Life Cycles and Diversity

One impact of highly automated manufacturing systems has been to enable manufacturers to produce an ever-more diverse set of products. Moreover, the rate at which technology is changing means that the life cycles of most products are becoming shorter. In the computer industry, for example, product models are used only a few years before they are replaced by more powerful versions. To be competitive manufacturers must keep up with the rapidly changing marketplace. Managers must have timely information about production costs and other product characteristics in order to respond quickly and effectively to the competition.

Time-based Competition

In a global competitive environment time has become a very significant element in many companies strategies for success. A companies can gain an important edge over its competitors by reducing the time it takes
to develop a new product and transporting the product in the market more quickly. Thus, the time to market becomes a critical objective for many companies.

Response time, lead time, on time and downtime are among the many time-based phrases that crop up in conversations of today’s managers. Reducing the time elapsed from the conceptualization of a new product to having the product in the retailers stores requires careful time management at each stage of a product’s development.

Delays between product development stages must be reduced if not totally eliminated. The production process must be efficient and product quality must be high.

**Global Competition**

An important development that drives the extensive changes in the contemporary business environment is the growth of international markets and trade. Business as well as consumers and regulators are all affected by the rapid growth of economic interdependence and increased competition from other countries. The growing number of alliances between large multinational firms makes it clear that the opportunities for growth and profitability lie in global markets.

Competition has become worldwide in many industries over the last several decades. This has been caused by

(a) Reductions in tariffs, quotas and other barriers to free trade

(b) Improvements in global transportation systems and information technology and

(c) Increasing sophistication in international markets.

These factors work together to reduce the costs of conducting international trade, and make it possible for foreign companies to operate and compete on a more equal footing with local firms. Local firms on the other hand cannot afford to be complacent and must become world-class competitors. And from the standpoint of consumers, heightened competition can result to an even greater variety of goods at higher quality and lower prices.
Chapter 2 Management Accounting and The Business Environment

How would increased global competition affect management accounting?

For a firm to become world-class, it should be able to plan, direct, control its operations, and make decisions using an effective management accounting system that provide the relevant data it needs. An excellent management accounting system will not by itself guarantee success, but a poor system can stymie the best efforts of people in an organization to make the firm truly competitive.

**Information and Communication Technology Management**

In the face of the increased global competition, firms around the world are adopting new manufacturing and information technologies to remain competitive. For example, just-in-time inventory methods are adopted to reduce the cost and waste of maintaining large levels of new materials and finished product. Also, methods that produce significant cost and quality improvements through the use of quality teams and statistical quality control are now being used by many firms around the world.

It has been reported in a research done in 2005 (Tanrivardi, 2005) by executives from 150 of the Fortune 1000 companies that the use of information technology is considered the major driver of globalization, allowing these firms to respond quickly to changing conditions around the world. Majority of the executives viewed information technology as a strategic investment because it enabled them to track financial and operating events in the firm, to improve service quality, to improve profits and to improve product quality.

**Cost Management System**

The term cost management is widely used today. No uniform definition however exists. Some entities would use cost management to describe the activities of managers in short-run and long-run planning and control of costs. For instance, managers make decisions regarding changes of plant processes and product design. Information from accounting systems helps managers make such rational decisions. But the systems and the information by themselves are not cost management.

Cost management has a broader focus. For example, to generate more revenues and profits, managers, will often deliberately incur additional costs for product improvement and advertising. Cost management is
often carried out as an important part of general management strategies and their implementation.

CONTINUOUS IMPROVEMENT AND BENCHMARKING

To stay competitive, companies must concentrate on continuously improving the different aspects of their own operations. One approach is the cross-functional approach as discussed in the earlier section. The continuous improvement targets are often set by benchmarking in measuring the quality of the products, services and activities of the company against the best levels of performance found in competing companies.

Continuous improvement is the constant effort to eliminate waste, reduce response time, simplify the design of both products and processes, and improve quality and customer service. Managerial accountants contribute to the continuous improvement programs of many organizations through the development of cost management systems which are discussed next.

Benchmarking is a process by which a firm identifies its critical success factors, studies the best practices of other firms (or other units within a firm) for these critical factors and then implement improvements in the firm’s process to match or beat the performance of those competitors.

Benchmarking efforts are facilitated today by cooperative networks of noncompeting firms that exchange benchmarking information. For example, the Institute of Management Accountants (IMA) has a Continuous Improvement Center to help organization benchmark and thereby improve their financial processes.

Reference:


Hüseyin Tanrivardi, Information Technology Relatedness, Knowledge Management Capability, and Performance of Multi-business Firm, Management Information Research Center, University of Minnesota © copyright 2005
SHORT QUESTIONS

1. Present several examples of managerial accounting information that could help a manager make each of the following decisions:
   a. A manufacturing company is currently making a part that is a production headache. The firm is deciding whether to abandon production and buy the part from an outside supplier.
   b. An operator of fast-food restaurants is deciding whether to open a new store in Dallas.

2. Borders Overnight operates an overnight package delivery service that competes with Federal Express and United Parcel Service (UPS). Top management is considering the use of a balanced scorecard to evaluate operations.
   a. What is a balanced scorecard and other than customer-satisfaction measures, what are its typical key components?
   b. List four customer-satisfaction measures that Borders might use to evaluate performance.

3. Briefly distinguish between managerial accounting and financial accounting. Be sure to comment on the general focus, users, and regulation related to the two fields.

4. Cross-functional teams and time-based competition are two themes of contemporary management accounting. Briefly explain these two concepts.

5. Unused or excess capacity is a key component of contemporary management accounting. Define the term "excess capacity" and explain how it would relate to a coffee shop.

EXERCISES

Problem 1
Consider the descriptors that follow.
1. Is heavily involved with the recordkeeping and reporting of assets, liabilities, and stockholders' equity.
2. Focuses on planning, decision making, directing, and control.
3. Is heavily regulated.
4. A field that is becoming more "cross-functional" in nature.
5. Much of the field is based on costs and benefits.
6. Is involved almost exclusively with past transactions and events.
7. Much of the information provided is directed toward stockholders, financial analysts, creditors, and other external parties.
8. Tends to focus more on subunits within an entity rather than the organization as a whole.
9. May become involved with measures of customer satisfaction, and the amount of actual cost incurred vs. budgeted targets.

Required:
Determine whether the descriptors are most closely associated with financial accounting or managerial accounting.

Problem 2
DreamWorks Pictures produces both motion pictures for theaters as well as a variety of television series. Consider the seven activities that follow.

1. Auditions for actors and actresses
2. Development of promotional materials for use by local newspapers
3. Focus groups to evaluate ideas for potential television comedy series
4. Production of DVDs for release to Best Buy and Blockbuster Video
5. On-location shooting of scenes
6. Fine-tuning and rewrites of scripts
7. Set design and construction for a new medical drama

Required:
1. Evaluate the seven activities as upstream (pre-production), production, or downstream (post-production) in nature.
2. Generally speaking, which activities (upstream, production, or downstream), if any, can management ignore if the company is to be successful in achieving its key strategic goals?
Problem 3
Tae Franklin is the sales manager of Darius Enterprises, a very profitable distributor of office furniture to local businesses. A recent economic downturn has created an extremely tight cash position, and the company has been hurt by the bankruptcy of two key customers.
In late October, anticipating an economic recovery, Franklin began an extensive remodeling of the company’s sales floor. Construction costs, decorating, and equipment purchases are projected to cost $250,000. Darius has a policy that individual expenditures in excess of $200,000 must be approved by the firm’s board of directors. Franklin, unfortunately, missed the deadline to have the board consider this project at its regular September meeting. Not wanting to wait until the next meeting in December, he subdivided the project in two parts—construction and decorating ($190,000) and equipment purchases ($60,000)—neither of which needed board approval because of the dollar amounts involved. The project was recently completed and sales have begun to recover. Customers have raved about the new sales area, noting that it is far superior to those of Darius’s competitors.

Required:
1. Would Franklin’s approach of subdividing the project in two parts have any effect on the company’s financial statements? Briefly explain.
2. Briefly discuss whether Franklin behaved in an ethical manner.
3. Which, if any, of the following standards of conduct would have applicability to Franklin’s conduct: competence, confidentiality, integrity, or credibility? Briefly explain.

Problem 4
Many professions have adopted a series of ethical standards to provide guidance for their memberships. The Institute of Management Accountants (IMA), for example, has published standards that focus on competence, confidentiality, integrity, and credibility. In light of these standards, consider the three cases that follow.
**Case A:** Leston Corporation has experienced serious financial difficulties in recent years. John Young, the company's chief financial officer, has just learned that a major competitor was likely to file for bankruptcy; however, he failed to disclose this information at a board meeting held later that day when a plant closure decision was being discussed. The board evaluated several proposals during the session that focused on improving Leston's financial position.

**Case B:** QBX Company manufactures fertilizer from various raw materials, including a raw material known as Felstar. Paul Kelly, the firm's purchasing manager, purposely acquired a lower grade of Felstar than normal because of a very attractive price. The lower-grade product resulted in increased usage during the manufacturing process but had no effect on the fertilizer's overall quality. An end-of-period report showed that QBX profited from Kelly's actions, with the overall savings in purchase price more than offsetting the cost of added consumption.

**Case C:** Central Distributing has a participative budgeting process, allowing employees to have a say in projected sales targets for the upcoming period. These targets are reflected in a series of performance reports that compare actual sales achieved against targeted amounts. Hillary Baxter submitted very low sales targets because, as she confided in a colleague, "I always want to look good in terms of meeting targets, even if anticipated sales and closures don't materialize."

**Required:**
Evaluate the three cases and determine the ethical issues, if any, that are involved.

**Problem 5**
Million Dollar Mills is a textile manufacturing firm located in the southern United States. The company carefully prepares all financial statements in accordance with GAAP, and gives a copy of all financial statements to each department. In addition, the company keeps records on quality control, safety, and environmental pollution by the company. It then prepares "scorecards" for each department indicating their performance. Recently, the financial impact of the second set of information was added,
Chapter 2 Management Accounting and The Business Environment

and the information has been used in the evaluation of employees for merit pay and promotions.

At the most recent employee meeting, Tyler Hanes, marketing manager, expressed his discomfort with the system. He said there was no guarantee that the second set of information was fair, since there were no generally accepted principles for this kind of information. He also said that it was kind of like keeping two sets of books—one following all legal requirements, and the other one actually used by the company.

**Required:**
1. Is it ethical to evaluate managers in the way described? Explain briefly.
2. Name at least two safeguards the company could build into its system to ensure the ethical treatment of employees.
CHAPTER 3
COST CONCEPTS AND CLASSIFICATIONS

LEARNING OBJECTIVES

After study this chapter, you should be able to

1. Explain the nature of cost, cost pools, cost objective and cost drivers.

2. Identity and explain the various classifications of costs.
   a. Costs classified by Nature
   b. Costs classified according to the Timing of Recognition as Expense
   c. Costs classification on Financial Statements
   d. Cost classification for Predicting Cost Behavior
   e. Costs classified by Types of Inventory
   f. Costs classified according to Traceability to Cost Objective
   g. Costs classification according to Managerial Influence
   h. Cost Terminologies Used for Planning and Control
   i. Cost classification according to a Time-frame Perspective
   j. Costs classified according to Time Period for Which the Cost is Incurred
   k. Costs classifications for Decision-making and other Analytical Purposes
CHAPTER 3
COST CONCEPTS AND CLASSIFICATIONS

Chapter 1 indicated that managerial accounting deals with the information managers need for making decisions and for planning and performance evaluation. From an accounting point of view, this information often relates to the costs of the organization.

Nature of Cost, Cost Pools, Cost Objects and Cost Drivers

At the most basic level, a cost may be defined as the value foregone or sacrifice of resources for the purpose of achieving some economic benefit which will promote the profit-making ability of the firm. It is also an outlay or expenditure of money to acquire goods and services that assist in performing operations.

In managerial accounting, the term cost may be used in different ways because there are many types of costs that may be classified differently according to the immediate needs of management. For instance, external financial reports require the use of historical cost data whereas decision making may require current or future cost data.

Accounting costs are classified in numerous ways. To prepare financial statements, accountants must associate costs with specific time periods. The classification of costs into product and period cost allows accountant to do that. Costs are classified differently depending on the type of organization involved that is merchandising, service, or manufacturing.

Cost data that are classified and recorded in a particular way for one purpose may be inappropriate for another use.

Cost pools are costs collected into meaningful groups. Cost pools may be classified by

1. type of cost (Labor cost in one pool, materials costs in another)
2. source (production department, marketing department and so on)
3. responsibility (production manager, marketing manager and so on)
4. and many more
Chapter 3 Cost Concepts and Classifications

A cost object is any product, service or organizational unit to which costs are assigned for some management purpose. Products and services are generally cost objects, while manufacturing departments are considered either cost pools or cost objects, depending on whether management’s main focus is on the costs of the products of for the production department. Any item to where costs can be traced and that has a key role in management strategy can be considered a cost object.

**Cost assignment** is the process of assigning costs to/from cost pools to cost objects. **Cost allocation** is the assignment of indirect costs to cost pools. Allocation bases are **cost drivers** used to allocate costs.

A critical first step for achieving a competitive advantage is to identify the key cost drivers in a firm or organization. A cost driver is any factor that has the effect of changing the level of total cost. The management of the key cost drivers is essential for a firm that competes on the basis of cost leadership. For example: to achieve its low-cost leadership in manufacturing products. Manufacturing firm watches carefully the design and manufacturing factors that drive the costs in its products. For firms that are not cost leaders, the management of cost drivers may not be as critical but focusing attention to the key cost drivers contributes directly to the success of the firm. For example: an important cost driver for retailers is loss and damage to merchandise so most retailers have careful procedures for handling, displaying and storing merchandise.

**Cost Classification**

Cost classifications are necessary for the development of cost information to serve the needs of management. Understanding these concepts and classifications enables the managerial accountant to provide appropriate cost data to the managers who need it. Basic cost classification and terminologies are presented in Figure 3.1
Costs classified by Nature

**Manufacturing Costs**

Manufacturing costs are all the costs associated with production of goods. They are frequently classified as direct materials, direct labor, and factory overhead. Since costs attach to the product or groups of products as they are manufactured, expenditures of their natures, usually are capitalized as inventory assets and do not become "expired costs" or "expenses" until the goods are sold.
Direct Materials

All raw material costs that become an integral part of the finished product and that can be conveniently and economically assigned to specific units manufactured.

Materials cost includes the invoice price plus other costs paid to the vendor, shipping costs, sales taxes, duty, cost of delivery containers and pallets (Less net of return refunds), and royalty payment based on direct materials quantities. Trade discounts and cash discounts (if they exceed reasonable interest rates) should reduce materials costs.

Materials cost should also include scrap, waste, and normally anticipated defective units that occur in the ordinary course of the production process. Unanticipated quantities of scrap, shrinkage, waste, or defective units should be included in manufacturing overhead or expensed in the period incurred. Also, routine quality assurance samples that are destroyed as part of testing should be classified as materials. However, nonroutine quality assurance samples are taken due to manufacturing problems and cost of marketing samples should not be added to materials costs.

Direct Labor

All labor costs related to time spent on product that can be conveniently and economically assigned to specific units manufactured.

Estimates of direct labor quantities and unit prices may be sufficiently accurate to be considered "specifically identified" with a cost object.

Manufacturing Overhead

Manufacturing overhead, the third element of manufacturing cost, includes all costs of manufacturing except direct materials and direct labor. Indirect materials, indirect labor, property taxes, insurance, supervisor's salaries, depreciation of factory building and factory equipment, and power are examples of factory overhead. Costs of operating service departments are also part of overhead. Service departments are those that do not work directly on manufacturing products but are necessary for the manufacturing process to occur. An example is equipment-maintenance departments.
Indirect materials: include materials and supplies used in the manufacturing operation that do not become part of the product, such as oil for the machinery and cleaning fluids for the custodian.

Indirect labor: Labor costs that cannot be identified or traced to specific units manufactured. Examples include supervision, inspection, maintenance, personnel and material handling.

Other Manufacturing Overhead: includes all manufacturing costs consumed in manufacturing finished product, but not be counted as material and labor costs of both direct and indirect costs.

To summarize, manufacturing costs include direct materials, direct labor and manufacturing overhead. Direct labor and overhead are often called conversion costs since they are the costs of “converting or transforming” raw material into finished products. Direct materials and direct labor are often referred to as prime costs.

Other manufacturing overhead costs include overtime premiums and the cost of idle time. An overtime premium is the extra compensation paid to an employee who works beyond the time normally scheduled.

**Nonmanufacturing Costs**

Nonmanufacturing costs generally include costs related to selling and other activities not related to the production of goods. Two major nonmanufacturing costs are marketing costs and general and administrative costs (operating costs).

Marketing or selling costs include all costs associated with marketing or selling a product or all costs incurred by the marketing division from the time the manufacturing process is completed until the product is delivered to the customer or all costs necessary to secure customer orders and get the finished product or service into to hands of the customer. These costs also called order-getting and order-filing costs. Examples of marketing costs are advertising, shipping, sales commissions and storage costs.

General administrative costs include all executive, organizational and clerical costs associated with the general management of the organization rather than with manufacturing, marketing or selling.
Production Costs in Service Industry Firms and Nonprofit Organizations

Service industry firms such as schools, hotels, banks, airlines, accounting firms, and automotive repair shops and many nonprofit organizations are also engaged in production. What distinguishes these enterprises from manufacturers is that a service is consumed as it is produced, whereas a manufactured product can be stored in inventory while less commonly applied in service firms, the same cost classifications used in manufacturing companies can be applied. For example, and automotive repair shop produces repair services. Direct materials include such costs as new parts installed to replace the worn out parts, paint and other materials used. Direct labor includes the wages paid to the service crew. Overhead costs include depreciation of equipment and other tools used and rental expense.

Recording and classifying costs is important not only for manufacturing firms but for service industry firms and nonprofit organizations as well. Cost analysis is necessary in pricing, banking and insurance services, hotel and travel rental agencies, setting tuition fees in schools and many more. As these organizations grow in number and in scope of business operations, applying managerial accounting to their activities take an even greater importance.

Costs classified according to the Timing of Recognition as Expense. An expense is defined as the cost incurred when an asset is used up or sold for the purpose of generating revenue. The terms product cost and period cost are used to describe the timing with which various expenses are recognized.

Product Costs

Product costs include all the costs that are involved in acquiring or making a product. Also called inventoriable costs, they are costs that "attach" or cling to the units that are produced and are reports as assets until the goods are sold. In the case of manufactured goods, these costs consist of direct materials, direct labor, and manufacturing overhead. So initially, product costs are assigned to an inventory account on the balance sheet. When the goods are sold, the costs are released from inventory as expense
(typically called cost of goods sold) and matched against sales revenue. This means that a product cost such as direct materials or direct labor might be incurred during one period but not treated as an expense until a following period when the completed product is sold.

**Period Costs**

Period costs are all the costs that are identified with accounting periods and not included in product costs. These costs are expensed on the income statement in the period in which they are incurred. Period costs are not included as part of the cost of either purchased or manufactured goods. Examples of period costs include selling and administrative expense such as sales commissions, office rent, and transportation expenses.

**Costs classification on Financial Statements**

The financial statements prepared by a manufacturing company are more complex than the statements prepared by a merchandising company. Manufacturing companies are more complex business firms than merchandising companies because the manufacturing company must produce its goods as well as market them. The production process gives rise to many costs that do not exist in merchandising company. The manufacturing company’s product costs include not only the cost of purchasing but also the cost of converting materials into saleable products. These product costs are counted as assets until the product is sold and the revenue from the sales is recorded on the income statement.

**The Statement of Financial position or Balance sheet**

The balance sheet or statement of financial position of a manufacturing company is similar to that of a merchandising company. However, the inventory accounts differ between the two types of companies. A merchandising company has only one class of inventory called merchandise inventory. These are goods purchased from suppliers that are awaiting resale to customers. In contrast, manufacturing companies have three classes of inventories, namely, raw materials, work in process and finished goods.
Raw materials are materials that are used to make a product. Work in process consists of units of product that are only partially complete and will require further work before they are ready for sale to a customer. Finished goods consist of units of product that have been completed but have not yet been sold to customers.

The overall inventory figure is usually broken down into these three classes of inventory in footnote to the financial statements.

The Income Statement

At first glance, the income statement of merchandising and manufacturing firms are very similar. The only apparent difference is in the captions of some of the entries in the computation of cost of goods sold.

The cost of goods sold for a merchandising company is determined as follows:

- Beginning merchandise inventory $xx
- Add: Purchases xx
- Total available for sale xx
- Less: Ending merchandise inventory xx
- Cost of goods sold $xx

The cost of goods sold for a manufacturing company is determined as follows:

- Beginning finished goods inventory $xx
- Add: Cost of goods manufactured xx
- Total available for sale xx
- Less: Ending finished goods inventory xx
- Cost of goods sold $xx

The cost of goods manufactured contains the three elements of product costs namely direct materials, direct and manufacturing overhead (Figure 3.2)

Illustrative Statement of a Merchandising Company

Figure 3.2 shows the income statement and current assets section of the balance sheet statement of a Merchandising Company.
Figure 3.2 Income Statement and current assets for merchandising firm

ABC Trading Company
Income Statement
For the Year Ended December 31, 20XX

Sales $1,000,000

Cost of goods sold:
  Merchandise inventory Jan 1 100,000
  Add purchases 650,000
  Goods available for sale 750,000
  Less Merchandise inventory Dec 31 150,000
  Gross margin 600,000

Less operating expenses:
  Selling expense 100,000
  Administrative expense 200,000
  Net income $ 100,000

ABC Trading Company
Current Assets Section of the Balance Sheet
December 31, 20XX

Current Assets:
  Cash $ 10,000
  Accounts receivable 60,000
  Merchandise inventory 150,000
  Prepaid expenses 5,000
  Total current assets $ 225,000

Illustrative Statement of a Manufacturing Company

Figure 3.3 shows the income statement and current assets section of the balance sheet statement of a Manufacturing Company.
Figure 3.3 Income Statement, Statement of cost of goods manufactured, and current assets for manufacturing firms

XYZ Company
Income Statement
For the Year Ended December 31, 20XX

Sales $1,500,000
Cost of goods sold:
  Finished goods inventory Jan 1 125,000
  Add cost of goods manufactured 850,000
  Goods available for sale 975,000
  Less Finished goods inventory Dec 31 175,000 800,000
Gross margin 700,000
Less operation expense:
  Selling expense 250,000
  Administrative expense 300,000 550,000
Net income $ 150,000

XYZ Company
Statement of Cost of Goods Manufactured
For the Year Ended December 31, 20XX

Direct materials
  Direct materials inventory, Jan 1 $ 30,000
  Purchases of direct materials 210,000
  Total direct materials available 240,000
  Direct materials inventory, Dec 31 15,000
Direct materials used $ 225,000
Direct labor 250,000
Manufacturing overhead
  Indirect materials $ 35,000
  Factory utilities 70,000
  Factory supervision 70,000
  Property taxes on factory equipment 20,000
  Factory maintenance and repairs 20,000
  Depreciation of plant and equipment 90,000
Total manufacturing overhead 305,000
Total manufacturing costs 780,000
Work in process inventory, Jan 1 130,000
Total 910,000
Work in process inventory, Dec 31 60,000
Cost of goods manufactured $ 850,000
**XYZ Company**  
**Current Assets Section of the Balance Sheet**  
**December 31, 20XX**

**Current Assets:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$15,000</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>100,000</td>
</tr>
<tr>
<td>Inventories:</td>
<td></td>
</tr>
<tr>
<td>Raw materials</td>
<td>15,000</td>
</tr>
<tr>
<td>Work in process</td>
<td>60,000</td>
</tr>
<tr>
<td>Finished goods</td>
<td>175,000</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Total current assets</strong></td>
<td><strong>$375,000</strong></td>
</tr>
</tbody>
</table>

**Illustrative Statement of a Service Company**

Figure 3.4 shows the income statement and the current assets section of the balance sheet of a service company.

**Figure 3.4: Income Statement for servicing firm**

**EFG Consulting Company**

**Income Statement**

For the Year Ended December 31, 20XX

**Revenues**

- Fees for professional service $500,000

**Less:** Direct costs

- Employees compensation & fringe benefits $245,000

**Contribution to Indirect Cost** $255,000

**Less:** Indirect costs

- Rent of office facilities $30,000
- Training and research $20,000
- Personnel recruiting $10,000
- Professional insurance and Litigation $6,000
- Others $25,000

**Total** $91,000

**Operating income** $164,000
EFG Consulting Company
Current Asset Section of the Balance Sheet
December 31, 20XX

Current Assets:
Cash $ 25,000
Accounts receivable 63,000
Unbilled services, at estimated billable rate 50,000
Prepaid expenses 14,000
Total current assets $ 152,000

Cost classification for Predicting Cost Behavior

Cost behavior refers to how a cost will react or respond to changes in the business activity. As the activity level rises and falls, a particular cost may rises and falls as well – or it may remain constant. For planning purposes, a manager must be able to anticipate which of these will happen; and if a cost is expected to change, the manager must know by how much it will change. To help make such distinction, costs are often categorized as variable, fixed or semi-variable.

Variable Costs are the costs that change directly in proportion to changes in activity (volume). Direct labor and direct materials are examples of variable costs. Fixed Costs are the costs that remain unchanged for a given time period regardless of change in activity (Volume). Rent, insurance on property, maintenance, and repairs of buildings, and depreciation of factory equipment are examples of fixed costs. Semivariavle Costs are the costs that contain both fixed and variable elements. Examples of semivariable costs are social security taxes, materials handling, personnel services, heat, light, and power. These cost elements must be divided into their proper elements. Semivariable cost is considered as a part of Mixed Costs behavior. It consists of semi variable and semi fixed cost. They will be discussed in the further chapter.

Costs classified by Types of Inventory

Merchandising firms has only one types of cost, the merchandise inventories, while manufacturing firms are difference. Merchandise inventory is the inventory available for sales the customer that were purchased from the suppliers. In the case of manufacturing industries,
classification of costs by the types of inventory can be classified as raw materials, work-in-process, and finished goods inventories.

**Raw Materials** Inventory is the cost of all raw material and production supplies that have been purchased but not used at the end of the period. **Work-in-process** Inventory the cost associated with goods partially completed at the end of the period. **Finished Goods** Inventory is the cost of completed goods that have not been sold at the end of the period.

**Costs classification according to Traceability to Cost Objective**

Classification of costs according to their traceability can be classified into two types, direct and indirect costs. **Direct costs** (traceable, separable) are costs that can be economically traced to a single cost object (i.e. product, department or unit). **Indirect costs** are the costs that are not directly traceable to the cost object (i.e. product, department, etc.). In related to manufacturing costs, material costs can also be classified as direct materials and indirect materials. Labor costs can also be classified as direct labor and indirect labor costs. The cost object for the classification of material and labor to direct and indirect costs are the traceability to the finished product produced.

**Costs classification according to Managerial Influence**

Management influence can be expressed in term of controllable or noncontrollable. Therefore, the classification of costs based on the managerial influence can be classified into controllable and noncontrollable costs. **Controllable cost** is the cost that subject to significant influence by a particular manager within the time period under consideration. **Noncontrollable cost** is the cost over which a given manager does not have any significant influence.

**Costs Terminologies Used for Planning and Control**

Two major functions of management are to plan and control. Costs relate to planning are standard costs and budgeted costs. **Standard costs** are a predetermined cost estimate that should be attained; usually expressed in terms of costs per unit. **Budgeted Costs** used to represent the expected/planned cost for a given period. For example, a company plans
to manufacture 1,000 units of product X, which has standard cost per unit of $4, would have budgeted cost for the period of $4,000 for product X.

Costs related to control function of management are absorption costing and direct costing. **Absorption Costing** is a costing method that includes all manufacturing costs – direct materials, direct labor, and both variable and fixed manufacturing overhead – in the cost of a unit of product. It is also referred to as the full cost method. **Direct Costing** is type of product costing where fixed costs are charged against revenue as incurred and are not assigned to specific units of product manufactured. This also referred to as variable costing.

For the purpose of managerial control, some types of costs are also related. They are information cost (the costs of obtaining information for decision making) and ordering cost (costs that must be met with a current expenditure or cash outlay).

**Costs classification according to a Time-frame Perspective**

According to a Time-frame perspective costs can be classified into committed and discretionary cost. **Committed cost** is the cost that is inevitable consequence of a previous commitment. **Discretionary cost**, or programmed or managed costs, are costs for which the size or the time of incurrence is a matter of choice.

**Costs classified according to Time Period for Which the Cost is incurred**

To complete the tasks, management needs adequate information in making any decision. Since decision involves the future actions, then the information must be the future information. Future information related to **future costs**. They are budgeted costs that are expected to be incurred in a future period. In the case that future costs are not adequate in making the decision, the modification of the historical data or historical costs can also be used to aid management decision making. As the term denotes itself, **historical costs** (or past costs) are the costs that were incurred in a past period.
Chapter 3 Cost Concepts and Classifications

**Costs classifications for Decision making and other Analytical Purposes**

Some costs term are also be used in managerial accounting and be classified by the decision making and analytical purposes. They are:

<table>
<thead>
<tr>
<th>Relevant Costs</th>
<th>Future costs that are different under one decision alternative than under another decision alternative.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Costs</td>
<td>The difference in cost between two or more alternatives. In evaluating a given alternative, incremental cost is the additional revenue to determine the feasibility of this particular alternative. To be an incremental cost, the cost must be a future cost and be different under various alternatives.</td>
</tr>
<tr>
<td>Sunk Costs</td>
<td>Past costs that have been incurred and are irrelevant to a future decision.</td>
</tr>
<tr>
<td>Opportunity Costs</td>
<td>The value of the best alternative foregone as the result of selecting a different use of resource or by choosing a particular strategy</td>
</tr>
<tr>
<td>Marginal Costs</td>
<td>Costs associated with the next unit or the next project or incremental cost associated with an additional project as opposed to the next discrete unit.</td>
</tr>
<tr>
<td>Value Added Costs</td>
<td>Costs that add value to the product. These costs result from activities that are necessary to satisfy the requirements of the consumer. Effort should be made to eliminate those costs that do not add value to the product, such as storage and materials handling</td>
</tr>
</tbody>
</table>

**Illustration Problem on Cost Classifications**

Cabrera is the production manager of a ready-to-wear manufacturing. A decision needs to be made about the type of
clothing material or fabric to need to make a shirt. The fabric that has been used in the previous production cost $40 per yard but it is not available currently. Similar material from another supplier will cost $50 per yard.

The cost of the fabric can be classified as follows:

1. **Time period**

   $40.00 - historical cost

   $50.00 - future cost

2. **Management function**

   The cost of the fabric is a manufacturing cost.

3. **Accounting treatment**

   Whatever is paid for the fabric will be capitalized as a product cost and carried in inventory until it is sold.

4. **Traceability to product**

   The fabric is a direct cost because it represents a significant portion of the cost of the product and can be traced to a specific unit of finished product.

5. **Cost behavior**

   Both the $40.00 and $50.00 cost per yard are variable costs. As the number of yards purchased increases, the total fabric cost increases proportionately.

6. **Decision significance**

   The $50.00 cost is relevant because it can be compared with the price of other fabrics of similar quality to select the best alternative. The $40.00 cost is irrelevant.
Chapter 3 Cost Concepts and Classifications

7. Managerial influence

The cost of the fabric to be acquired is a controllable cost since Ms. Cabrera has the authority to make production decisions.

8. Others

The fabric is an out-of-pocket cost associated until producer additional skirts which will involve cash outlay in its acquisition.
SHORT QUESTIONS

1. Financial and managerial accounting are both concerned with the economic events of an enterprise. Similarities between financial and managerial accounting do exist, but they do have a different focus. Briefly distinguish between financial and managerial accounting as they relate to (1) the primary users, (2) the type and frequency of reports, (3) the purpose of reports, and (4) the content of reports.

2. You are studying for her accounting mid-term examination. Summarize what you should know about management functions.

3. A manufacturing company makes the products that it sells. Briefly identify and define the cost elements that are incurred in making a product. After product cost elements are identified, how is the cost of goods manufactured for a period determined?

4. Identify the difference between product costs and period costs.

5. What is non-manufacturing costs? What is the difference between non-manufacturing costs and costs for service industry (or the non-manufacturing firms).

6. Identify the cost items if they are classified by their behaviors. What is the differences of costs if they are classified by their behavior and by the time frame?

7. Do you think the inventory cost will be difference if they are classified by difference context (i.e. by time frame or purpose of cost identification)? Why or why not?

8. Explain the costs that are classified for the purpose of planning and controlling.

EXERCISES

Problem 1:
Financial accounting information and managerial accounting information have a number of distinguishing characteristics. For each of the characteristics listed below, indicate which characteristics are more closely related to financial accounting by placing the letter "F" in the space to the left of the item and indicate those characteristics which are more closely associated with managerial accounting by placing the letter "M" to the left of the item.
Chapter 3 Cost Concepts and Classifications

1. General-purpose reports
2. Reports are used internally
3. Prepared in accordance with generally accepted accounting principles
4. Special purpose reports
5. Limited to historical cost data
6. Reporting standard is relevance to the decision to be made
7. Financial statements
8. Reports generally pertain to the business as a whole
9. Reports generally pertain to subunits
10. Reports issued quarterly or annually

Problem 2:
Identify whether each of the following is classified as a product cost or a period cost.

1. Direct labor
2. Direct materials
3. Factory utilities
4. Repairs to office equipment
5. Property taxes on factory building
6. Sales salaries

Problem 3:
Presented below is a list of costs and expenses incurred in the factory by Nu-Way Corporation, a manufacturer of recreational vehicles.

1. Property taxes on the factory land
2. Nails and glue used in production
3. Cabinet maker’s wages
4. Factory supervisors’ salaries
5. Metal used in manufacturing
6. Depreciation on factory machines
7. Factory utilities
8. Carpentry for the recreational vehicles
9. Property taxes on the factory building
10. Insurance on factory equipment
Chapter 3 Cost Concepts and Classifications

Required
Classify the above items into the following categories:

- DM — Direct Materials
- DL — Direct Labor
- MO — Manufacturing Overhead

Problem 4:
Kennedy Company reports the following costs and expenses in May.

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory utilities</td>
<td>$13,500</td>
</tr>
<tr>
<td>Sales salaries</td>
<td>$48,400</td>
</tr>
<tr>
<td>Depreciation on equipment</td>
<td>$12,650</td>
</tr>
<tr>
<td>Property taxes on factory Building</td>
<td>$2,500</td>
</tr>
<tr>
<td>Indirect factory labor</td>
<td>$48,900</td>
</tr>
<tr>
<td>Repairs to office equipment</td>
<td>$1,300</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>$70,800</td>
</tr>
<tr>
<td>Factory repairs</td>
<td>$2,000</td>
</tr>
<tr>
<td>Direct materials used</td>
<td>$157,600</td>
</tr>
<tr>
<td>Advertising</td>
<td>$23,000</td>
</tr>
<tr>
<td>Factory manager's salary</td>
<td>$8,000</td>
</tr>
<tr>
<td>Office supplies used</td>
<td>$2,640</td>
</tr>
</tbody>
</table>

Required
From the information, determine the total amount of:

- (a) Manufacturing overhead.
- (b) Product costs.
- (c) Period costs.

Problem 5:
Kwik Delivery Service reports the following costs and expenses in June 20x1

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect materials</td>
<td>$8,400</td>
</tr>
<tr>
<td>Driver’s salary</td>
<td>$14,000</td>
</tr>
<tr>
<td>Depreciation on delivery</td>
<td>$5,100</td>
</tr>
<tr>
<td>Advertising</td>
<td>$300</td>
</tr>
<tr>
<td>Equipment</td>
<td>$870</td>
</tr>
<tr>
<td>Delivery equipment</td>
<td>$650</td>
</tr>
<tr>
<td>Dispatcher’s salary</td>
<td>$300</td>
</tr>
<tr>
<td>Repair</td>
<td>$1,490</td>
</tr>
<tr>
<td>Property taxes on Office</td>
<td>$180</td>
</tr>
<tr>
<td>Building</td>
<td>$180</td>
</tr>
<tr>
<td>Office Supplies</td>
<td>$1,490</td>
</tr>
<tr>
<td>CEO’s salary</td>
<td>$180</td>
</tr>
<tr>
<td>Repair on Office</td>
<td>$180</td>
</tr>
<tr>
<td>Gas and oil for delivery</td>
<td>$180</td>
</tr>
<tr>
<td>trucks</td>
<td>$180</td>
</tr>
</tbody>
</table>
Chapter 3 Cost Concepts and Classifications

Required
Determine the total amount of (a) delivery service (product) costs and (b) period costs.

Problem 6:
Yates Manufacturing Company incurs the following manufacturing costs and expenses during the month of May.
1. Assembly line wages
2. Raw materials used directly in product
3. Depreciation on office equipment
4. Property taxes on factory building
5. Rent on factory building
6. Sales commissions
7. Depreciation on factory equipment
8. Factory utilities
9. Wages for factory maintenance workers
10. Advertising
11. Indirect materials used in production
12. Factory manager’s salary

Required
Complete the following matrix by placing an X mark under the appropriate headings.

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Direct Materials</th>
<th>Direct Labor</th>
<th>Manufacturing Overhead</th>
<th>Period Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td>11</td>
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<tr>
<td>12</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Problem 7:

Peters Manufacturing Company has the following data at June 30, 20x1:

- Raw materials inventory, June 1: $13,800
- Work in process inventory, June 1: 18,100
- Finished goods inventory, June 1: 43,500
- Total manufacturing costs: 430,000
- Sales: 590,000
- Work in process inventory, June 30: 30,400
- Finished goods inventory, June 30: 65,200
- Raw materials inventory, June 30: 18,000

Required
(a) Prepare an income statement through gross profit for June.
(b) Indicate the balance sheet presentation of the June 30 inventories.

Problem 8:

Presented below are incomplete 2013 manufacturing cost data for Tardy Corporation.

<table>
<thead>
<tr>
<th>Direct Materials Used</th>
<th>Direct Labor</th>
<th>Manufacturing Overhead</th>
<th>Total Manufacturing Costs</th>
<th>WIP (1/1)</th>
<th>WIP (12/31)</th>
<th>CGM</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) $38,000</td>
<td>$80,000</td>
<td>$48,000</td>
<td>?</td>
<td>$120,000</td>
<td>$96,000</td>
<td>?</td>
</tr>
<tr>
<td>(b) $149,000</td>
<td>$53,000</td>
<td>$90,000</td>
<td>$292,000</td>
<td>?</td>
<td>$98,000</td>
<td>$311,000</td>
</tr>
<tr>
<td>(c) $53,000</td>
<td>$116,000</td>
<td>$121,000</td>
<td>$290,000</td>
<td>$403,000</td>
<td>?</td>
<td>$515,000</td>
</tr>
</tbody>
</table>

Required
Determine the missing amounts.

Problem 9:
From the account balances listed below, prepare a schedule of cost of goods manufactured for Sampson Manufacturing Company for the month ended December 31, 20x1.
### Account Balance

- Finished Goods Inventory, December 31 $42,000
- Factory Supervisory Salaries 12,000
- Income Tax Expense 18,000
- Raw Materials Inventory, December 1 12,000
- Work In Process Inventory, December 31 15,000
- Sales Salaries Expense 14,000
- Factory Depreciation Expense 8,000
- Finished Goods Inventory, December 1 35,000
- Raw Materials Purchases 95,000
- Work In Process Inventory, December 1 20,000
- Factory Utilities Expense 6,000
- Direct Labor 70,000
- Raw Materials Inventory, December 31 19,000
- Sales Returns and Allowances 5,000
- Indirect Labor 21,000

### Problem 10:

The following costs and inventory data were taken from the accounts of Simon Company for 20x1:

<table>
<thead>
<tr>
<th>Inventories:</th>
<th>January 1</th>
<th>December 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>$8,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Work in process</td>
<td>15,000</td>
<td>13,000</td>
</tr>
<tr>
<td>Finished goods</td>
<td>16,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

**Costs incurred:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials purchases</td>
<td>$93,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>42,000</td>
</tr>
<tr>
<td>Factory rent</td>
<td>8,000</td>
</tr>
<tr>
<td>Factory utilities</td>
<td>10,000</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>4,000</td>
</tr>
<tr>
<td>Indirect labor</td>
<td>9,000</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>17,000</td>
</tr>
</tbody>
</table>

**Required**

a. Prepare a schedule showing the amount of direct materials used in production during the year.
Chapter 3 Cost Concepts and Classifications

b. Compute the amount of manufacturing overhead incurred during the year.
c. Prepare a schedule of Cost of Goods Manufactured for Simon Company for the year ended December 31, 20x1 in good form.
d. Prepare the Cost of Goods Sold section of the Income Statement for Simon Company for the year ended December 31, 20x1 in good form.
CHAPTER 4
COST BEHAVIOR: ANALYSIS AND USES

LEARNING OBJECTIVES

1. Understand the meanings of cost behavior.
2. State the importance of understanding cost behavior.
3. Enumerate and explain the basic cost behavior patterns.
4. Understand and diagram the behavior of variable costs, fixed costs and mixed costs in relation to volume of activity.
5. Discuss the methods of estimating the relation between costs and activity levels.
6. Determine the variable cost rate and the fixed costs using the different methods.
7. Compare the strengths and weaknesses of the various cost estimation methods.
8. Compute the coefficient of determination and apply correction analysis.
CHAPTER 4
COST BEHAVIOR: ANALYSIS AND USES

Definition of Cost Behavior
Cost behavior means how a cost will react as changes take place in the level of business activity. Managers who understand how costs behave are better able to predict what costs will be under various operating circumstances. An understanding of cost behavior under varying conditions is essential to adequate decision making in the planning and control of firm activity.

Importance of Understanding Cost Behavior
Planning requires that management make decisions based in part on expectations as to the future. These expectations should be based on data relevant to the decision objectives, gathered and analyzed in a competent, unbiased fashion. Failure in this activity could mean displacement costs due to unexpected events. Control is the process of using feedback information for comparison with expectations and the implementation of actions on the basis of that comparison.

Cost Analysis is an integral part of the planning and control function. The key to effective cost prediction lies in an understanding of cost behavior patterns.

This chapter reviews and discusses in greater depth variable costs, fixed costs and mixed costs which were introduced in the previous chapter.

Types of Cost Behavior Patterns

1. **Variable Costs**

Variable costs are those costs that change in total as the level of activity changes in the short run and within the relevant range. To the economist, the short run is the time period long enough to allow management to change the level of production or other activity within the constraints of current total productive or operating capacity. Furthermore, the estimates of variable and other costs are applicable
only if the contemplated level of activity is within the relevant range. Relevant range is the range activity within which assumptions relative to variable cost and fixed cost behavior are valid. Variable cost per unit is assumed to remain constant within this range. For a cost to be variable, it must be variable with respect to its activity base.

An activity base is a measure of whatever causes the incurrence of variable cost. An activity base is sometimes referred to as a cost driver. Some of the most common activity drivers are units sold, units produced, direct labor-hours and machine hours. Other activity bases (cost drivers) might include the number of miles driven by salespersons, the number of pounds of laundry cleaned by a hotel, the number of calls handled by technical support staff at a software company, and the number of beds occupied in a hospital.

---

**Figure 4.1 Variable Cost Behavior**

![Graph showing total cost of batteries vs. number of cars produced](image)

- Y-axis: Total cost of batteries
- X-axis: Number of cars produced
- The graph shows a linear relationship between the total cost of batteries and the number of cars produced, with the total cost increasing as the number of cars produced increases.
2. **Fixed Costs**

Fixed costs are costs that remain constant in total regardless of changes in the level of activity within the relevant range. Fixed costs however may change due to some outside force, such as price changes. Fixed cost per unit will react inversely with change in activity. Fixed costs decrease per unit as the activity level rises and increase per unit as the activity level fall. The concept of a fixed cost is shown in graphic form in Figure 4.2

**Figure 4.2 Fixed Cost Behavior**
Types of Fixed Costs

Fixed costs are sometimes referred to as capacity costs, since they result from outlays made for buildings, equipment, skilled professional employees, and other items needed to provide the basic capacity for sustained operations. For planning purposes, fixed costs can be viewed as being either committed or discretionary.

Committed fixed costs relate to the investment in facilities, equipment, and the basic organizational structure of a firm. Examples of such costs include depreciation of buildings and equipment, taxes on real estate, insurance, and salaries of top management and operating personnel. The two key characteristics of committed fixed costs are that (1) they are long term in nature, and (2) they can't be significantly reduced even for short periods of time without seriously impairing the profitability or long-run goals of the organization. Even if operations are interrupted or cut back, the committed fixed costs will still continue largely unchanged.

Discretionary fixed costs (often referred to as managed fixed costs) usually arise from annual decisions by management to spend in certain fixed cost areas. Examples of discretionary fixed costs include advertising, research, public relations, management development programs, and internships for students. The most important characteristic of discretionary fixed costs is that management is not locked into a decision regarding such costs. They can be adjusted from year to year or even perhaps during the course of a year if circumstances demand such a modification.

Fixed Costs and the Relevant Range

The concept of relevant range is also important in understanding fixed costs particularly discretionary fixed costs. The levels of discretionary fixed costs are typically decided at the beginning of the year and depend on the support needs of planned programs such as advertising and training. The scope of these programs will depend, in
turn, on the overall anticipated level of activity for the year. At very high levels of activity, programs are usually broadened or expanded.

For example, if the company hopes to increase sales by 25%, it would probably plan for much larger advertising costs than if no sales increase were planned. So the planned level of activity might affect total discretionary fixed costs. However, once the total discretionary fixed costs have been budgeted, they are unaffected by the actual level of activity. For example, once the advertising budget has been decided on and has been spent, it will not be affected by how many units are actually sold. Therefore, the cost is fixed with respect to the actual number of units sold.

Examples of Costs that are Generally Fixed: Rent, insurance, property taxes, supervisory salaries, straight-line depreciation, administrative salaries and advertising.

3. Mixed Costs (Semivariable Costs)

A mixed cost is one that contains both variable and fixed cost elements. Mixed costs are also known as semivariable costs. Figure 4.3 shows the behavior of mixed costs in relation to volume. Note that the total cost line slopes upward as the variable cost element is added to the fixed cost element.

Common Examples of Mixed or Semivariable Costs include: Maintenance Costs, Electric Utility Costs

The relationship between mixed cost and the level of activity also be expressed in the following equation:

\[ Y = a + bX \]

Where:

- \( Y \) = The total mixed cost (the dependent variable)
- \( a \) = The total fixed cost (the vertical intercept of the line)
- \( b \) = The variable cost per unit of activity (the line slope)
- \( X \) = The level of activity (the independent variable)
The independent variable is called also the explanatory variable or cost driver. In cost estimation, we identify some independent variable (the activity) and the functional relationship that permit computation of the corresponding value of the dependent variable (the costs).

**Figure 4.3 Mixed Cost Behavior**

![Mixed Cost Behavior Graph]

**Cost Estimation**

**The Analysis of Mixed Costs**

The fixed portion of mixed cost represents the basic, minimum cost of just having a service ready and available for use while the variable portion represent the cost incurred for the actual consumption of the service. The variable element varies in proportion to the amount of service that is consumed.

How does management go about in estimating the fixed and variable components of a mixed cost?
The basic idea in cost estimation is estimate the relation between costs and the variables (factors) affecting the costs.

This chapter discusses the methods of estimating the relation between cost behavior and activity levels that are commonly used in practice as well as a brief overview of the theory and some important considerations for their application. These are:

1. Account Analysis method
2. Industrial Engineering method or Work Measurement method.
3. Conference method
4. Quantitative Analysis of Current and Past Costs Relationships
   a. High –Low Method
   b. Regression Analysis Method
      1) Scattergraph or Visual fit method
      2) The Least-squares Regression method

It is possible that results will differ from method to method. Consequently, more than one approach is often applied so that results can be compared. Line managers should apply their own best judgment, modifying the estimates submitted by the controller’s staff, a final step in the estimation process.

**Account Analysis Method**

Account analysis is considered a very useful and easier way to estimate costs. It makes use of the experience and judgment of managers and accountants who are familiar with company operations and the way costs react to changes in activity level.

The account analysis involves the following steps:

1. Review cash cost account used to record the costs that are of interest. Each cost is identified as either fixed or variable depending on the relationship between the cost and some activity.
2. Each major class of manufacturing overhead or other mixed cost is itemized. Each cost is then divided into its estimated variable and fixed components. This is done on the basis of the experience and judgment of accounting and other personnel.
Chapter 4 Cost Behavior: Analysis and Uses

An advantage of account analysis is that it involves a detailed examination of the data base by accountants and managers who are familiar with it. Other methods may overlook this expert judgment in uncovering cost behavior patterns. A disadvantage of this method is that it uses subjective, judgmental approach so that different analysts may provide different estimates of cost behavior.

Industrial Engineering Method

The industrial engineering method estimates cost functions by analyzing the relationship between inputs and outputs in physical forms. Engineering estimates indicate what costs should be. This method is so named because it was first used in estimating manufacturing costs from industrial engineers’ specifications of the required input to the manufacturing process for a unit of manufactured output. This method is not just confined to manufacturing. Time-and-motion studies have also been used in banks, fast food companies, government units, hospitals, and many other nonmanufacturing operations. (Abdul Talib Bon and Aliza Ariffin, 2010)

Steps in Applying the Engineering Method of Estimating Costs

1. A study of the physical relation between the quantities of inputs (material, labor, etc.) and each unit of output (finished product) is done. This involves the following activities.
   a. A detailed step-by-step analysis of each phase of each manufacturing process together with the kinds of work performed, and time to perform each step is done. (This is sometimes part of time-and-motion study). This serves as a basis for estimating direct labor time.
   b. Engineering estimates of the materials required for each unit of production are obtained from drawings and specifications sheets.
2. Costs are then assigned to each of the physical inputs (wages, material price, insurance charges, etc.) to estimate the cost of the outputs.

One advantage to the engineering approach is that it can detail each step required to perform an operation. It therefore enables the company to
review its manufacturing productivity and identify specific strengths and weaknesses. Another advantage is that it can be used to estimate costs for totally new activities because it does not require data from prior activities in the organization.

A disadvantage that can be attributed to this method is that it can be quite expensive to use because each activity is using engineering norms and expert engineers which are costly. Another consideration is that engineering estimates are often based on optimal condition. It is also difficult to estimate the indirect costs of production.

**Conference Method**

Under the conference method, cost functions are estimated based on the analysis and opinions about costs and their drivers obtained from various departments of an organization such as purchasing, process engineering, employee relations and so on. This information is used to determine the selling price of the product, optimum product mix and evaluate cost improvements over time.

The conference method allows quick development of cost functions and cost estimates. Its credibility is gained through the pooling of expert knowledge from each value-chain area. The accuracy of the cost estimates however, is dependent largely on the objectivity, care, and the detail taken by the people providing the inputs of information.

**The High-Low Method**

The High-Low Method of analysis mixed costs is based on costs observed at both the high and low levels of activity within the relevant range.

**Steps in Applying the High-Low Cost Estimation**

1. Obtain relevant data on past costs and related actual activity levels.
2. Estimate the variable cost per unit or rate using the following equation.

\[
\text{Variable cost rate or per unit} = \frac{\text{Cost at highest activity} - \text{Cost at lowest activity}}{\text{Highest activity} - \text{Lowest activity}}
\]
3. Compute the fixed cost as follows:

\[
\text{Fixed Cost} = \text{Total Cost at highest Activity} - \left( \text{Variable cost per unit} \times \text{activity in units} \right)
\]

or

\[
\text{Fixed Cost} = \text{Total Cost at lowest Activity} - \left( \text{Variable cost per unit} \times \text{activity in units} \right)
\]

The fixed cost represents the intercept on the graph because it represents the costs that would be incurred at a zero activity level given existing capacity “if the relationship plotted is valid from the data points back to the origin.”

**Illustrative Problem 1: Predictors, Inc.**

Given

Data for the past 10 months were collected for Predictors, Inc. to estimate the variable and fixed manufacturing overhead.

The following data on supplies cost and direct labor hours from January to October are available.

<table>
<thead>
<tr>
<th>X</th>
<th>Direct Labor hours</th>
<th>Y</th>
<th>Supplies Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>$50</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td></td>
<td>110</td>
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<tr>
<td>60</td>
<td>60</td>
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<td>70</td>
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<td></td>
<td>110</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>
Determine the variable cost rate per hour and the fixed cost portion using the high–low method.

Predictors, Inc.

1. Variable cost rate per hour
   \[ \frac{150 - P60}{60 - 10} = \frac{90}{50} = \frac{1.80}{60} \]

2. Fixed Cost:
   \[ \text{at 60-hour level} \]
   \[ FC = 150 - (P\$80 \times 60) = 150 - 108 = 42 \]
   \[ \text{at 10-hour level} \]
   \[ FC = 60 - 18 = 42 \]

Regression Analysis Method
Regression analysis uses all available data to estimate the cost function. It is a statistical method that measures the average amount of change in the dependent variable (costs) that is associated with a unit change of one or more independent variables (cost drivers such as number of units produced, machine hours, etc.) Simple regression analysis estimates the relationship between the dependent variable and one independent variable; while multiple regression analysis estimates the relationship between the dependent variable and multiple independent variables.

Multiple regression is used when the dependent variable (i.e., cost) is caused by more than one factor. Although adding more factors or variables make the computation more complex, the principles involved are the same as in the simple regression analysis.

Simple regression analysis uses the following estimated cost function or equation:

\[ Y = a + bX \]

While multiple regression analysis uses the following equation:

\[ Y = a + b_1X_1 + b_2X_2 + \ldots + u \]
Where:

\[ Y = \text{costs to be predicted (dependent variable)} \]
\[ X, X_1, X_2, \ldots = \text{independent variables which the prediction is to be based} \]
\[ a = \text{fixed cost} \]
\[ b, b_1, b_2, \ldots = \text{estimated coefficients of the regression model} \]
\[ u = \text{residual term that includes the net effect of other factors not in the model and measurement errors in the dependent and independent variables} \]

**Least – squares Regression Method**

A statistical technique which is often used in separating mixed costs into their fixed and variable components is least-squares regression. Basically, a line of regression is determined by solving two simultaneous linear equations which are based on the condition that the sum of deviations above the line equals the sum of deviations below the line.

The equation for the determination of a straight line is:

\[ Y = a + bX \]

The two linear equations that are used to solve for \( a \) and \( b \) are:

**Equation (1)**

\[ \sum Y = Na + b \sum X \]

**Equation (2)**

\[ \sum XY = \sum Xa + b \sum X^2 \]

Where

\[ Y = \text{Total cost} \]
\[ a = \text{Fixed cost} \]
\[ b = \text{Variable cost rate} \]
\[ X = \text{measure of activity (e.g., hours, units)} \]
\[ N = \text{number of observations} \]
\[ \Sigma = \text{Greek letter signifying summation} \]

Using the data in Illustrative Problem 1 (Predictors, Inc.), determine the variable cost rate and the fixed cost under the Least- squares regression method.
Predictors, Inc. (Least-squares regression method)

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>XY</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>$50</td>
<td>1,000</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>110</td>
<td>4,400</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>150</td>
<td>9,000</td>
<td>3,600</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>70</td>
<td>1,400</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>80</td>
<td>2,400</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>4,000</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>150</td>
<td>7,500</td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>600</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>110</td>
<td>3,300</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>120</td>
<td>6,000</td>
<td>2,500</td>
<td></td>
</tr>
</tbody>
</table>

\[
\Sigma X = 350 \quad \Sigma Y = 1,000 \quad \Sigma XY = 39,600 \quad \Sigma X^2 = 14,500
\]

Equation (1):  
1,000 = 10a + 350b

Equation (2):  
39,600 = 350a + 14,500b

To eliminate one unknown (a), and solve for b, multiply Equation 1 by 35 (least common denominator) and subtract the new Equation 3 from Equation 2:

Equation (3):  
39,600 = 350a + 14,500b

[Equation 1 x 35]:  
35,000 = 350a + 12,250b

-4,600 = 2,250b

Variable cost rate or b = $2.04

To solve for a (fixed cost) substitute the value of b to Equation 1. Thus,

\[
1,000 = 10a + 350(2.04)
\]

\[
1,000 - 714 = 10a
\]

\[
a = \frac{286}{10}
\]

\[
a = $28.60
\]

**Scatter graph or Visual Fit**

This is a rough guide for cost estimation which plot the cost against past activity levels. These activities are referred to as predictors (X) or
independent variables, or the right-hand-side of a regression equation. The cost to be estimated may be called the dependent variables, \( Y \) or the left-hand-side of the regression equation. The line is drawn, insofar as it is possible by visual judgment, so that the distances of the observation above the line are equal to the distances of the observations below the line. This line called the line of regression represents the data as a line of conditional expected values.

The steps involved in the use of Scatter graph are as follows:

1. On a graph, plot actual costs (on vertical axis) during the period under study against the volume levels (on horizontal axis).
2. The line of best fit is then drawn by visual inspection of the plotted points, the line representing the trend shown by the majority of the points.
3. The fixed cost is estimated by extending the left end of the line to the vertical axis.
4. The variable cost rate or slope of the cost line is determined by dividing the difference between any two level of activities by the difference in costs corresponding to the same level of activities.

Using the data in Illustrative Problem 1 (Predictors, Inc.), determine the variable cost rate and the fixed cost under the Scatter graph method.

Predictors, Inc. (under the Scatter graph method)

Variable cost rate (b) = \( $110 - $70 \)
\[ 40 - 20 \]
\[ = \frac{$40}{20} \]
\[ = $2 \text{ per hour} \]

Fixed cost (a) is $30 which is where the line of regression begins.
Strengths and weaknesses of Cost Estimation Methods

Each of the methods discussed have advantages and disadvantages. When deciding which to use in practice, the cost of each method must be compared with the benefits. The strengths and weaknesses of these methods are summarized as follows:

<table>
<thead>
<tr>
<th>Method</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Analysis</td>
<td>Provides a detailed expert analysis of the cost behavior in each account</td>
<td>Subjective</td>
</tr>
<tr>
<td>Engineering Method</td>
<td>Based on studies of what future costs should be rather than what past costs have been</td>
<td>Not particularly useful when the physical relation between inputs and outputs is indirect</td>
</tr>
<tr>
<td>High-low Method</td>
<td>Simple to apply</td>
<td>Uses only two data points. Which may not produce accurate result.</td>
</tr>
<tr>
<td>Scatter Method</td>
<td>Uses all the observations of cost data. Relatively easy to use.</td>
<td>The fitting of the line to the observation is</td>
</tr>
</tbody>
</table>
Chapter 4 Cost Behavior: Analysis and Uses

<table>
<thead>
<tr>
<th>Understand and apply.</th>
<th>Subjective. Difficult to do where several independent variables are to be used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least-squares Regression Method</td>
<td>Uses all of the observations of cost data. The line is statistically fit to the observations. A measure of the goodness of fit of the line to the observations is provided. Relatively easy to use with computers and Sophisticated calculators.</td>
</tr>
<tr>
<td></td>
<td>The regression model requires that several relatively strict Assumptions be satisfied for The results to be valid.</td>
</tr>
</tbody>
</table>

Correlation Analysis

In the process of estimating and controlling costs, management must evaluate whether or not the factor selected for estimating cost behavior is suitable for that purpose. Costs may or may not react with changes in the factor selected for cost analysis. The degree of correlation between the level of activity and costs may be measured by the “coefficient of determination”, most frequently designated as $r^2$. To compute for this, the equation is:

$$
)r^2 = 1 - \frac{(\text{Estimated conditional standard deviation measured from line of regression})^2}{(\text{Standard deviation measured from the average of all data})^2}
$$

a) Estimated conditional standard deviation measured from the line of regression:

$$\sqrt{\frac{\sum(\text{Y} - \bar{\text{Y}})^2}{n - 2}}$$

$\text{Y} = \text{actual cost}$

$\bar{\text{Y}} = \text{line of regression cost}$

$n = \text{number of items of data}$
Chapter 4 Cost Behavior: Analysis and Uses

b) Standard deviation measured from average of all data:

\[ \sqrt{\frac{\sum (Y - \bar{Y})^2}{n}} \]

\[ Y \quad = \quad \text{actual cost} \]
\[ \bar{Y} \quad = \quad \text{average cost} \]
\[ n \quad = \quad \text{number of items of data} \]

If \( r^2 \) expressed as a percentage will be relatively high, the correlation is good. It means that the costs follow the factor selected.

Using the data in Illustrative Problem 1 (Predictors, Inc.), evaluate the degree of correlation between the direct labor hours and suppliers cost by solving for \( r^2 \) or coefficient of determination.

\[ r^2 = 1 - \frac{($2.83)^2}{($33.17)^2} \]
\[ = 1 - \frac{8}{1,100} \]
\[ = 1 - 0.007 \]
\[ = 99.3\% \]

Conclusion: There is apparently a very high degree of correlation hours of operation and supplies costs.

Schedule I Computation of Estimated Conditional Standard Deviation Measured from the line of regression.
### Conditional

<table>
<thead>
<tr>
<th>Hours</th>
<th>Actual Cost</th>
<th>Expected Average Cost*</th>
<th>Deviations</th>
<th>Deviations Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>$50</td>
<td>$69.40</td>
<td>(19.40)</td>
<td>376.36</td>
</tr>
<tr>
<td>40</td>
<td>110</td>
<td>110.20</td>
<td>(0.20)</td>
<td>0.04</td>
</tr>
<tr>
<td>60</td>
<td>150</td>
<td>151.00</td>
<td>(1.00)</td>
<td>1.00</td>
</tr>
<tr>
<td>20</td>
<td>70</td>
<td>69.40</td>
<td>0.60</td>
<td>0.36</td>
</tr>
<tr>
<td>30</td>
<td>80</td>
<td>89.80</td>
<td>(9.80)</td>
<td>96.04</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>110.20</td>
<td>(10.20)</td>
<td>104.04</td>
</tr>
<tr>
<td>50</td>
<td>150</td>
<td>130.60</td>
<td>19.40</td>
<td>376.36</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
<td>49.00</td>
<td>11.00</td>
<td>121.00</td>
</tr>
<tr>
<td>30</td>
<td>110</td>
<td>89.80</td>
<td>20.20</td>
<td>408.04</td>
</tr>
<tr>
<td>50</td>
<td>120</td>
<td>130.60</td>
<td>(10.60)</td>
<td>112.36</td>
</tr>
</tbody>
</table>

\[
\text{Estimated Conditional Standard Deviation} = \sqrt{\frac{1,595.60}{10 - 2}} = \sqrt{249.27} = \$2.83
\]

### Schedule II

Computation of standard deviation measured from average of all data.

<table>
<thead>
<tr>
<th>Actual Cost</th>
<th>Average Cost*</th>
<th>Deviations</th>
<th>Deviations Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50</td>
<td>$100</td>
<td>(50)</td>
<td>2,500</td>
</tr>
<tr>
<td>110</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>150</td>
<td>100</td>
<td>50</td>
<td>2,500</td>
</tr>
<tr>
<td>70</td>
<td>100</td>
<td>(30)</td>
<td>900</td>
</tr>
<tr>
<td>80</td>
<td>100</td>
<td>(20)</td>
<td>400</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>150</td>
<td>100</td>
<td>50</td>
<td>2,500</td>
</tr>
<tr>
<td>60</td>
<td>100</td>
<td>(40)</td>
<td>1,600</td>
</tr>
<tr>
<td>110</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>120</td>
<td>100</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

\[
\text{Total} = 11,000
\]
Chapter 4 Cost Behavior: Analysis and Uses

\[
\text{Standard Deviation} = \sqrt{\frac{11,000}{10}} = \$33.17
\]

Cost behavior models are correlational rather than causal; in a causal model, X results in Y, while in a correlational model, occurrences or movements in Y are associated with occurrences or movements in X. The most important issue in estimating a cost function (behavior) is to determine whether a cause-and-effect relationship exists between the cost driver (X) and the resulting costs (Y). The cause-and-effect relationship might arise in several ways:

1. A physical relationship exists between costs and the cost driver.
   
   Example: To produce more units of product requires more materials which result in higher materials costs.

2. Cause-and-effect then arise from a contractual arrangement.
   
   Example: Under the metered system, the number of phone-minutes used is the cost driver of the telephone line costs.

3. Logic and knowledge of operations can establish cause-and-effect.
   
   Example: When the number of component parts is used as a cost driver of design costs, a complex product design with many component parts will incur higher design costs than a simple product with few component parts.

A high correlation or connection between two variables may not mean that either variable causes the other. A high correlation between two variables, X and Y, may not necessarily imply cause-and-effect but may merely indicate that the two variables move together. It is possible that X may cause Y; X and Y may interact; both may be affected by a third variable Z or a correlation may be due to chance. No conclusions about cause-and-effect may be warranted by high correlations. For example, higher materials costs and higher labor costs are caused by higher
production. Materials costs and labor costs are highly correlated but neither causes the other.

A vital aspect of cost estimation is establishing economic plausibility. Only a true cause-and-effect relationship not merely correlation establishes an economically plausible relationship between costs and their cost drivers. Economic plausibility gives the analyst confidence that the estimated relationship will repeatedly appear in other similar sets of data.

The Learning Curve Theory

One assumption in estimating cost behavior is that the cost of each input is a linear function of the quantity assigned. However, the relationship between costs and independent variables is not always linear. As a worker performs a certain task, a systematic, nonlinear relationship has been found. The learning curve theory, also called the improvement curve theory is based on the proposition that as workers gain experience in a task, they need less time to complete the job and productivity increases.

Case studies have shown that learning often follows a pattern: as the cumulative number of units manufactures is doubled the cumulative average time that is takes to make a unit is advised by a constant percentage. If the rate of reduction is 20% the learning curve is referred to as an 80% curve. The learning curve is a power function, and if plotted on double logarithmic paper will appear as a straight line.

Some of the Uses of Learning Curves are as follows:
1. Preparing cost estimates for bidding purposes
2. Setting standards and budget allowances
3. Scheduling labor requirements
4. Evaluating performance by comparing progress reports with the accomplishments anticipated under the learning curve
5. Setting incentive wage rates with due consideration for the fact that labor times will normally be reduced as the workman becomes more experienced.

In solving learning curve problems, the following steps may be followed:
1. Double the cumulative quantity
2. Multiply the cumulative average by the learning curve percentage.
3. Multiply the cumulative average by the cumulative quantity
For example, a worker can finish one unit of product in two hours and a 20% learning curve is applicable. The cumulative time schedule will be shown as follows:

<table>
<thead>
<tr>
<th>Cumulative Quantity</th>
<th>Cumulative Average Worker-Hours per unit</th>
<th>Predicted Total Hours to Perform Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>1.6 (2.0 hrs X 80%)</td>
<td>3.2 (2 X 1.6 hrs)</td>
</tr>
<tr>
<td>4</td>
<td>1.3 (1.6 hrs X 80%)</td>
<td>5.2 (4 X 1.3 hrs)</td>
</tr>
<tr>
<td>8</td>
<td>1.0 (1.3 hrs X 80%)</td>
<td>8.0 (8 X 1.0 hrs)</td>
</tr>
<tr>
<td>16</td>
<td>0.8 (1.0 hrs X 80%)</td>
<td>12.8 (16 X 1.8 hrs)</td>
</tr>
<tr>
<td>32</td>
<td>0.6 (0.8 hrs X 80%)</td>
<td>19.2 (32 X 0.6 hrs)</td>
</tr>
<tr>
<td>64</td>
<td>0.5 (0.6 hrs X 80%)</td>
<td>32.0 (64 X 0.5 hrs)</td>
</tr>
</tbody>
</table>

**Learning Rate.** The reduction in time varies 10 and 40 percent depending on the repetitiveness of labor operations, with 20% being a common reduction. In calculating the learning rate that applies to the specific situation, data on manufacturing the first two lots of a product can be used. The formula to compute for the Learning Rate is:

\[
\text{Learning Rate} = \frac{\text{Average input quantity (cost) for the first 2 x units}}{\text{Average input quantity (cost) for the first x units}}
\]

**Example:** Assume that for a project, the first lot of four units required for a total of 4000 direct labor-hours. The second lot of four more units requires an additional 2,800 direct labor hours. Learning rate for this operation is calculated as follows:

\[
\frac{(4,000 + 2,800)}{4} = \frac{6,800}{4} = 1,700 \text{ average direct labor hours} = 85\%
\]

**Illustrative Problem II. Speed, Inc.**

Speed, Inc. manufactures complex units of motorboats. Fabricating these units require a high degree of technical skill. However, employees have an opportunity to learn how to produce the units more effectively. In estimating direct labor-hours, a 70% learning curve can be used. Completing one prototype unit required 1,200 labor hours at a cost of $18,000.
Chapter 4 Cost Behavior: Analysis and Uses

1. The cumulative average worker-hours per unit for a total of 2 units is
   a. 2,400
   b. 1,200
   c. 840
   d. 1,680

2. The cumulative average worker-hours per unit for a total of 8 units is
   a. 9,600
   b. 6,720
   c. 3,293
   d. 412

3. The estimated direct labor cost for an order of seven additional units, after completing one unit is
   a. $49,620
   b. $144,000
   c. $31,620
   d. $18,000

Solution: Speed, Inc.

<table>
<thead>
<tr>
<th>Cumulative Units</th>
<th>Cumulative Average Hours per unit</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,200.0</td>
<td>1,200 @ 15</td>
</tr>
<tr>
<td>2</td>
<td>840.0 (1,200 x 0.70)</td>
<td>1,680</td>
</tr>
<tr>
<td>4</td>
<td>588.0 (840 x 0.70)</td>
<td>2,532</td>
</tr>
<tr>
<td>8</td>
<td>411.6 (588 x 0.70)</td>
<td>3,293</td>
</tr>
</tbody>
</table>

Direct labor cost for 8 units (3,293 x $15) $49,620
Less: Direct labor cost for the 1st unit $18,000
Direct labor cost for 7 additional units $31,620

Answers:
1. c
2. d
3. C

Reference:
Abdul Talib Bon and Aliza Ariffin, (2010), An Impact Time Motion Study on Small Medium Enterprise Organization, Academia.edu,
Kai Zheng, Michael H. Gao, and David Hanauer, (2011), Using the Time-and-Motion to study Clinical wrok Processes and Workflow: Methodological Inconsistency and a Call for Standardization Research, PubMed.gov
SHORT QUESTIONS

1. Compare and contrast the following types of costs: (1) variable and step-variable and (2) fixed and step-fixed.

2. Define the term "relevant range" and explain its importance in understanding cost behavior.

3. What is the differentiate between committed costs and discretionary costs. Be sure to present two examples of each and explain which of the two cost types would likely be cut should a company encounter financial difficulties.

EXERCISES

Problem 1:
Dollywood Corporation accumulates the following data concerning a mixed cost, using miles as the activity level.

<table>
<thead>
<tr>
<th>Miles Driven</th>
<th>Total Cost</th>
<th>Miles Driven</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 10,000</td>
<td>$15,000</td>
<td>March 9,000</td>
<td>$12,500</td>
</tr>
<tr>
<td>February 8,000</td>
<td>$14,500</td>
<td>April 7,500</td>
<td>$12,000</td>
</tr>
</tbody>
</table>

Required:
Compute the variable and fixed cost elements using the high-low method.

Problem 2:
Consider the graphs that follow (the horizontal axis represents activity; the vertical axis represents total dollars).
Chapter 4 Cost Behavior: Analysis and Uses

Required:
For items A-I that follow, choose the graph that best represents the cost behavior pattern described. Note: Graphs can be used more than once.

1. Straight-line depreciation on machinery.
2. The cost of chartering a private airplane. The cost is $800 per hour for the first 6 hours of a flight; it then drops to $600 per hour.
3. The wages of table service personnel in a restaurant. The employees are part-time workers who can be called upon for as little as 4 hours at a time.
4. Weekly wages of store clerks who work 40 hours each week. One clerk is hired for every 125 sales made during the month.
5. The cost of tires used in the production of trucks.
6. Outbound shipping charges that increase at a decreasing rate as sales rise because the firm can use more efficient modes of transportation (e.g., full trailer loads, full rail cars, etc.). Gradually, however, at high levels of sales, freight costs start to increase at an increasing rate, which reflects more transactions made to customers in far-away locations.
7. Equipment leasing costs that are computed at $2 per machine hour worked. The company pays a maximum of $120,000 per month.

8. The monthly cost of a franchise fee for a fast-food restaurant. The franchisee must pay $20,000 plus 5% of gross dollar sales.

9. The cost of electricity during peak demand periods, which is based on the following schedule:
   Up to 20,000 kilowatt hours (KWH): $4,000
   Above 20,000 kilowatt hours: $4,000 + $0.02 per KWH

Problem 3:
Vincente Corporation has a machining capacity of 200,000 hours per year. Utilization of capacity is normally 75%; it has been as low as 40% and as high as 90%. An analysis of the accounting records revealed the following selected costs:

<table>
<thead>
<tr>
<th>Cost A:</th>
<th>At a 40% Utilization Rate</th>
<th>At a 90% Utilization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$440,000</td>
<td>$440,000</td>
</tr>
<tr>
<td>Per hour</td>
<td>$5.50</td>
<td>?</td>
</tr>
<tr>
<td>Cost B:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>?</td>
<td>$1,944,000</td>
</tr>
<tr>
<td>Per hour</td>
<td>$10.80</td>
<td>$10.80</td>
</tr>
<tr>
<td>Cost C:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$680,000</td>
<td>$1,330,000</td>
</tr>
<tr>
<td>Per hour</td>
<td>$8.50</td>
<td>$7.39</td>
</tr>
</tbody>
</table>

Vincente uses the high-low method to analyze cost behavior.

Required:
1. Classify each of the costs as being either variable, fixed, or semivARIABLE.
2. Calculate amounts for the two unknowns in the preceding table.
3. Calculate the total amount that Viscount would expect at a 75% utilization rate for Cost A, Cost B, and Cost C.
4. Develop an equation that Vincente can use to predict total cost for any level of hours within its range of operation.
Problem 4:
Managers in the Stamping Department have been studying overhead cost and the relationship with machine hours. Data from the most recent 12 months follow.

<table>
<thead>
<tr>
<th>Month</th>
<th>Overhead</th>
<th>Machine Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$5,030</td>
<td>2,730</td>
</tr>
<tr>
<td>February</td>
<td>1,600</td>
<td>600</td>
</tr>
<tr>
<td>March</td>
<td>7,210</td>
<td>3,403</td>
</tr>
<tr>
<td>April</td>
<td>4,560</td>
<td>2,200</td>
</tr>
<tr>
<td>May</td>
<td>6,880</td>
<td>3,411</td>
</tr>
<tr>
<td>June</td>
<td>6,520</td>
<td>2,586</td>
</tr>
<tr>
<td>July</td>
<td>6,230</td>
<td>3,364</td>
</tr>
<tr>
<td>August</td>
<td>5,570</td>
<td>2,411</td>
</tr>
<tr>
<td>September</td>
<td>7,728</td>
<td>3,960</td>
</tr>
<tr>
<td>October</td>
<td>5,810</td>
<td>2,897</td>
</tr>
<tr>
<td>November</td>
<td>4,580</td>
<td>2,207</td>
</tr>
<tr>
<td>December</td>
<td>6,010</td>
<td>2,864</td>
</tr>
</tbody>
</table>

The manager of the department has requested a regression analysis of these two variables (labeled no. 1 below). However, the staff person performing the analysis decided to run another regression that excluded February (labeled no. 2). She observed that the volume of activity was very low for that month because of two factors: a severe flu outbreak and an electrical fire that disrupted operations for about 10 working days.

<table>
<thead>
<tr>
<th>Regression No. 1</th>
<th>Regression No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>428.00</td>
</tr>
<tr>
<td>R²</td>
<td>0.79</td>
</tr>
<tr>
<td>b coefficient</td>
<td>1.86</td>
</tr>
<tr>
<td>Constant</td>
<td>550.00</td>
</tr>
<tr>
<td>R²</td>
<td>0.74</td>
</tr>
<tr>
<td>b coefficient</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Required:
1. Prepare an overhead cost breakdown by using the high-low method. The analysis should be useful in helping to predict variable and fixed costs under normal operating conditions.
2. Prepare an estimate of overhead cost for a volume of 3,000 machine hours by using regression no. 1.

3. You now have the ability to analyze three cost estimates from the high-low data in part (a) and the two regression equations. Which one do you feel would provide the best estimate? Explain the factors that support your choice. Note: Do not calculate an overhead cost estimate with regression no. 2.

Problem 5
Shortly after being hired as an analyst with Harbor Rentals in upstate New York, Raul Gomez was asked to prepare a report that focused on the company's order processing costs—a cost driven largely by the number of rental invoices written. Raul knew that he could use several different tools to analyze cost behavior, including scatter diagrams, least-squares regression, and the high-low method. In addition, he knew that he could present the results of his analysis in the form of algebraic equations. Those equations follow.

Scatter diagram: $OP = 56,000 + 6.80RI$
Least-squares regression: $OP = 59,000 + 6.75RI$
High-low method: $OP = 53,500 + 7.25RI$

where $OP =$ total order processing costs and $RI =$ number of rental invoices written.

Raul had analyzed data over the past 12 months and built equations based on these data, purposely including the slowest month of the year and the busiest month so that things would "tend to even out." He observed that February was especially slow because of a paralyzing blizzard, one that forced the company to close for four days.

Required:
1. Will scatter diagrams, least-squares regression, and the high-low method normally result in the same equation? Why?
Chapter 4 Cost Behavior: Analysis and Uses

2. Assuming the use of least-squares regression, explain what the $59,000 and $6.75 figures represent.

3. Assuming the use of a scatter diagram, predict the order processing cost of an upcoming month when Harbor expects to write 2,500 rental invoices.

4. Did Raul err in constructing the equations on data of the past 12 months? Briefly discuss. If "yes," determine which of the three tools is likely to be affected the most and explain why.

Problem 6:
Ellington Corporation uses least-squares regression to analyze a variety of operating costs. A staff assistant determined that monthly machine hours (MH) have a strong cause-and-effect relationship with total maintenance costs, and generated the following statistics:
Intercept: $170,000
b coefficient: $3.80
Total machine hours for the year: 36,500

Required:
1. Construct the company's regression equation.
2. Based on your answer in part "A," identify Ellington's dependent variable and independent variable.
3. What does the b coefficient really represent?
4. Predict the company's maintenance cost in a month when 3,200 machine hours are worked.

Problem 7
Norde Company is making plans for the introduction of a new product, which has a target selling price of $7 per unit. The following estimates of manufacturing costs have been derived for 6 million units, to be produced during the first year:
- Direct material: $6,000,000
- Direct labor: $2,100,000 (at $14 per hour)
  o Overhead costs have not yet been estimated, but monthly data on total production and overhead for the past 12 months have been analyzed by using least-squares regression. The major overhead cost driver is direct labor
hours, with the following results:
Computed values:
Fixed overhead cost: $3,200,000
Coefficient of independent variable: $2.25

Required:
1. Prepare the company's regression equation \( Y = a + bX \) to estimate overhead.
2. Calculate the predicted overhead cost at an activity level of 6,300,000 units.
3. What is Norde's dependent variable in this case?
4. How can the company evaluate the "quality" of its regression equation?

Problem 8
Chambliss Corporation has three costs: A, which is variable; B, which is fixed; and C, which is semivariable. The company uses the high-low method and extracted the following data from its accounting records:
- At 180,000 hours of activity, Cost A totaled $2,610,000.
- At 140,000 hours, the low point during the period, Cost C totaled $1,498,000; at 200,000 hours, the high point, Cost C's fixed portion amounted to $1.75 per hour.
- At 160,000 hours of activity, the sum of Costs A, B, and C amounted to $8,162,000.

Required:
1. Compute the variable portion (total) of Cost C at 140,000 hours of activity.
2. Compute Cost C (total) at 160,000 hours of activity.
3. Compute Cost B (total) at 160,000 hours of activity.

Problem 9
Ai Corporation extracts ore for eight different companies in Colorado. The firm anticipates variable costs of $65 per ton along with annual fixed overhead of $840,000, which is incurred evenly throughout the year. These costs exclude the following semivariable costs, which are expected
to total the amounts shown for the high and low points of ore extraction activity:

March (850 tons): $39,900  
August (1,300 tons): $46,200  
A-1 uses the high-low method to analyze cost behavior.

Required:

1. Calculate the semivariable cost for an upcoming month when 875 tons will be extracted.
2. Calculate the total cost for that same month.
3. Ai uses Cortez Trucking to haul extracted ore. Cortez's monthly charges are as follows:

<table>
<thead>
<tr>
<th>Tons</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 - 1,099</td>
<td>$70,000</td>
</tr>
<tr>
<td>1,100 - 1,399</td>
<td>90,000</td>
</tr>
<tr>
<td>1,400+</td>
<td>110,000</td>
</tr>
</tbody>
</table>

a) From a cost behavior perspective, what type of cost is this?
b) If Ai plans to extract 875 tons, is the company being very "cost effective" with respect to Cortez's billing rates? Briefly discuss.
CHAPTER 5

SYSTEMS DESIGN: JOB-ORDER COSTING
AND PROCESS COSTING

LEARNING OBJECTIVES
After studying this chapter, you should be able to:

1. Explain the relationship between cost accounting and management accounting.
2. Describe the flow of costs in a merchandising company and a manufacturing company.
3. Describe and distinguish between the job order costing system, process costing system and operation costing system.
4. Apply the job order costing system in a manufacturing company and a service enterprise.
5. Apply the process costing system in a manufacturing company.
6. Determine the basic in choosing between job order and process costing systems.
7. Describe application of operation costing system.
Introduction to Cost Accounting and Management

Accounting systems serve people both inside and outside an organization. The different needs of external and internal users require different approaches to reporting information. Chapter 1 outlined the differences between financial accounting, which is primarily concerned with external reporting and managerial accounting which is primarily concerned with internal reporting. Although the two branches differ in their objectives, they share a common data base as well as some basic concepts.

Cost accounting is the subfield of accounting records, measures, and reports information about costs. When costs are used inside the organization by managers to evaluate the performance of operations or personnel, or as a basis for decision making, we say costs are used for managerial accounting purposes. When costs are used by outsiders, such as shareholders or creditors, to evaluate the performance for top management and make investment decisions about the organization we say costs are used for financial accounting purposes.

Flow of Costs in a Merchandising Company

Merchandising companies such as computer stores, department stores, drugstores and retail outlets, purchase the merchandise they sell to customers. Their product costs are the purchase price of the merchandise. When products are purchased, their costs are recorded as assets on the balance sheet under Merchandise Inventory. This account includes all goods purchased for resale that were not sold, their costs are removed from the statement of financial position or balance sheet and charged against sales revenues in the income statement. Selling and administrative costs are charged also against income as operating expense for the period in the income statement.

Figure 5.1 illustrates the basic flow of costs in a merchandising concern. It starts from the time of purchase of merchandise to the time of sales.
Figure 5.1 Flow of Costs in a Merchandising Company

Notice that costs move from one account to another in the same sequence as products flow through the factory to the customer. The starting point is the purchase of direct materials, which is recorded as an asset in the Raw Materials account. As materials are used, their cost is removed from the Raw Materials account and placed in the Work in Process account. The cost of direct materials still on hand in either account at period end will appear as an asset in their respective accounts on the balance sheet.

Flow of Costs in a Manufacturing Company

The most complex cost classification systems are found in manufacturing organizations, where a special statement must be prepared to determine the cost of goods, sold. Figure 5.2 shows the basic flow of costs in a manufacturing company while Figure 5.3 illustrates the flow of manufacturing costs through manufacturing accounts.
Figure 5.2 Flow of Costs in a Manufacturing Company

<table>
<thead>
<tr>
<th>Costs</th>
<th>Statement of financial position or Balance Sheet</th>
<th>Income Statement Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Purchases</td>
<td>Raw material</td>
<td></td>
</tr>
<tr>
<td>Direct labor</td>
<td>Work in process</td>
<td></td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>Finished goods</td>
<td>Cost of goods sold</td>
</tr>
</tbody>
</table>

Selling and administrative     Period cost                          Selling and administrative

Unlike direct materials, direct labor costs are recorded as they are consumed. Direct labor expires with time and cannot be stored for use in a latter accounting period. As direct labor is used, the cost is placed in the Work in Process account and the Salaries and Wages Payable account. Manufacturing overhead is placed in the Work in Process account from depreciation charges, use of indirect labor, expiration of insurance premiums, and use or expiration of other factors necessary for manufacturing operations. The manufacturing overhead costs are recorded in accounts such as Accumulated Depreciation, Prepaid Insurance, or Accounts Payable on the balance sheet. In the illustration, these accounts are in the Manufacturing Overhead Accounts.

As products are completed and moved from the factory to the storeroom, the accountant moves direct materials, direct labor, and manufacturing overhead costs from the Work in Process account to the Finished Goods account. Finally, when the products are sold, their total is transferred from the Finished Goods account to the Cost of Goods Sold account.
Manufacturing Cost Accounting Systems

Manufacturing companies use either job order, process costing or operation costing systems to assign costs to products.

In designing any cost accounting system, accountants are required to make four decisions.

1. Will the system use historical costs or standard cost? Historical costs are actual costs incurred in the past. Standard costs are estimates of what unit costs should be, based on past costs and engineering estimates. The system described in this chapter uses historical costs.

2. Will the system be a job order or a process cost accounting system? The answer to this question depends on whether the product is produced in distinct batches or in a continuous process.
3. Will the system be based on full absorption or direct costing of inventory? The choice will determine whether fixed manufacturing overhead is included in the unit cost of inventory. Full absorption costing includes fixed manufacturing overhead as a period cost rather than an inventory cost.

4. What system will be used to assign overhead costs to products? Will the company use plantwide or activity-based predetermined overhead rates? What and how many cost drivers should be used?

Cost accounting systems can vary greatly depending on these decisions. For example, a standard process costing system might be based on full absorption costing and a plantwide overhead rate. A standard job order costing system might be based on direct costing and a departmental overhead rate. Some combinations are more common than others. But to completely describe a cost accounting system, all four decisions must be made.

**JOB ORDER COSTING SYSTEM**

**Concept and Application**

With a job order cost system, costs are assigned to each job. A job may be an order, a contract, a unit of production, or a batch performed to meet customers’ specifications. For example, when repairing a television set, an electrician uses job order costing to accumulate the costs of the repair job. The electrician collects the cost of repair parts and the direct labor-hours spent in repairing the TV set. Overhead costs are applied using an overhead rate. Accountants also use job order costing in the construction of commercial and residential buildings, ships, and machines. For example, a printing company uses job order costing because printers usually produce each printing order to customers’ specifications. Job order costing is appropriate for companies making different components for inventory.

Usually company will not only manufacture only single type of product, and the basic concept of job-order costing is to produce specific product for specific customer, it is, therefore, important for the company to
Chapter 5 System Design: Job-order Costing and Process Costing

cumulate the manufacturing costs of each particular job. Cost accounting provides a useful tool to gather and cumulate the data on manufacturing costs of each job. The tool calls "Job-cost sheet" or "Job-cost record". This sheet provides various cost data as well as other related data to the job, i.e., number of units produced, date job start and complete, etc. Finally, the cost per unit will also be calculated and shown on the job-cost sheet. Figure 5.6 presents the example of job-cost sheet.

**Figure 5.4 Flows of Documents in a Job-Order Costing System**

**Figure 5.5 Flow of Costs in Job-order Costing**

The work in process account consists of individual jobs in a job-order system.
Figure 5.6 Example of job-cost sheet

<table>
<thead>
<tr>
<th>JOB COST SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job number:</td>
</tr>
<tr>
<td>Description:</td>
</tr>
<tr>
<td>Date start:</td>
</tr>
<tr>
<td>Date completed:</td>
</tr>
<tr>
<td>Units completed:</td>
</tr>
<tr>
<td>Date sales</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIRECT MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Nov-01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIRECT Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Nov-25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MANUFACTURING OVERHEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Nov-25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COST SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost items</td>
</tr>
<tr>
<td>Total direct material</td>
</tr>
<tr>
<td>Total direct labor</td>
</tr>
<tr>
<td>Total Manufacturing overhead</td>
</tr>
<tr>
<td>Total cost</td>
</tr>
<tr>
<td>Unit cost</td>
</tr>
</tbody>
</table>

Summary of Accounting Procedures using Job Order Costing to a Manufacturing Company

1. Record the purchase and issue of materials with journal entries.

   To record the purchase of materials, the accountant increases both the Materials Inventory (dr) and Accounts Payable (cr) accounts. To record the issue of direct materials, the accountant reduces the Materials Inventory (cr) account and increases the Work in Process Inventory (dr) account by the amount shown on the materials requisition form. To record the issue of indirect materials, the accountant reduces the Materials Inventory (cr) account.
account and increases the Actual Manufacturing Overhead (dr) account.

2. Record labor costs with journal entries.

To record the incurrence of direct labor costs, the accountant increases the Work in Process Inventory (dr) and Wages Payable (cr) accounts by total direct labor costs on a job. This total is calculated from workers, timecards. Indirect labor is recorded as an increase to the Actual Manufacturing Overhead (dr) account and an increase to Wages Payable (Cr).

3. Calculate a predetermined overhead rate and use it to assign overhead costs to a job.

Because manufacturing overhead costs are common costs that benefit more that one job, the manufacturing overhead costs incurred on a specific job cannot be measured. Instead they must be assigned according to a ratio called the predetermined overhead rate. The predetermined overhead rate is the ratio of total estimated manufacturing overhead costs for the year to the expected manufacturing activity for the year, measured according to some cost driver, such as direct labor costs. To assign, or apply, overhead costs, the accountant multiplies total monthly output per job, measured by the chosen cost driver, by the predetermined overhead rate.

4. Record applied manufacturing overhead costs with journal entries.

To record applied overhead, the accountant increases the Work in Process Inventory (dr) and Applied Manufacturing Overhead (Cr) accounts by the amount of overhead assigned to jobs, using the predetermined overhead rate.

5. Complete a job cost sheet and calculate the average cost per unit of a job.

The cost of direct materials used, direct labor, and applied overhead is recorded on job cost sheets. When a job is completed, these costs are totaled. The average cost per unit is
determined by dividing the total cost of the job (from the job cost sheet) by the number of goods units produced.

6. Record actual manufacturing overhead costs with journal entries.

To record actual manufacturing overhead costs, the accountant adds these costs to the Actual Manufacturing Overhead (dr) account. Actual overhead costs include the cost of indirect materials and indirect labor as well as other indirect costs, such as insurance and utilities. Thus, expired factory insurance simultaneously reduces the Prepaid Insurance account and increases the Actual Manufacturing Overhead account. Factory depreciation would increase the Accumulated Depreciation account; utilities costs, the Accounts payable account.

7. Compute over – and underapplied overhead.

Because applied overhead costs are an average amount each month, whereas actual overhead costs follows seasonal or irregular patterns, actual manufacturing overhead often differs from applied overhead. To find the amount by which these costs were over- or underapplied, the accountant compares total applied overhead costs to total actual overhead costs.

When applied overhead is greater than actual manufacturing overhead, the overhead is referred to as overapplied. When applied overhead is less than actual manufacturing overhead, the overhead is underapplied. Over – or underapplied overhead costs are usually subtracted from or added to the cost of goods sold on the monthly income statement.

Manufacturing overhead may be over – or underapplied at month end because of seasonal variations in actual overhead costs, an irregular occurrence of actual overhead costs, seasonal variations in production volume, or inaccurate estimates of total manufacturing overhead or total production output.

Although the first three causes will produce difference between actual and applied overhead on a monthly basis, by year-end the
differences will average out. No corrective act is needed. The last cause, faulty estimates, can also produce over – or underapplied overhead at year – end as well as at month end. If the differences are large, the predetermined overhead rate should be revised.

8. Calculate cost of goods manufactured and cost of goods sold.

Cost of goods completed during the month is called the cost of goods manufactured. It can be computed by analyzing activity in the Work in Process Inventory account over the past month. The process for preparing the statement and calculating cost of goods manufactured is to add the manufacturing costs by the difference between beginning and ending work in process inventory.

The cost of goods manufactured is used in preparing the statement of cost of goods sold. Cost of goods manufactured can also be calculated by summarizing the cost of all jobs completed during the period.

The statement of cost of goods sold can be considered an analysis of the Finished Goods Inventory account. Computing the cost of goods sold of merchandising firm and manufacturing firm are almost similar. Cost of goods sold for manufacturing firm can be calculated using cost of goods manufactured added by the difference between beginning and ending finished inventory.

The cost of goods sold can also be calculated by multiplying the number of units sold times the per unit cost shown on the job cost sheets. Cost of goods sold is used in preparing the income statement.

There is the relationship among the cost of goods manufactured and cost of goods sold that is a part of income statement. This relationship is shown in figure 5.6
Figure 5.6 Relationship between cost of goods manufactured and income statement

Illustrative Problem 5.1 Job Order Costing in a Manufacturing Company

Palmera Company is a manufacturing firm that uses job-order costing. On January 1, the beginning of its fiscal year, the company's inventory balances were as follows:

- Raw materials $200,000
- Work in process 150,000
- Finished goods 300,000

The company applies overhead cost to jobs on the basis of machine-hours worked. For the current year, the company estimated that it would work 750,000 machine-hours and incur $4,500,000 in manufacturing overhead cost. The following transactions were recorded for the year:

a. Raw materials were purchased on account, $4,100,000.

b. Raw materials were requisitioned for use in production, $3,800,000 ($3,600,000 direct materials and $200,000 indirect materials)
c. The following costs were incurred for employee services: direct labor, $750,000; indirect labor, P1,100,000; sales commissions, $900,000; and administrative salaries, $2,000,000.

d. Sales travel costs were $170,000.

e. Utility costs in the factory were $430,000.

f. Advertising costs were $1,800,000.

g. Depreciation was recorded for the year, $3,500,000 (80% relates to factory operations, and 20% relates to selling and administrative activities).

h. Insurance expired during the year, $100,000 (70% relates to factory operations, and the remaining 30% relates to selling and administrative activities).

i. Manufacturing overhead was applied to production. Due to greater than expected demand for its products, the company worked 800,000 machine – hours during the year.

j. Goods costing $9,000,000 to manufacture according to their job cost sheets were completed during the year.

k. Goods were sold on account to customers during the year at a total – selling price of $15,000,000. The goods cost $8,700,000 to manufacture according to their job cost sheets.

**REQUIRED:**

1. Prepare journal entries to record the preceding transactions.

2. Post the entries in (1) above to T-accounts (don’t forget to enter the beginning balances in the inventory accounts).

3. Is Manufacturing Overhead underapplied or overapplied for the year? Prepare a journal a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold. Do not allocate the balance between ending inventories and Cost of Goods Sold.

4. Prepare an income statement for the year.
Solution: Palmera Company

1. a. Raw Materials 4,100,000
   Accounts Payable 4,100,000

   b. Work in Process 3,600,000
   Manufacturing Overhead 200,000
   Raw Materials 3,800,000

   c. Work in Process 750,000
   Manufacturing Overhead 1,100,000
   Sales Commissions Expense 900,000
   Administrative Salaries Expense 2,000,000
   Salaries and Wages Payable 4,750,000

   d. Sales Travel Expense 170,000
   Accounts Payable 170,000

   e. Manufacturing Overhead 430,000
   Accounts Payable 430,000

   f. Advertising Expense 1,800,000
   Accounts Payable 1,800,000

   g. Manufacturing Overhead 2,800,000
   Depreciation Expense 700,000
   Accumulated Depreciation 3,500,000

   h. Manufacturing Overhead 70,000
   Insurance Expense 30,000
   Prepaid Insurance 100,000

i. The predetermined overhead rate for the year would be computed as follows:
Chapter 5 System Design: Job-order Costing and Process Costing

\[
\text{Predetermined Overhead rate} = \frac{\text{Estimated total manufacturing overhead cost}}{\text{Estimated total units in the allocation base}}
\]

\[
= \frac{\$4,500,000}{750,000 \text{ machine – hours}}
\]

\[
= \$6 \text{ per machine – hour}
\]

Based on the 800,000 machine – hours actually worked during the year, the company would have applied $4,800,000 in overhead cost to production. 800,000 machine – hours x $6 per machine – hour = $4,800,000. The following entry records this application of overhead cost:

\[
\begin{align*}
\text{Work in Process} & \quad \text{4,800,000} \\
\text{Manufacturing Overhead} & \quad \text{4,800,000} \\
\text{j. Finished Goods} & \quad \text{9,000,000} \\
\text{Work in Process} & \quad \text{9,000,000} \\
\text{k. Accounts Receivable} & \quad \text{15,000,000} \\
\text{Sales} & \quad \text{15,000,000} \\
\text{Cost of Goods Sold} & \quad \text{8,700,000} \\
\text{Finished Goods} & \quad \text{8,700,000}
\end{align*}
\]

2.

<table>
<thead>
<tr>
<th>Accounts receivable</th>
<th>Raw material</th>
<th>Work in process</th>
</tr>
</thead>
<tbody>
<tr>
<td>(k)</td>
<td>Bal</td>
<td>200,000</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>3,800,000</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>1,400,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(k)</td>
<td>Bal</td>
<td>500,000</td>
</tr>
</tbody>
</table>

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3. Manufacturing overhead is overapplied for the year. The entry to close it out to Cost of Goods Sold is as follows:

\[
\begin{align*}
\text{Manufacturing Overhead} & \quad 200,000 \\
\text{Cost of Goods Sold} & \quad 200,000
\end{align*}
\]
Chapter 5 System Design: Job-order Costing and Process Costing

PALMERA COMPANY
Income Statement
For the Year Ended December 31

Sales $15,000,000
Less cost of goods sold ($8,700,000
  – $200,000) 8,500,000
Gross margin 6,500,000
Less selling and administrative expense
Commission expense $  
Administrative salaries expense 900,000
Sales travel expense 2,000,000
Advertising expense 170,000
Depreciation expense 1,800,000
Insurance expense 700,000
  30,000
Net operating income 5,600,000
  900,000

Illustrative Problem 5.2 Comprehensive Problem

Sterling Millwork, Ltd., produces reproductions of antique residential moldings at a plant. Since there are hundreds of products, some of which are made only to order, the company uses a job-order costing system. On July 1, the start the company’s fiscal year, inventory account balances were as follow

<table>
<thead>
<tr>
<th>Inventory Category</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>$10,000</td>
</tr>
<tr>
<td>Work in process</td>
<td>4,000</td>
</tr>
<tr>
<td>Finished goods</td>
<td>8,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$22,000</strong></td>
</tr>
</tbody>
</table>

The company applies overhead cost to jobs on the basis of machine-hours as a plant-wide rate throughout the organization. For the fiscal year starting July, it was estimated that the plant would operate 45,000 machine-hours and incur $99,000 in manufacturing overhead cost. During the year, the following transactions were completed.

a. Raw materials purchased on account, $160,000
b. Raw materials requisitioned for use in production, $140,000 (materials costing $120,000 were chargeable directly to jobs; the remaining materials were indirect).

c. Costs for employee services were incurred as follows:

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct labor</td>
<td>$90,000</td>
</tr>
<tr>
<td>Indirect labor</td>
<td>60,000</td>
</tr>
<tr>
<td>Sales commissions</td>
<td>20,000</td>
</tr>
<tr>
<td>Administrative salaries</td>
<td>50,000</td>
</tr>
</tbody>
</table>

d. Prepaid insurance expired during the year, $18,000 ($13,000 of this amount related to factory operations, and the remainder related to selling and administrative activities).

e. Utility costs incurred in the factory, $10,000

f. Advertising costs incurred, $15,000

g. Depreciation recorded on equipment, $25,000. ($20,000 of this amount was on equipment used in factory operations; the remaining $5,000 was on equipment used in selling and administrative activities).

h. The company recorded 50,000 machine-hours of operating time during the year.

i. Goods that had cost $310,000 to manufacture according to their job cost sheets were transferred into the finished goods warehouse.

j. Sales (all on account) to customers during the year totaled $498,000. These goods had cost $308,000 to manufacture according to their job cost sheets.

REQUIRED:

1. Prepare journal entries to record the transactions for the year.

2. Prepare T-accounts for inventories, Manufacturing Overhead, and Cost of Goods Sold. Post relevant data from your journal entries to these T-accounts (don't forget to enter the opening balances in
your inventory accounts) Compute an ending balance in each account.

3. Is Manufacturing overhead underapplied or overapplied for the year? Prepare a journal entry to close any balance in the Manufacturing Overhead account to Cost of Goods Sold.

4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the journal entries and T-accounts you have prepared.)

Solution: Sterling Millwork, Ltd.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Raw Materials</td>
<td>160,000</td>
</tr>
<tr>
<td>Accounts Payable</td>
<td>160,000</td>
</tr>
<tr>
<td>b. Work in Process</td>
<td>120,000</td>
</tr>
<tr>
<td>Manufacturing Overhead</td>
<td>20,000</td>
</tr>
<tr>
<td>Raw Materials</td>
<td>140,000</td>
</tr>
<tr>
<td>c. Work in Process</td>
<td>90,000</td>
</tr>
<tr>
<td>Manufacturing Overhead</td>
<td>60,000</td>
</tr>
<tr>
<td>Sales Commissions Expense</td>
<td>20,000</td>
</tr>
<tr>
<td>Salaries Expense</td>
<td>50,000</td>
</tr>
<tr>
<td>Salaries and Wages Payable</td>
<td>220,000</td>
</tr>
<tr>
<td>d. Manufacturing Overhead</td>
<td>13,000</td>
</tr>
<tr>
<td>Insurance Expense</td>
<td>5,000</td>
</tr>
<tr>
<td>Prepaid Insurance</td>
<td>18,000</td>
</tr>
<tr>
<td>e. Manufacturing Overhead</td>
<td>10,000</td>
</tr>
<tr>
<td>Accounts Payable</td>
<td>10,000</td>
</tr>
<tr>
<td>f. Advertising Expense</td>
<td>15,000</td>
</tr>
<tr>
<td>Accounts Payable</td>
<td>15,000</td>
</tr>
<tr>
<td>g. Manufacturing Overhead</td>
<td>20,000</td>
</tr>
<tr>
<td>Depreciation Expense</td>
<td>5,000</td>
</tr>
<tr>
<td>Accumulated Depreciation</td>
<td>25,000</td>
</tr>
<tr>
<td>h. Work in Process</td>
<td>110,000</td>
</tr>
</tbody>
</table>

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Chapter 5 System Design: Job-order Costing and Process Costing

Manufacturing Overhead 110,000

Estimated total manufacturing overhead cost = \$99,000 = \$2.20 per MH
Estimated total units of the allocation base 45,000 MHs

50,000 actual MHs x \$2.20 per MH = \$110,000 overhead applied.

i. Finished Goods 310,000
   Work in Process 310,000

J. Accounts Receivable 498,000
   Sales 498,000

Cost of Goods Sold. 308,000
   Finished Goods 308,000

2.

<table>
<thead>
<tr>
<th>Raw materials</th>
<th>Work in process</th>
<th>Finished goods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bal 10,000</td>
<td>a 160,000</td>
<td>Bal 8,000</td>
</tr>
<tr>
<td>b 140,000</td>
<td></td>
<td>Bal 8,000</td>
</tr>
<tr>
<td>Bal 30,000</td>
<td></td>
<td>Bal 10,000</td>
</tr>
</tbody>
</table>

Manufacturing overhead is underapplied by \$13,000 for the year. The
entry to close this balance to Cost of Goods Sold would be:

Cost of Goods Sold 13,000
   Manufacturing Overhead 13,000

4.
STERLING MILLWORK, LTD.  
Income Statement  
For the Year Ended June 30

Sales $498,000  
Less cost of goods sold ($8,700,000 – $200,000)  
Gross margin 177,000  
Less selling and administrative expense  
Sales commissions $20,000  
Administrative salaries 50,000  
Insurance expense 5,000  
Advertising expense 15,000  
Depreciation expense 5,000  
Net operating income 95,000  
Total 82,000

Illustrative Problem 5.3 Job Order Costing in a Service Company

Rivera & Associates is a law firm specializing in labor relations and employee related work. It employs 25 professionals (5 partners and 20 associates) who work directly with its clients. The average budgeted total compensation per professional for the year is $104,000. Each professional is budgeted to have 1,600 billable hours to clients during the year. Rivera is a highly respected firm, and all professionals work for clients to their maximum 1,600 billable hours available. All professional labor costs are included in a single direct – cost category and are traced to jobs on a per-hour basis.

All costs of Rivera & Associates other than professional labor costs are included in a single indirect-cost pool (legal support) and are allocated to jobs using professional labor-hours as the allocation base. The budgeted level of indirect costs during the current year is $2.2 million.

REQUIRED:

1. Present an overview diagram of Rivera’s job-costing system.

2. Compute the current annual budgeted professional labor-hour direct-cost rate.
3. Compute the current annual budgeted indirect-cost rate per hour of professional labor.

4. Rivera & Associates is considering bidding on two jobs:
   a) Litigation work for Santa Trading, Inc., that requires 100 budgeted hours of professional labor.
   b) Labor contract work for Roger Manufacturing Co., that requires 150 budgeted hours of professional labor.

5. Prepare a cost estimate for each job.

Solution: Rivera & Associates

2.

\[
\text{Budgeted professional Labor-hour direct cost rate} = \frac{\text{Budgeted total direct labor compensation}}{\text{Budgeted total direct labor-hours}}
\]

\[
= \frac{$104,000}{1,600 \text{ hours}}
\]
3. Budgeted indirect cost rate = \frac{\text{Budgeted total costs in indirect cost pool}}{\text{Budgeted total professional labor-hours}}

= \frac{$2,200,000}{1,600 \text{ hours} \times 25}

= \frac{$2,200,000}{40,000 \text{ hours}}

= $55 \text{ per professional labor-hour}

4. Santa Trading

<table>
<thead>
<tr>
<th>Direct costs:</th>
<th>Roger Manu.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional labor, $65 x 100; 150</td>
<td>$6,500</td>
</tr>
<tr>
<td>Indirect costs:</td>
<td></td>
</tr>
<tr>
<td>Legal support, $55 x 100; 150</td>
<td>5,500</td>
</tr>
<tr>
<td>Total</td>
<td>$12,000</td>
</tr>
</tbody>
</table>

PROCESS COSTING SYSTEM

Concept and Application

Using a process costing system, accountants accumulate cost for each department for a time period and allocate them among all the products manufactured during the period. They use process costing in ice cream processing, petroleum refining, and other industries where there is a continuous production process. Direct material, direct labor, and applied factory overhead are accumulated for each department for a period, usually a month. At the end of the period, departmental cost is divided by the number of units produced to obtain a cost per unit. Figure 5.7 shows
the flow of costs in a Process Costing System. Figure 10.7 shows the T-account Model of Process Costing Flows.

**Figure 5.7 Flow of Costs – Process Costing System**

![Diagram showing the flow of costs in a Process Costing System](Image)

**Figure 5.8 T-account Model for Process Costing Flows**

![Diagram showing the T-account Model for Process Costing Flows](Image)
Summary of Accounting Procedures using Process Costing in a Manufacturing Company

1. Costs are accumulated and cost per unit is calculated.

   Process costing is used when products are produced continuously, that is, when there are no distinguishable starting and stopping points in the production process. When using this method, you accumulate costs by activity and calculate cost per unit by activity at the end of a specified time period, usually a month. Cost per unit is calculated by dividing activity costs by units processed.

   A cost summary summarizes costs and units for an activity when process costing is used. It is a useful tool, especially when computations are complex, such as when partially completed units must be accounted for.

2. Prepare journal entries to record manufacturing costs and transfers.

   The journal entries used to transfer costs between activities in process costing are basically the same as those used in job order costing. The way you calculate the unit costs needed to make the journal entries, however, is different.

   Journal entries transfer separate costs from one production activity to another to Finished Goods Inventory. Other journal entries are required to add direct materials costs, direct labor costs, and applied manufacturing overhead to each production activity.

3. Calculate equivalent units when resources are added uniformly.

   Partially completed units are often in inventory at the end of a period. Since some of the period's production costs belong to those partially completed units, their cost must be calculated according to equivalent rather than physical units.

   Prior department costs are rarely added uniformly. Instead, they are added at the start of the process. Conversion costs, however, are almost always added uniformly. And direct materials are usually added in a lump at some point in the production process, but are sometimes added uniformly, as in a mixing process. When resources are added uniformly throughout the production process, equivalent
units are found by estimating the percentage of completion or effect put into the partially completed units. That percentage is then multiplied by the number of physical units. Since direct materials costs, prior department costs, and conversion costs may differ in their percentage of completion, equivalent units must be calculated separately for each cost category.

4. Calculate equivalent units when resources are added in a lump.

When a resource is added in a lump, 100 percent of the resource is added at a specified time in the production process, often at the start. Prior department costs and direct materials costs are usually added this way. When they are costs and direct materials costs are usually added this way. When they are, equivalent units equal the number of physical units that have passed this point.

For resources added in a lump at the start, equivalent units equal the number of units started. For resources added in a lump at the end of the production process, equivalent units equal the number of units completed.

5. Using equivalent units, calculate the unit cost for all types of costs and record them on a cost summary report.

The first step in calculating unit cost is to analyze the flow of physical units. This task can be done by using a bar diagram. Next, equivalent units must be calculated for each cost category. This is done by multiplying the number of physical units by the percentage of completion in each category. The same process is used for units started and completed and for ending inventory, whether the moving average or the FIFO cost flow assumption is used. Equivalent units of beginning inventory are treated differently under each assumption, however. Finally, the cost per unit is found by dividing the total monthly cost of each cost category by equivalent units for that category.

6. Calculate unit cost using the moving average method, and use it to compute the cost of completed units and ending work in process.

When an activity using a moving average has partially completed units on hand at both the beginning and end of the month, the costs of
the beginning inventory are averaged with the current month’s production costs. This average unit cost is then used to calculate the cost of goods transferred to finished goods and the cost of ending work in process.

7. Calculate unit cost using the FIFO method, and use it to compute the cost of completed units and ending work in process.

When the FIFO method is used, the costs of beginning work in process are separated from current costs. Using the current month’s costs and equivalent units, a unit cost is calculated for each cost category. The unit costs are used to calculate (1) the cost of completing beginning work in process and (2) the cost of units started and completed during the month. Finally, unit costs are used to calculate the cost of partially completed work in process at month end.

Because the moving average method is slightly easier and yields almost the same result as FIFO, most companies use a moving average.

Illustrative Problem 5.4 Process Cost Flows and Reports

Wallguard Home Paint Company produces exterior latex paint, which it sells in one-gallon containers. The company has two processing departments-Processing and Finishing: White paint, which is used as a base for all the company’s paints, is mixed from raw ingredients in the Processing Department. Pigments are then added to the basic white paint, the pigmented paint is squirted under pressure into one-gallon containers, and the containers are labeled and packed for shipping in the Finishing Department. Information relating to the company’s operations for April follows:

a. Raw materials were issued for use in production: Processing Department, $85,100; and Finishing department, $62,900

b. Direct labor costs were incurred: Processing Department, $33,000; and Finishing Department, $27,000
c. Manufacturing overhead cost was applied: Processing Department, $66,500; and Finishing Department, $40,500.

d. Basic white paint was transferred from the Processing Department to the Finishing Department, $185,000.

e. Paint that had been prepared for shipping was transferred from the Finishing Department to Finishing Goods, $320,000.

REQUIRED:

1. Prepare journal entries to record items (a) through (e) above.

2. Post the journal entries form (1) above to T-accounts. The balance in the Processing Department’s Work in Process account on April 1 was $15,000; the balance in the Finishing Department’s Work in Process account was $7,000. After posting entries to the T-accounts, find the ending balance in each department’s Work in Process account.

3. Prepare a production report for the Processing Department for April. The following additional information is available regarding production in the Processing Department during April:

Production data

Units (gallons) in process, April 1: materials 100% complete, Labor and overhead 60% complete 3,000
Units (gallons) started into production during April 42,000
Units (gallons) completed and transferred to the Finishing Department 37,000
Units (gallons) in process, April 30; materials 50% complete, Labor and overhead 25% complete 8,000

Cost data:

Work in process inventory, April 1:

<table>
<thead>
<tr>
<th>Materials</th>
<th>Labor</th>
<th>Overhead</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,200</td>
<td>2,100</td>
<td>3,700</td>
</tr>
</tbody>
</table>

Total cost of work in process $15,000
Cost added during April:

- Materials $85,100
- Labor 33,000
- Overhead 66,500
- Total cost added during April $184,600

Solution: Wallguard Home Paint Company

1. a. Work in Process – Processing Department 85,100
   Work in Process – Finishing Department 62,900
   Raw Materials 148,000

   b. Work in Process – Processing Department 33,000
      Work in Process – Finishing Department 27,000
      Salaries and Wages Payable 60,000

   c. Work in Process – Processing Department 66,500
      Work in Process – Finishing Department 40,500
      Manufacturing Overhead 107,000

   d. Work in Process – Finishing Department 185,000
      Work in Process – Processing Department 185,000

   e. Finished Goods 320,000
      Work in Process – Finishing Department 320,000

2.

<table>
<thead>
<tr>
<th>Work in process</th>
<th>Work in process</th>
<th>Finished goods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing</td>
<td>Finishing</td>
<td></td>
</tr>
<tr>
<td>Department</td>
<td>Department</td>
<td></td>
</tr>
<tr>
<td>Bal 15,000</td>
<td>Bal 7,000</td>
<td>Bal XXX</td>
</tr>
<tr>
<td>a 85,100</td>
<td>a 62,900</td>
<td>e 320,000</td>
</tr>
<tr>
<td>b 33,000</td>
<td>b 27,000</td>
<td></td>
</tr>
<tr>
<td>c 66,500</td>
<td>c 40,500</td>
<td></td>
</tr>
<tr>
<td>d 66,500</td>
<td>d 185,000</td>
<td></td>
</tr>
<tr>
<td>Bal 14,600</td>
<td>Bal 2,400</td>
<td></td>
</tr>
</tbody>
</table>

Manufacturing overhead

| (Variable overhead costs) c 107,000 |

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Chapter 5 System Design: Job-order Costing and Process Costing

3.

### WELLGUARD HOME PAINT COMPANY

**Production Cost Report - Processing Department**

*For the month ended April 30*

<table>
<thead>
<tr>
<th>Physical Units</th>
<th>% of Comp.</th>
<th>Equivalent Units</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in Process: Beg</td>
<td>3,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start during the month</td>
<td>42,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To account for</td>
<td>45,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete and Transferred</td>
<td>37,000</td>
<td>100%</td>
<td>37,000</td>
</tr>
<tr>
<td>Work in Process: End</td>
<td>8,000</td>
<td>50%/25%</td>
<td>4,000</td>
</tr>
<tr>
<td>To be accounted for</td>
<td>45,000</td>
<td></td>
<td>41,000</td>
</tr>
</tbody>
</table>

| | | Material | Labor | Overhead | Total |
|-------------------------------|------------------|------------------|------------------|------------------|
| Work in Process: Beg | | $9,200 | $2,100 | $3,700 | $12,900 |
| Cost incurred during month | 85,100 | 33,000 | 66,500 | 184,600 |
| Total Cost to account for | $94,300 | $35,100 | $70,200 | $164,500 |
| Equivalent Unit | 41,000 | 39,000 | 39,000 |
| Cost per Unit | $2.30 | $0.90 | $1.80 | $4.10 |
| **Reconciliation** | | | | | |
| Completed and transferred out | | $4.10 * 37,000 | | $151,700 |
| Work in Process: End | | | | | |
| Material | | $2.30 * 4,000 | | 9,200 |
| Labor | | $0.90 * 2,000 | | 1,800 |
| Manufacturing overhead | | $1.80 * 2,000 | | 3,600 |
| Total Cost to be accounted for | | | | $164,500 |

### Illustrative Problem 5.5 Manufacturing Applications of Process Costing

Camia Company manufactures a product that goes through three departments, A, B, and C. Information relating to activity I department A during October is given below:

<table>
<thead>
<tr>
<th>Units</th>
<th>Percent Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Conversion</td>
<td></td>
</tr>
<tr>
<td>Work in Process, October 1</td>
<td>50,000</td>
</tr>
<tr>
<td>Started into production</td>
<td>390,000</td>
</tr>
<tr>
<td>Completed and transferred to Department B</td>
<td>410,000</td>
</tr>
<tr>
<td>Work in process, October 31</td>
<td>30,000</td>
</tr>
</tbody>
</table>

**REQUIRED:**

1. Compute the equivalent units for October, assuming that the company uses the weighted average method of accounting for units and costs.

2. Compute the equivalent units of production for October, assuming that the company uses the FIFO method of accounting for units and costs.

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Solution: Camia Company

1. Weighted – Average Method

Units accounted for as follows:

<table>
<thead>
<tr>
<th>Equivalent Units</th>
<th>Materials</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units transferred to Department B</td>
<td>410,000</td>
<td>410,000</td>
</tr>
<tr>
<td>Work in process, October 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30,000 units x 70%</td>
<td>21,000</td>
<td></td>
</tr>
<tr>
<td>30,000 units x 50%</td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>Equivalent units of production</td>
<td>431,000</td>
<td>425,000</td>
</tr>
</tbody>
</table>

2. FIFO Method

Units to be accounted for as follows:

<table>
<thead>
<tr>
<th>Equivalent Units</th>
<th>Materials</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in process, October 1:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50,000 units x 10% *</td>
<td>5,000</td>
<td></td>
</tr>
<tr>
<td>50,000 units x 40% *</td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>Started and completed during October**</td>
<td>360,000</td>
<td>360,000</td>
</tr>
<tr>
<td>Work in process, October 31:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30,000 units x 70% *</td>
<td>21,000</td>
<td></td>
</tr>
<tr>
<td>30,000 units x 50% *</td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>Equivalent units of production</td>
<td>386,000</td>
<td>395,000</td>
</tr>
</tbody>
</table>

* Work needed to complete these units.
** 410,000 – 50,000 = 360,000

Systems Choice: Job Costing versus Process Costing

In job costing, costs are collected for each unit produced. In process costing, costs are accumulated in a department for an accounting period (for example, a month). Then spread evenly or averaged, over all units produced that month. Process costing assumes each unit produced is relatively uniform.

Process costing has less detailed recordkeeping; hence, if a company was choosing between job and process costing, it would generally find that recordkeeping costs are lower under process costing. Of course,
process costing does not provide as much information as job costing because records of the cost of each unit produced are not kept using process costing. The choice of process versus job costing systems involves a comparison of the costs and benefits of each system.

As a general rule, job systems are usually more costly than process system. Thus, managers and accountants must decide whether there are enough additional benefits (for example, from better decisions) from knowing the actual cost of each unit, which is available in a job costing system, to justify additional recordkeeping costs. For companies producing relatively large, heterogeneous items, the additional benefits of job costing usually justify the additional recordkeeping costs.

If recordkeeping costs were equal under job and process systems for the units in a product line, then the job systems are better because they provide all of the data that process systems do, plus more.

**Operation Costing**

**Concept and Application**

Each company develops its own product costing system that meets its specific needs. Many companies employ an operation costing system in the manufacture of goods that have some common characteristics plus some individual characteristics. An operation is a routine production method, technique, or step that is repetitively performed. Distinctions are made between batches of product, such as Style A ladies’ suits and Style B ladies’ suits. For example, various styles of ladies’ suits require different fabrics and different hand sewing operations.

As in job order costing, accountants specifically allocate direct materials to the batches using operation costing. However, direct labor and overhead are absorbed in the same manner as under process costing. They apply conversion costs to physical units passing through the operation by using a single average unit conversion cost for the operation. Operation costing best meets the needs of a batch of manufacturer whose products has variations of single design and requires a varying sequence of standardized operations.
Chapter 5 System Design: Job-order Costing and Process Costing

An operation costing system represents a hybrid method, having some of the characteristics of both process and job order costing. For example, in operation costing, accountants allocate direct materials specifically to the batches. This is like job order costing. They apply direct labor and overhead to all physical units passing through the operation by using a single average unit conversion cost for the operation. This is like process costing.

Companies use operation costing when manufacturing goods that have some common characteristics plus some individual characteristics. Operation costing meets the needs of a batch manufacturer whose products have variations of a single design and requires a varying sequence of standardized operations. Job costing continues to be the best alternative for accumulating the cost of contracts and customized manufacturing. However, the trend is toward process costing systems and cost systems that are custom designed, such as operation costing.
Chapter 5 System Design: Job-order Costing and Process Costing

SHORT QUESTIONS:
1. Describe the flow of costs in a job order cost system
2. Explain the nature and importance of a job cost sheet.
3. Indicate how the predetermined overhead rate is determined and used in both job order costing and process costing system
4. Distinguish between under- and overapplied manufacturing overhead.

EXERCISES:

Problem 1:

A selected list of accounts used by Cline Manufacturing Company follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>F</td>
</tr>
<tr>
<td>B</td>
<td>G</td>
</tr>
<tr>
<td>C</td>
<td>H</td>
</tr>
<tr>
<td>D</td>
<td>I</td>
</tr>
<tr>
<td>E</td>
<td>J</td>
</tr>
</tbody>
</table>

A selected list of accounts used by Cline Manufacturing Company follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cash</td>
</tr>
<tr>
<td>B</td>
<td>Accounts Receivable</td>
</tr>
<tr>
<td>C</td>
<td>Raw Materials Inventory</td>
</tr>
<tr>
<td>D</td>
<td>Work In Process Inventory</td>
</tr>
<tr>
<td>E</td>
<td>Finished Goods Inventory</td>
</tr>
<tr>
<td>F</td>
<td>Accounts Payable</td>
</tr>
<tr>
<td>G</td>
<td>Factory Labor</td>
</tr>
<tr>
<td>H</td>
<td>Manufacturing Overhead</td>
</tr>
<tr>
<td>I</td>
<td>Cost of Goods Sold</td>
</tr>
<tr>
<td>J</td>
<td>Sales Revenue</td>
</tr>
</tbody>
</table>

Cline Manufacturing Company uses a job order system and maintains perpetual inventory records.

Required:
Place the appropriate code letter in the columns indicating the appropriate account(s) to be debited and credited for the transactions listed below.

<table>
<thead>
<tr>
<th>Transactions</th>
<th>Account(s) Debited</th>
<th>Account(s) Credited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials were purchased on account.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issued a check to Dixon Machine Shop for repair work on factory equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct materials were requisitioned for Job 280.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory labor was paid as incurred.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognized direct labor and indirect labor used.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The production department requisitioned indirect materials for use in the factory.

Overhead was applied to production based on a predetermined overhead rate of $8 per labor hour.

Goods that were completed were transferred to finished goods.

Goods costing $80,000 were sold for $105,000 on account.

Paid for raw materials purchased previously on account.

<table>
<thead>
<tr>
<th>Problem 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sardin Company begins the month of March with $17,000 of work in process costs from Job 324. Information from job cost sheets shows the following additional costs assigned during March, April, and May of 2013:</td>
</tr>
</tbody>
</table>

| Manufacturing Costs Assigned |
|---|---|---|
| Job No. | March | April | May |
| 324 | $26,000 |
| 325 | 20,000 | 28,000 | $15,000 |
| 326 | 41,000 | 11,000 |
| 327 | 16,000 | 34,000 |
| 328 | 29,000 | 51,000 |

Job 324 was completed in March. Jobs 325 and 327 were completed in May, and Job 326 was completed in April. Jobs are sold during the month after completion. Total revenue for jobs sold during the 3-month period is $145,000.

**Required**

Calculate the balances of the work in process and finished goods inventory accounts at the end of May.
Chapter 5 System Design: Job-order Costing and Process Costing

Problem 3:

Foster Manufacturing uses a job order cost accounting system. On April 1, the company has Work in Process Inventory of $7,600 and two jobs in process: Job No. 221, $3,600, and Job No. 222, $4,000. During April, a summary of source documents reveals the following:

<table>
<thead>
<tr>
<th>Materials Requisition Slips</th>
<th>Labor Time Tickets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job No.221</td>
<td>$1,200</td>
</tr>
<tr>
<td>222</td>
<td>1,700</td>
</tr>
<tr>
<td>223</td>
<td>2,400</td>
</tr>
<tr>
<td>224</td>
<td>2,600</td>
</tr>
<tr>
<td>General use</td>
<td>600</td>
</tr>
<tr>
<td>Totals</td>
<td>$8,500</td>
</tr>
<tr>
<td></td>
<td>$1,600</td>
</tr>
<tr>
<td></td>
<td>2,200</td>
</tr>
<tr>
<td></td>
<td>2,900</td>
</tr>
<tr>
<td></td>
<td>2,800</td>
</tr>
<tr>
<td></td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>$9,900</td>
</tr>
</tbody>
</table>

Foster applies manufacturing overhead to jobs at an overhead rate of 60% of direct labor cost. Job No. 221 is completed during the month.

Required
1. Prepare summary journal entries to record the raw materials requisitioned, factory labor used, the assignment of manufacturing overhead to jobs, and the completion of Job No. 221.

2. Calculate the balance of the Work in Process Inventory account at April 30.

Problem 4:

Manhattan, Inc., uses a weighted-average process-costing system. All materials are introduced at the beginning of production; conversion cost is incurred evenly throughout manufacturing. The following information pertains to April:

- Beginning work in process (80% complete): 9,000 units
- Goods completed during April: 53,000 units
- Ending work in process (30% complete): 12,000 units

The company's accountant has already computed the cost per equivalent unit, as follows: materials, $5; conversion, $14.
Required:
Calculate the cost of goods completed during April and the cost of the ending work-in-process inventory.

Problem 5:

Marcellus Corporation, which uses the weighted-average method of process costing, reported the following as of February 1:

<table>
<thead>
<tr>
<th>Work in process, Feb. 1:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct material</td>
<td>$42,000</td>
</tr>
<tr>
<td>Conversion</td>
<td>20,000</td>
</tr>
<tr>
<td>February production costs:</td>
<td></td>
</tr>
<tr>
<td>Direct material</td>
<td>470,000</td>
</tr>
<tr>
<td>Conversion</td>
<td>280,000</td>
</tr>
</tbody>
</table>

Conversations with the production supervisor revealed that materials are introduced at the start of the process and conversion cost is incurred evenly throughout manufacturing. The company started 29,000 units during the month. Goods in process at the beginning and end of February totaled 3,000 units and 5,000 units, respectively, the latter batch being 60% complete.

Just prior to leaving on vacation, a trusted staff assistant was asked to compute the cost of February's ending work-in-process inventory. Her calculations showed a huge rise in unit cost when compared with the February 1 figures, soaring to $250 [($470,000 + $280,000) ÷ 3,000 units (5,000 units × 60%)].

Required:
1. Did the staff assistant make any errors in her calculations? Explain.
2. Analyze the company's production volume and determine the proper equivalent-unit figures for February.
3. Calculate the proper unit costs for February.
4. Calculate the cost of the February 28 work-in-process inventory.
Problem 6:

Baxley Products manufactures office furniture by using an assembly-line process. All direct materials are introduced at the start of the process, and conversion cost is incurred evenly throughout manufacturing. An examination of the company's Work-in-Process account for August revealed the following selected information:

**Debit side**
August 1 balance: 600 units, 40% complete; cost, $44,600*
Production started: 1,800 units
Direct materials used during August: $90,000
August conversion cost: $51,400

**Credit side**
Production completed: 1,400 units
Supplementary records disclosed direct material cost of $30,000 and conversion cost of $14,600.
Conversation with manufacturing personnel revealed that the ending work in process was 80% complete.

Required:
1. Prepare a production cost report for the month ended August 31, to determine the followings:
   a. the number of units in the August 31 work-in-process inventory.
   b. the cost of goods completed during August.
   c. the cost of the August 31 work-in-process inventory.
2. Prepare the appropriate journal entry to record completed production.
CHAPTER 6
SYSTEMS DESIGN:
ACTIVITY-BASED COSTING AND MANAGEMENT

After studying this chapter, you should be able to:
1. Define activity-based costing.
2. State the advantage and limitations of activity-based costing.
3. Describe the steps in designing an activity-based costing system.
4. Enumerate example of activity centers, cost drivers, and traceable costs.
5. Apply activity-based costing to a manufacturing company.
6. Apply activity-based costing to a merchandising company.
7. Apply activity-based costing to a trading company.
8. Discuss activity-based management.
9. Describe the opportunity cost concept.
CHAPTER 6
SYSTEMS DESIGN:
ACTIVITY-BASED COSTING AND MANAGEMENT

ACTIVITY-BASED COSTING

The most difficult task in computing accurate unit cost lies in determining the proper amount of overhead cost to assign to each job, a unit of product or service activity.

Today, accountants recognize that manufacturing and providing services are related activities. Thus, they direct attention to the cost of these activities. The activity-based management system links resource consumption to the activities a company performs and costs the activities to products or customers. Activity-based management uses activity-based costing (also called transaction-based costing) to measure and control these relationships.

Activity-based costing (ABC) has been developed in response to the manager’s need for more accurate product costs to make them more globally competitive.

ABC helps managers identify more clearly the costs involved in manufacturing a product or providing a service and thereby provides more accurate unit cost information on which to base pricing and other decisions.

Activity-based costing (ABC) is a costing method that is designed to provide managers with cost information for strategic and other decisions that potentially affect capacity and therefore “fixed” costs. ABC is ordinarily used as a supplement to, rather than as a replacement for the company’s usual costing system.

Most organizations that use activity-based costing have two costing systems- the official costing system that is used for preparing external financial reports and the activity-based costing system that is used for internal decision making and for managing activities.
Advantages and Limitations of ABC

Activity-based costing provides several benefits to the manager, namely

1. More accurate product costs
2. Better data for decision making
3. Tighter cost control

ABC has also several limitations, the chief of which is the difficulty and high costs involved with gathering data relating to activity centers and cost drivers.

Design of an Activity-Based Costing System
The steps or activities required in designing an ABC system are

1. Process Value Analysis (PVA)
2. Identifying Activity Centers
3. Assigning Costs to Activity Centers
4. Selecting Cost Drivers

Step 1. Process Value Analysis involves the following steps.
   a) Analyze activities required to make the product or perform the service. This can be done through the preparation of a flowchart detailing each in the manufacturing process from the receiving of materials to the final inspection of the completed product. This requires walking through an operation and documenting every activity observed as well as the time involved. An activity is any event or transaction that is a cost driver—that is, it causes the incurrence of cost in an organization.
   b) Classify each activity as value-added or non-value-added.
   c) Identify ways to either reduce or eliminate the non-value-added activities.
Example. Suppose the production process looks like this.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Nature of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving</td>
<td>non-value-added activity</td>
</tr>
<tr>
<td>Store raw materials</td>
<td>non-value-added activity</td>
</tr>
<tr>
<td>Operation 1</td>
<td>value-added activity</td>
</tr>
<tr>
<td>Move and wait</td>
<td>non-value-added activity</td>
</tr>
<tr>
<td>Operation 2</td>
<td>value-added activity</td>
</tr>
<tr>
<td>Store finished goods</td>
<td>non-value-added activity</td>
</tr>
<tr>
<td>Pack and ship</td>
<td>value-added activity</td>
</tr>
</tbody>
</table>

The goal is to reduce or eliminate the non-value added activities.

Step 2. Identifying Activity Centers

An activity center can be defined as a part of the production process for which management wants a separate reporting of the cost of the activity involved. Generally, the levels of activities can be classified into four as follows:

1. Unit-level activities, which are performed each time a unit is produced;
2. Batch-level activities, which are performed each time a batch of goods is handled or processed;
3. Product-level activities, which are performed as needed to support the production of each different type of product; and
4. Facility-level activities which simply sustain a facility's general manufacturing process.

Step 3. Assign Cost to Activity Centers

Assign costs to the activity centers where they are accumulated while waiting to be applied to products. Costs that are traceable to the activity center should be assigned directly to activity centers. Other costs shared by two or more activity centers should be
assigned according to some cost driver that controls the utilization of the costs involved.

Step 4. Select Cost Drivers

This involves assigning costs from the activity center to the product using appropriate cost drivers. When selecting a cost driver, one must consider the following factors:

1. The case of obtaining data relating to the cost driver
2. The degree to which the cost driver measures actual consumption by products of the activity method
3. Cost driver must be measurable, i.e., number of units produced, number of employees, area in square meter, direct labor hours, designing hours, etc.

Examples of Activity Centers, Cost Drivers, and Traceable Costs are shown in Figure 6.1

**Figure 6.1 Activity center, cost drivers and traceable costs.**

---

<table>
<thead>
<tr>
<th>Activity Centers</th>
<th>Cost Drivers</th>
<th>Traceable Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Unit – Level Activities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine-related activities, Such as milling, cutting, and maintenance</td>
<td>Machine-hours</td>
<td>Power costs</td>
</tr>
<tr>
<td>Labor-related activities, including fringe benefits</td>
<td>Labor-hours</td>
<td>Maintenance costs</td>
</tr>
<tr>
<td></td>
<td>Number of units of output</td>
<td>Labor costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory supplies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depreciation of general-use machines and equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depreciation of maintenance equipment</td>
</tr>
</tbody>
</table>

**II. Batch – Level activities**

<table>
<thead>
<tr>
<th>Activity Centers</th>
<th>Cost Drivers</th>
<th>Traceable Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase order processing</td>
<td>Number of orders processed</td>
<td>Clerical costs</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Supplies consumed</td>
</tr>
</tbody>
</table>
### III. Product-Level Activities

<table>
<thead>
<tr>
<th>Activity Centers</th>
<th>Cost Drivers</th>
<th>Traceable Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product testing</td>
<td>Number of tests</td>
<td>Testing facility costs</td>
</tr>
<tr>
<td>Parts inventory</td>
<td>Hours of testing time</td>
<td>Parts administration costs</td>
</tr>
<tr>
<td>management</td>
<td>Number of part types</td>
<td>Parts carrying costs</td>
</tr>
<tr>
<td>Product design</td>
<td>Hours of design time</td>
<td>Product engineering costs</td>
</tr>
<tr>
<td></td>
<td>Number of engineering change</td>
<td>Design costs</td>
</tr>
<tr>
<td></td>
<td>orders</td>
<td></td>
</tr>
</tbody>
</table>

### IV. Facility-Level Activities

<table>
<thead>
<tr>
<th>Activity Centers</th>
<th>Cost Drivers</th>
<th>Traceable Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>General factory</td>
<td>Machine-hours</td>
<td>Plant management salaries</td>
</tr>
<tr>
<td>Plant occupancy</td>
<td>Labor-hours</td>
<td>Plant depreciation</td>
</tr>
<tr>
<td>Personnel administration and training*</td>
<td>Number of employees (head count)</td>
<td>Property taxes &amp; insurance</td>
</tr>
<tr>
<td></td>
<td>Hours of training time</td>
<td>Personnel administration costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employee training costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work recreational facilities</td>
</tr>
</tbody>
</table>

* The costs of some of these activities may be traceable in part to the facility level and in part to other activity centers at the unit level, product level, and batch level. Personnel administration and training may be such an activity.
Illustrative Problem 6.1 Manufacturing Applications of Activity-based Costing

Each year, Lucky Company manufactures 4,000 units of Product X and 20,000 units of Product Y. The company currently uses direct labor hours to assign overhead costs to products. Product X requires 2.5 DLH and Product B requires 2.0 DLH to produce.

Presently, Lucky Company uses a plantwide overhead allocation rate. Using this method, the unit product cost is:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$36.00</td>
<td>$30.00</td>
</tr>
<tr>
<td>Direct labor</td>
<td>17.50</td>
<td>14.00</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>45.00</td>
<td></td>
</tr>
<tr>
<td>2.5 DLH x $18</td>
<td></td>
<td>36.00</td>
</tr>
<tr>
<td>2.0 DLH x $18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total unit product cost</td>
<td>$98.50</td>
<td>$80.00</td>
</tr>
</tbody>
</table>

Management at Lucky believes that overhead costs are actually caused by the following five activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Traceable cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setup</td>
<td>$255,000</td>
</tr>
<tr>
<td>Quality inspections</td>
<td>160,000</td>
</tr>
<tr>
<td>Production orders</td>
<td>81,000</td>
</tr>
<tr>
<td>Machine-hours worked</td>
<td>314,000</td>
</tr>
<tr>
<td>Material receipts</td>
<td>90,000</td>
</tr>
<tr>
<td>Total</td>
<td>$900,000</td>
</tr>
</tbody>
</table>

The following transaction data has been compiled by the management of Lucky:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total</th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setup</td>
<td>5,000</td>
<td>3,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Quality inspections</td>
<td>8,000</td>
<td>5,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Production orders</td>
<td>600</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Machine-hours worked</td>
<td>40,000</td>
<td>12,000</td>
<td>28,000</td>
</tr>
<tr>
<td>Material receipts</td>
<td>750</td>
<td>150</td>
<td>600</td>
</tr>
</tbody>
</table>
These data can be used to develop overhead rates for each of the five activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost</th>
<th>Total</th>
<th>ABC Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setup</td>
<td>$255,000</td>
<td>5,000</td>
<td>$51.00 per setup</td>
</tr>
<tr>
<td>Quality inspections</td>
<td>$160,000</td>
<td>8,000</td>
<td>$20.00 per inspections</td>
</tr>
<tr>
<td>Production orders</td>
<td>$81,000</td>
<td>600</td>
<td>$135.00 per order</td>
</tr>
<tr>
<td>Machine-hours worked</td>
<td>$314,000</td>
<td>40,000</td>
<td>$7.85 per hour</td>
</tr>
<tr>
<td>Material receipts</td>
<td>$90,000</td>
<td>750</td>
<td>$120.00 per receipt</td>
</tr>
</tbody>
</table>

The activity based overhead rates that were just calculated can be used to assign overhead costs to Luzon’s two products.

**Product A**

<table>
<thead>
<tr>
<th>Activity</th>
<th>ABC Rate</th>
<th>Transaction</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setup</td>
<td>$51.00 per setup</td>
<td>3,000</td>
<td>$153,000</td>
</tr>
<tr>
<td>Quality inspections</td>
<td>$20.00 per inspect.</td>
<td>5,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Production orders</td>
<td>$135.00 per order</td>
<td>200</td>
<td>27,000</td>
</tr>
<tr>
<td>Machine-hours worked</td>
<td>$7.85 per hour</td>
<td>12,000</td>
<td>94,200</td>
</tr>
<tr>
<td>Material receipts</td>
<td>$120.00 per receipt</td>
<td>150</td>
<td>18,000</td>
</tr>
<tr>
<td>Total overhead applied</td>
<td></td>
<td></td>
<td>$392,000</td>
</tr>
<tr>
<td>No. of units produced</td>
<td></td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Overhead per unit</td>
<td></td>
<td></td>
<td>$98.05</td>
</tr>
</tbody>
</table>

**Product B**

<table>
<thead>
<tr>
<th>Activity</th>
<th>ABC Rate</th>
<th>Transaction</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setup</td>
<td>$51.00 per setup</td>
<td>2,000</td>
<td>$102,000</td>
</tr>
<tr>
<td>Quality inspections</td>
<td>$20.00 per inspect.</td>
<td>3,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Production orders</td>
<td>$135.00 per order</td>
<td>400</td>
<td>54,000</td>
</tr>
<tr>
<td>Machine-hours worked</td>
<td>$7.85 per hour</td>
<td>28,000</td>
<td>219,800</td>
</tr>
<tr>
<td>worked</td>
<td>$120.00 per receipt</td>
<td>600</td>
<td>72,000</td>
</tr>
<tr>
<td>Material receipts</td>
<td></td>
<td></td>
<td>$507,800</td>
</tr>
<tr>
<td>Total OH applied</td>
<td></td>
<td></td>
<td>20,000</td>
</tr>
<tr>
<td>No. of units produced</td>
<td></td>
<td></td>
<td>$25.39</td>
</tr>
<tr>
<td>Overhead per unit</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now compare the unit product costs using the old costing system and our ABC system.
Chapter 6 System Design: Activity-Based Costing and Management

<table>
<thead>
<tr>
<th>Costing Method</th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity-based costing</td>
<td>$151.55</td>
<td>$69.39</td>
</tr>
<tr>
<td>Old costing system</td>
<td>98.50</td>
<td>80.00</td>
</tr>
</tbody>
</table>

**Illustrative Problem 6.2 Activity-based Costing Application to a Merchandising Company**

Essence, Inc., specializes in the distribution of soap products. Essence buys from manufacturers and resells to each of three different markets:

a. General supermarket chains  
b. Drugstore chains  
c. Small convenience stores

The new controller of Essence reported the following data for September:

<table>
<thead>
<tr>
<th>General supermarket chain</th>
<th>Drug store</th>
<th>Small Convenience store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average revenue per delivery</td>
<td>30,900</td>
<td>10,500</td>
</tr>
<tr>
<td>Average CGS per delivery</td>
<td>30,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Number of delivery</td>
<td>120</td>
<td>300</td>
</tr>
</tbody>
</table>

For many years, Essence has used gross margin percentage \([(Revenue - Cost of goods sold) + Revenue]\) to evaluate the relative profitability of its different groupings of customers (distribution outlets).

Controller recently attended a seminar on activity-based costing and decides to consider using it at Essence. He meets with all the key managers and many staff members. People generally agree that three are five key activity areas at Essence:

<table>
<thead>
<tr>
<th>Activity Area</th>
<th>Cost Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Customer purchase order processing</td>
<td>Purchase orders by customers</td>
</tr>
<tr>
<td>2. Line-item ordering</td>
<td>Line items per purchase order</td>
</tr>
<tr>
<td>3. Store delivery</td>
<td>Store deliveries</td>
</tr>
<tr>
<td>4. Cartons shipped to stores</td>
<td>Cartons shipped to a store per delivery</td>
</tr>
<tr>
<td>5. Shelf-stocking at customer stores</td>
<td>Hours of shelf - stocking</td>
</tr>
</tbody>
</table>

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Each customer purchase order consists of one or more line items. A line item represents a single product (such as Oil of Olay soap). Each store delivery entails delivery of one or more cartons of products to a customer. Each product is delivered in one or more separate cartons. Essence staffs stack cartons directly onto display shelves in a store. Currently, there is no charge for this service, and not all customers use Essence for this activity.

The September operating costs (other than cost of goods sold) of Essence are $301,080. These operating costs are assigned to the five activity areas. The costs in each area and the amount of the cost drivers units used in that area for September are as follows:

<table>
<thead>
<tr>
<th>Activity Area</th>
<th>Total Costs in September</th>
<th>Total Units of Cost Driver Used in September</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Customer purchase order</td>
<td>$80,000</td>
<td>2,000 orders</td>
</tr>
<tr>
<td>Processing</td>
<td>63,840</td>
<td>21,280 line items</td>
</tr>
<tr>
<td>2. Line-item ordering</td>
<td>71,000</td>
<td>1,420 store deliveries</td>
</tr>
<tr>
<td>3. Store delivery</td>
<td>76,000</td>
<td></td>
</tr>
<tr>
<td>4. Cartons shipped to store</td>
<td>10,240</td>
<td>76,000 cartons</td>
</tr>
<tr>
<td>5. Shelf – stocking at customer stores</td>
<td></td>
<td>640 hours</td>
</tr>
<tr>
<td></td>
<td>$301,080</td>
<td></td>
</tr>
</tbody>
</table>

Other data for September include the following:

<table>
<thead>
<tr>
<th>General supermarket chain</th>
<th>Drug store</th>
<th>Small Convenience store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of orders</td>
<td>140</td>
<td>360</td>
</tr>
<tr>
<td>Average number of line items per order</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total number of store deliveries</td>
<td>120</td>
<td>300</td>
</tr>
<tr>
<td>Average number of cartons shipped per store delivery</td>
<td>300</td>
<td>80</td>
</tr>
<tr>
<td>Average number of hours of shelf-stocking per store delivery</td>
<td>3.0</td>
<td>0.6</td>
</tr>
</tbody>
</table>

REQUIRED:
1. Compute the September gross-margin percentage for each of its three distribution markets. What is the operating income of Essence?
2. Compute the September per unit cost driver rate for each of the five activity areas.

3. Compute the operating income of each distribution market in September using the activity-based costing information. Comment on the results. What new insights are available with the activity-based information?

4. Describe four challengers controller would face in assigning the total September operating costs of $301,080 to the five activity areas.

Solution: Essence, Inc.

Requirement 1:

<table>
<thead>
<tr>
<th></th>
<th>General Supermarket chain</th>
<th>Drugstore chain</th>
<th>Small Convenience store</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue a</td>
<td>$3,708,000</td>
<td>$3,150,000</td>
<td>$1,980,000</td>
<td>$8,838,000</td>
</tr>
<tr>
<td>Cost of goods sold b</td>
<td>3,600,000</td>
<td>3,000,000</td>
<td>1,800,000</td>
<td>8400,000</td>
</tr>
<tr>
<td>Gross margin</td>
<td>108,000</td>
<td>150,000</td>
<td>180,000</td>
<td>438,000</td>
</tr>
<tr>
<td>Other operating costs</td>
<td></td>
<td></td>
<td></td>
<td>301,080</td>
</tr>
<tr>
<td>Operating income</td>
<td></td>
<td></td>
<td></td>
<td>$136,920</td>
</tr>
</tbody>
</table>

 Gross margin %

|                      | 2.91% | 4.76% | 9.09% |

\[a (30,900 \times 120); (10,500 \times 300); (1,980 \times 1,000)\]
\[b (30,000 \times 120); (10,000 \times 300); (1,800 \times 1,000)\]

The gross margin of Essence, Inc. was 4.96% ($438,000 / $8,838,000). The operating income margin of Essence, Inc. was 1.55% ($136,920 / $8,838,000).

Requirement 2: The per unit cost driver rates are:

1. Customer purchase order processing, $80,000 / 2,000
   = $40 per order

2. Line item ordering, $63,840 / 21,280
   = $3 per line item

3. Store delivery, $71,000 / 1,420
   = $50 per delivery

4. Cartons shipped to stores, $76,000 / 76,000
   = $1 per carton

5. Shelf-stocking, 410,240 / 640
   = $16 per hour
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Requirement 3: The activity-based costing of each distribution market for September is:

<table>
<thead>
<tr>
<th>Activity</th>
<th>General Supermarket chain</th>
<th>Drugstore chain</th>
<th>Small Convenience store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer purchase order processing</td>
<td>$5,600</td>
<td>$14,400</td>
<td>$60,000</td>
</tr>
<tr>
<td>($40 x 140; 360; 1,500)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line item ordering</td>
<td>5,880</td>
<td>12,960</td>
<td>45,000</td>
</tr>
<tr>
<td>[$3 x (140 x 14; 360 x 12; 1,500 x 10)]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store delivery</td>
<td>6,000</td>
<td>15,000</td>
<td>50,000</td>
</tr>
<tr>
<td>($50 x 120; 300; 1,000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cartons shipped to stores</td>
<td>36,000</td>
<td>24,000</td>
<td>16,000</td>
</tr>
<tr>
<td>[$1 x (120 x 300; 300 x 80; 1,000 x 16)]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelf-stocking</td>
<td>2,760</td>
<td>2,880</td>
<td>1,600</td>
</tr>
<tr>
<td>[$16 x (120 x 3; 3,300 x 0.6; 1,000 x 0.1)]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>$59,240</strong></td>
<td><strong>$69,240</strong></td>
<td><strong>$172,600</strong></td>
</tr>
</tbody>
</table>

The revised operating income statement is:

<table>
<thead>
<tr>
<th></th>
<th>General Supermarket chain</th>
<th>Drugstore chain</th>
<th>Small Convenience store</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$3,708,000</td>
<td>$3,150,000</td>
<td>$1,980,000</td>
<td>$8,838,000</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>3,600,000</td>
<td>3,000,000</td>
<td>1,800,000</td>
<td>8,400,000</td>
</tr>
<tr>
<td>Gross margin</td>
<td>108,000</td>
<td>150,000</td>
<td>180,000</td>
<td>438,000</td>
</tr>
<tr>
<td>Other operating costs</td>
<td>59,240</td>
<td>69,240</td>
<td>172,600</td>
<td>301,080</td>
</tr>
<tr>
<td>Operating income</td>
<td><strong>$48,760</strong></td>
<td><strong>$80,760</strong></td>
<td><strong>$7,400</strong></td>
<td><strong>$136,920</strong></td>
</tr>
<tr>
<td>Operating income %</td>
<td>1.31%</td>
<td>2.56%</td>
<td>0.37%</td>
<td></td>
</tr>
</tbody>
</table>

The ranking of the three markets are:

**Using Gross Margin**
1. Small Convenience Stores 9.09%
2. Drugstore Chains 4.76%
3. General Supermarket Chains 2.91%

**Using Operating Income**
1. Drugstore Chains 2.56%
2. General Supermarket Chains 1.31%
3. Small Convenience Stores 0.37%
The activity-based analysis of costs highlights how the Small Convenience Stores use a larger amount of Essence resources per revenue peso than do the other two markets. The ratio of the operating costs to revenues across the three markets is:

<table>
<thead>
<tr>
<th>Type</th>
<th>Ratio</th>
<th>Operating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Supermarket Chains</td>
<td>1.60%</td>
<td>$ 59,240 / $3,708,000</td>
</tr>
<tr>
<td>Drugstore Chains</td>
<td>2.20%</td>
<td>$ 69,240 / $3,150,000</td>
</tr>
<tr>
<td>Small Convenience Stores</td>
<td>8.72%</td>
<td>$172,600 / $1,980,000</td>
</tr>
</tbody>
</table>

Requirement 4: Problems that may be encountered in assigning costs

a. Choosing the appropriate cost drivers for each area. The case gives a cost driver for each chosen activity area. However, it is likely that over time further refinements in cost drivers would occur. For example, not all store deliveries are equally easy to make, depending on parking availability, accessibility of the storage/shelf space to the delivery point, etc. Similarly, not all cartons are equally easy to deliver – their weight, size, or likely breakage component are factors that can vary across carton types.

b. Developing a reliable data base on the chosen cost drivers. For some items, such as the number of orders and the number of line items, this information likely would be available in machine readable form at a high level of accuracy. Unless the delivery personnel have hand-held computers that they use in a systematic way, estimates of shelf-stocking time are likely to be unreliable. Advances in information technology likely will reduce problems in this area over time.

c. Deciding how to handle costs that may be common across several activities. For example, (3) store delivery and (4) cartons shipped to stores have the common cost of the same trip. Some organizations may treat (3) as the primary activity and attribute to (4) only incremental costs. Similarly, (1) order processing and (2) line item ordering may have common costs.

d. Choice of the time period to compute cost rates per cost driver. Cruz calculates driver rates on a monthly basis (September 2005). He may want to consider using longer time periods that may be less affected by seasonal or random variations in demand.
e. Behavioral factors are likely to be a challenge to Cruz. He must now tell those salespeople who specialize in Small Convenience stores accounts that they have been less profitable than previously thought.

Illustrative Problem 6.3 Activity-based Costing Application to a Trading Company

"Foods R Us" Supermarkets found that its ABC analysis provided important insights. It extends the analysis to cover three more product lines – breads & pastries, juices, and frozen delights. The revenues, cost of goods sold, store support costs, and activity area usage of the three product lines is as follows:

<table>
<thead>
<tr>
<th>Financial data</th>
<th>Breads &amp; Pastries</th>
<th>Juices</th>
<th>Frozen Delights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$57,000</td>
<td>$53,000</td>
<td>$52,000</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>38,000</td>
<td>47,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Store support</td>
<td>11,400</td>
<td>14,100</td>
<td>10,500</td>
</tr>
<tr>
<td>Activity area usage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordering (purchase orders)</td>
<td>30</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>Delivery (deliveries)</td>
<td>98</td>
<td>38</td>
<td>28</td>
</tr>
<tr>
<td>Shelf-stocking (hours)</td>
<td>183</td>
<td>165</td>
<td>24</td>
</tr>
<tr>
<td>Customer support (items sold)</td>
<td>15,500</td>
<td>20,500</td>
<td>7,900</td>
</tr>
</tbody>
</table>

There are no bottle returns for any of these three product lines.

REQUIRED:

1. Use the previous costing system (support costs allocated to products at the rate of 30% of cost of goods sold) to compute a product-line profitability report for "Foods R Us".

2. Use the ABC system (ordering at $100 per purchase order, delivery at $80 per delivery, shelf-stacking at $20 per hour, and customer support at $0.20 per item sold) to compute a product-line profitability report for "Foods R Us".

3. What new insights does the ABC system in requirement 2 provide to "Foods R Us" managers?
Solution: “Foods R Us” Supermarkets

Requirement 1

The previous costing system reports the following:

<table>
<thead>
<tr>
<th></th>
<th>Breads &amp; Pastries</th>
<th>Juices</th>
<th>Frozen Delights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$57,000</td>
<td>$63,000</td>
<td>$52,000</td>
<td>$172,000</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs of goods sold</td>
<td>38,000</td>
<td>47,000</td>
<td>36,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Store support</td>
<td>11,400</td>
<td>14,100</td>
<td>10,500</td>
<td>36,000</td>
</tr>
<tr>
<td>Total costs</td>
<td>49,400</td>
<td>61,100</td>
<td>46,500</td>
<td>156,000</td>
</tr>
<tr>
<td>Operating income</td>
<td>$7,600</td>
<td>$1,900</td>
<td>$6,500</td>
<td>$16,000</td>
</tr>
<tr>
<td>income / Revenues</td>
<td>13.33%</td>
<td>3.02%</td>
<td>12.50%</td>
<td>9.30%</td>
</tr>
</tbody>
</table>

Requirement 2.

The ABC system reports the following:

<table>
<thead>
<tr>
<th></th>
<th>Breads &amp; Pastries</th>
<th>Juices</th>
<th>Frozen Delights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$57,000</td>
<td>$63,000</td>
<td>$52,000</td>
<td>$172,000</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs of goods sold</td>
<td>38,000</td>
<td>47,000</td>
<td>35,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Ordering</td>
<td>3,000</td>
<td>2,500</td>
<td>1,300</td>
<td>6,800</td>
</tr>
<tr>
<td>Delivery</td>
<td>7,840</td>
<td>2,880</td>
<td>2,240</td>
<td>12,960</td>
</tr>
<tr>
<td>Shelf-stocking</td>
<td>3,660</td>
<td>3,320</td>
<td>480</td>
<td>7,460</td>
</tr>
<tr>
<td>Customer support</td>
<td>3,100</td>
<td>4,100</td>
<td>1,580</td>
<td>8,780</td>
</tr>
<tr>
<td>Total costs</td>
<td>55,600</td>
<td>59,800</td>
<td>40,600</td>
<td>156,000</td>
</tr>
<tr>
<td>Operating income</td>
<td>$1,400</td>
<td>$3,200</td>
<td>$11,400</td>
<td>$16,000</td>
</tr>
<tr>
<td>income / Revenues</td>
<td>2.46%</td>
<td>5.08%</td>
<td>21.92%</td>
<td>9.30%</td>
</tr>
</tbody>
</table>

These activity costs are based on the following:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost Allocation Rate</th>
<th>Breads &amp; Pastries</th>
<th>Juices</th>
<th>Frozen Delights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering</td>
<td>$100 per purchase order</td>
<td>30</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>Delivery</td>
<td>$80 per delivery</td>
<td>98</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td>Shelf-stocking</td>
<td>$20 per hour</td>
<td>183</td>
<td>166</td>
<td>24</td>
</tr>
<tr>
<td>Customer support</td>
<td>$0.20 per item sold</td>
<td>15,500</td>
<td>20,500</td>
<td>7,900</td>
</tr>
</tbody>
</table>
The ranking of products in terms of relative profitability are:

<table>
<thead>
<tr>
<th>Previous Costing System</th>
<th>ABC System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Breads &amp; pastries</td>
<td>Frozen delights</td>
</tr>
<tr>
<td>13.33%</td>
<td>21.92%</td>
</tr>
<tr>
<td>2. Frozen delights</td>
<td>Juices</td>
</tr>
<tr>
<td>12.50</td>
<td>5.08</td>
</tr>
<tr>
<td>3. Juices</td>
<td>Breads &amp; pastries</td>
</tr>
<tr>
<td>3.02</td>
<td>2.46</td>
</tr>
</tbody>
</table>

The percentage revenue, COGS, and activity costs for each product-line are:

<table>
<thead>
<tr>
<th></th>
<th>Breads &amp; Pastries</th>
<th>Juices</th>
<th>Frozen Delights</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>33.14</td>
<td>36.63</td>
<td>60.23</td>
<td>100.00</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>31.67</td>
<td>39.17</td>
<td>29.16</td>
<td>100.00</td>
</tr>
<tr>
<td>Activity areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordering</td>
<td>44.12</td>
<td>36.76</td>
<td>19.12</td>
<td>100.00</td>
</tr>
<tr>
<td>Delivery</td>
<td>60.49</td>
<td>22.22</td>
<td>17.28</td>
<td>100.00</td>
</tr>
<tr>
<td>Shelf-stocking</td>
<td>49.06</td>
<td>44.50</td>
<td>6.44</td>
<td>100.00</td>
</tr>
<tr>
<td>Customer support</td>
<td>35.31</td>
<td>46.70</td>
<td>17.09</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Requirement 3.

The breads & pastries line drops sizably in profitability when the ABC is used. Although it constitutes 31.67% of cost of goods sold, it uses a higher percentage of total resources in each activity area, especially the high cost delivery activity area. In contrast, frozen delights draw a much lower percentage of total resources used in each activity area than its percentage of total cost of goods sold. Hence, under ABC, frozen delights are much more profitable.

"Foods R Us" Supermarkets may want to explore ways to increase sales of frozen delight. It may also want to explore price increases on breads & pastries.

**ACTIVITY-BASED MANAGEMENT**

Activity-based management (ABM) is a management tool that involves analyzing and costing activities with the goal of improving efficiency and
effectiveness. Basically, this management approach aims to improve the value of products or services to customers and increase the firm's profit. May companies draw on ABC as its major source of information and focuses on the efficiency and effectiveness of key business processes and activities.

Using ABM enhances management's ability to pinpoint avenues for improving operations, reducing costs, or increasing values to customer. By identifying the resources spent on customer, products and activities, ABM improve, management's focus on the firm's critical success factors and enhances its competitive advantage.

ABM is closely related to ABC, but the two schemes differ in their primary goals. To clarify the difference, consider activities involved in setting up machinery for a production user. ABC seeks to measure the cost of setups and then assign a cost to products based on how many setups each product requires. The objective of ABM, on the other hand, is to improve the efficiency and effectiveness of these activities. Therefore, ABM would focus on ways to improve the setup process and ways to eliminate the demand for set-up activity (thus reducing setup cost). In other words, one needs to know the costs of activities before one can do a good job of managing them.

There are basically two categories of ABM applications, namely

a. Operational ABM, and

b. Strategic ABM.

Operational ABM enhances operation efficiency and asset utilization and lowers cost. It focuses on doing things right and performing activities more efficiently. Among the management techniques that are applied in operational ABM are activity management, business process reengineering total quality management and performance management.

Strategic ABM, on the other hand, attempts to alter the demand for activities and increase profitability at the current or improved activity efficiency. It focuses on choosing the activities for the operations. Strategic ABM applications use management techniques such as process design, product-line and customer mix, supplier relationship; customer
relationship (delivery, pricing, order size, packaging, etc.) market segmentation and distribution channel.

Frequently, ABM uses cost-driver analysis, activity analysis and performance measurement, to improve operations. A brief explanation of these techniques follows:

**Cost-driver analysis**

This technique examines, quantifies, and explains the effects of the cost driver on the cost of an activity. Its purpose is to search for the root cause of activity costs. Among the tools used in cost driver analysis include benchmarking, cause-and-effect diagrams, and Pareto analysis.

Benchmarking involves the search for the best practices anywhere to identify ways to improve the operation for a task, activity, or process.

A cause-and-effect diagram maps out cause that effect an activity, process, stated problem or desired outcome.

A Pareto analysis is a histogram of the cost drivers that contribute to the total cost. Most analysis under this technique shows that 20 percent of the cost drivers are responsible for 80 percent of the total cost incurred.

**Activity analysis**

To be competitive a firm must assess each of its activities based on its need by the product or customer; and its value content. A firm performs an activity because it is:

- Required to meet the specification of the product or service or satisfy customer demand;
- Required to sustain the organization; or
- Deemed beneficial to the firm.

Activity analysis identifies and describes the activities in an organization. Through interviews, questionnaires, observation, and a review of documentation, an activity analysis collects information.
Performance measurement

This involves the identification of the work performed and the results achieved by an activity process, or organizational unit. Performance measures include both financial and nonfinancial. Examples of financial performance measures are the cost per unit of output, return on sales, and cost of every department’s high-value added and low-valued-added activities.

Nonfinancial performance measures evaluate operating characteristics of manufacturing process and measures of or feedback from customers or personnel. Examples of nonfinancial performance measures are the:

(a) number of customer complaints
(b) customer satisfaction
(c) number of defective parts or output
(d) number of output unit
(e) cycle-time
(f) on-time delivery rate
(g) number of employees suggestions
(h) score on employee morale.

Opportunity Costing Concepts

One significant factor that managers should include in their decision process information is the capacity usage of the plant and the other resources of the entity. Capacity usage information is a critical signal of the potential relevance of opportunity costs, the benefit lost when one chosen option precludes the benefits from an alternative option.

When a firm has excess capacity, that is, it is able to produce the current demand as well as handle a special order or new product, no opportunity cost is present. When the plant is operating at full capacity, opportunity costs are an important consideration because the decision to produce a special order or add a new product line can cause the reduction, delay, or loss of sales of products and services currently offered.

When opportunity costs are relevant, the manager must consider the value of lost sales as well as the contribution from the new order or new product.
Managers can never be sure whether their decisions were wise or unwise because

1. unexpected events can influence subsequent results, and

2. what would have happened had the decision been different can never be known.

Before making a decision, managers must gain a thorough understanding of the cost information that is relevant. In previous chapters, we have examined various issues involving costs: determining the costs of products and services using job order and process costing systems, activity-based costing, and variable costing. In the course of those discussions, we considered examples of how cost information is used in decision making.

The basic approach to decision making is to compare decision alternatives in terms of costs and revenues that are incremental. Cost that can be avoided by taking a particular course of action are always incremental costs and, therefore, relevant to the analysis of a decision. Costs that are sunk (i.e., already incurred and not reversible) are never incremental costs, because they do not differ among the decision alternatives. Therefore, they are not relevant in making a decision.

Students of managerial accounting often assume that fixed costs are equivalent to sunk costs and are thus irrelevant (i.e., are not incremental costs), but this is not always the case. Fixed costs may be sunk and, therefore, irrelevant. Fixed costs may not be sunk but still irrelevant. Finally, fixed costs may not be sunk and may be relevant.

Finally, opportunity costs represent the benefit foregone by selecting a particular decision alternative over another. By their nature, they are always incremental costs, and they must be considered when making a decision. To illustrate opportunity costs, consider this example. The company is considering dropping the garden supplies product line. Suppose that if garden supplies are dropped, more space can be devoted to selling tools, sales of tools will increase and the contribution margin associated with tools will increase by $20,000. In this case, there is a $20,000 opportunity cost associated with the decision to keep the garden supplies product line. Considering this opportunity cost would make
dropping the product line desirable than undesirable if the contribution margin of the contribution margin of the garden supplies is lesser.

If a resource can be used in more than one way, it has an opportunity cost. An opportunity cost is the benefit lost by taking one action as opposed to another. The "other" action is the best alternative available other than the one being contemplated.

**Illustrative Problem 7.4 Opportunity Costs**

The Rainbow Corporation is working at full production capacity producing 10,000 units of a unique product, Spectrum. Manufacturing costs per unit for Spectrum are as follows:

- Direct materials: $2
- Direct manufacturing labor: $3
- Manufacturing overhead: $5

**Total manufacturing costs:** $10

Manufacturing overhead costs per unit are based on variable costs per unit of $2 and fixed costs of $30,000 (at full capacity of 10,000 units). Selling costs, all variable, are $4 per unit, and the selling price is $20.

A customer, the Summer Company, has asked Rainbow to produce 2,000 units of Kaleidoscope, a modification of Spectrum. Kaleidoscope would require the same manufacturing processes as Spectrum. Summer has offered to pay Rainbow $15 for a unit of Kaleidoscope and half the selling costs per unit.

**REQUIRED:**

1. What is the opportunity cost to Rainbow of producing the 2,000 units of Kaleidoscope? (Assume that no overtime is worked.)

2. The Colours Corporation has offered to produce 2,000 units of Spectrum for Rainbow so that Rainbow may accept the Kaleidoscope offer. That is, if Rainbow accepts the Colours offer, Rainbow would manufacture 8,000 units of Spectrum and 2,000 units of Kaleidoscope and purchase 2,000 units of Spectrum from Colours. Colours would charge Rainbow $14 per unit to
manufacture Spectrum. Should Rainbow accept the Colours offer? Show your calculations.

3. Suppose Rainbow had been working at less than full capacity, producing 8,000 units of Spectrum at the time the Kaleidoscope offer was made. Calculated the minimum price Rainbow should accept for Kaleidoscope under these conditions. (Ignore the previous p15 unit price.)

Solution

1. The opportunity cost to Rainbow of producing the 2,000 units of Kaleidoscope is the contribution margin lost on the 2,000 units of Spectrum that would have to be forgone, as computed below:

   Selling price $20
   Variable costs per unit:
   Direct materials $2
   Direct manufacturing labor 3
   Variable manufacturing overhead 2
   Variable nonmanufacturing cost 4
   Contribution margin per unit $9
   Contribution margin for 2,000 units $18,000

   The opportunity cost is $18,000. Opportunity cost is the maximum contribution to operating income that is foregone (rejected) by not using a limited resource in its next-best alternative use.

2. Contribution margin from manufacturing 2,000 units of Kaleidoscope and purchasing 2,000 units of Spectrum from Colours is $16,000 as follows:

<table>
<thead>
<tr>
<th>Selling price</th>
<th>Manufacture Kaleidoscope</th>
<th>Purchase Spectrum</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable costs per unit:</td>
<td>$15</td>
<td>$20</td>
<td></td>
</tr>
<tr>
<td>Purchase costs</td>
<td>-</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct manufacturing labor</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable manufacturing OH</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable nonmanufacturing OH</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable costs per unit</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Contribution margin per unit</td>
<td>$6</td>
<td>$2</td>
<td></td>
</tr>
<tr>
<td>Contribution margin from selling 2,000 units of Kaleidoscope and 2,000 units of Spectrum</td>
<td>$12,000</td>
<td>$4,000</td>
<td>$16,000</td>
</tr>
</tbody>
</table>
As calculate in requirement 1, Rainbow’s contribution margin from continuing to manufacture 2,000 units of Spectrum is $18,000. Accepting the Summer Company and Colours offer will cost Rainbow $2,000 ($16,000 – $18,000). Hence, Rainbow should refuse the Summer Company and Colours Corporation’s offers.

3. The minimum price would be $9, the sun of the incremental costs as computed in requirement 2. This follows because, if Rainbow has surplus capacity, the opportunity cost will be $0. For the short-run decision of whether to accept Kaleidoscope’s offer, fixed costs of Rainbow are irrelevant. Only the incremental costs need to be covered for it to be worthwhile for Rainbow to accept the kaleidoscope offer.
SHORT QUESTIONS:

1. What are the difference between Traditional approach and Activity-based approach to allocate the manufacturing overhead cost?

2. What is the difference between activity-pool rate and predetermined overhead rate? Explain

3. What are the indicators for any organization to change from volume based approach to activity-based approach?

4. Explain the criteria for choosing the cost drivers.

5. In your own opinion, do you think activity-based costing system be applied to be used with serving firms? Why?

EXERCISES:

Problem 1

The legal firm of West, Green, and Ink uses ABC to allocate its overhead costs. The firm has identified the following activity cost pools:

A. Direct labor fringe benefits.
B. Printing and photocopying.
C. Secretarial support.
D. Client support.
E. Recruiting and training.
F. Computer support
G. Liability insurance

Required
Match these cost pools with the appropriate cost driver listed below.

1. Revenue billed.
2. CPU minutes.
3. Number of pages.
4. Direct labor cost.
5. Number of clients.
6. Number of recruits.
7. Direct professional hours.
Problem 2:

The controller for Wofford Machining has established the following overhead cost pools and cost drivers:

<table>
<thead>
<tr>
<th>Overhead Cost Pool</th>
<th>Budgeted Overhead Cost</th>
<th>Cost Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setups</td>
<td>$240,000</td>
<td>Number of setups</td>
</tr>
<tr>
<td>Material handling</td>
<td>90,000</td>
<td>Units of raw material</td>
</tr>
<tr>
<td>Quality control inspection</td>
<td>48,000</td>
<td>Number of inspections</td>
</tr>
<tr>
<td>Other overhead costs</td>
<td>160,000</td>
<td>Machine hours</td>
</tr>
<tr>
<td>Total</td>
<td>$538,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overhead Cost Pool</th>
<th>Budgeted Level for Cost Driver</th>
<th>Pool Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine setups</td>
<td>200 setups</td>
<td>$1,200 per setup</td>
</tr>
<tr>
<td>Material handling</td>
<td>60,000 units</td>
<td>$1.50 per unit</td>
</tr>
<tr>
<td>Quality control</td>
<td>1,200 inspections</td>
<td>$40 per inspection</td>
</tr>
<tr>
<td>Other overhead</td>
<td>20,000 machine hours</td>
<td>$8 per machine hour</td>
</tr>
</tbody>
</table>

Order no. 715 has the following production requirements:

- Machine setups: 7 times
- Raw material: 11,200 units
- Inspections: 16 times
- Machine hours: 850 hours

Required:

1. Compute the total overhead that should be assigned to order no. 715 by using activity-based costing.

2. Suppose that Wofford were to use a single, predetermined overhead rate based on machine hours. Compute the rate per hour and the total overhead assigned to order no. 715.

3. Discuss the merits of an activity-based costing system in comparison with a traditional costing system.
Chapter 6 System Design: Activity-Based Costing and Management

Problem 3:
Weston Enterprises uses a traditional-costing system to estimate quality-control costs for its PDA product line. Costs are estimated at 32% of direct-labor cost, and direct labor totaled $860,000 for the quarter just ended. Management is contemplating a change to activity-based costing, and has established three cost pools: incoming material inspection, in-process inspection, and final product certification. Number of parts, number of units, and number of orders has been selected as the respective cost drivers.
The following data show the pool rates that have been calculated by the company along with the quantity of driver units for the PDAs:

<table>
<thead>
<tr>
<th>Pool Rate</th>
<th>Driver Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 0.50 per part</td>
<td>20 parts</td>
</tr>
<tr>
<td>0.12 per unit</td>
<td>28,000 units</td>
</tr>
<tr>
<td>115.00 per order</td>
<td>90 orders</td>
</tr>
</tbody>
</table>

Required:
1. Calculate the quarterly quality-control cost that is allocated to the PDA product line under Weston’s traditional-costing system.
2. Calculate the quarterly quality-control cost that is allocated to the PDAs if activity-based costing is used.
3. Does the traditional approach under- or overcost the product line? By how much?

Problem 4:
Lennox Industries manufactures two products: A and B. A review of the company’s accounting records revealed the following per-unit costs and production volumes:

<table>
<thead>
<tr>
<th>Production volume (units)</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,500</td>
<td>5,000</td>
</tr>
<tr>
<td>Direct material</td>
<td>$40</td>
<td>$60</td>
</tr>
<tr>
<td>Direct labor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 hours at $12</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>3 hours at $12</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Manufacturing overhead:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 hours at $93</td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>3 hours at $93</td>
<td></td>
<td>279</td>
</tr>
</tbody>
</table>
Manufacturing overhead is currently computed by spreading overhead of \$1,860,000 over 20,000 direct labor hours. Management is considering a shift to activity-based costing in an effort to improve the firm's accounting procedures, and the following data are available:

<table>
<thead>
<tr>
<th>Cost Pool</th>
<th>Cost</th>
<th>Cost Driver</th>
<th>Cost Driver Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$ 240,000</td>
<td>Number of setups 100</td>
<td><strong>Total</strong> 120</td>
</tr>
<tr>
<td>Setups</td>
<td>1,500,000</td>
<td>Direct labor hours 5,000</td>
<td>15,000 20,000</td>
</tr>
<tr>
<td>General factory</td>
<td>120,000</td>
<td>Machine hours   2,200</td>
<td>800 3,000</td>
</tr>
<tr>
<td><strong>Machine processing</strong></td>
<td><strong>$1,860,000</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lennox determines selling prices by adding 40% to a product's total cost.

**Required:**
1. Compute the per-unit cost and selling price of product B by using Lennox's current costing procedures.
2. Compute the per-unit overhead cost of product B if the company switches to activity-based costing.
3. Compute B's total per-unit cost and selling price under activity-based costing.
4. Lennox has recently encountered significant international competition for product B, with considerable business being lost to very aggressive suppliers. Will activity-based costing allow the company to be more competitive with product B from a price perspective? Briefly explain.
5. Will the cost and selling price of product A likely increase or decrease if Lennox changes to activity-based costing? Why? **Hint:** No calculations are necessary.

**Problem 5**
Heartfelt Bank & Trust operates in a very competitive marketplace, using a traditional labor-hour-based system to determine the cost of processing its mortgage loans. Recently, the firm explored a switch to activity-based costing to determine the wisdom of its previous ways. The following information is available:
<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost</th>
<th>Driver</th>
<th>Driver Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application processing</td>
<td>$900,000</td>
<td>Applications</td>
<td>4,000</td>
</tr>
<tr>
<td>Loan underwriting</td>
<td>800,000</td>
<td>Underwriting hours</td>
<td>16,000</td>
</tr>
<tr>
<td>Loan closure</td>
<td>880,000</td>
<td>Legal hours</td>
<td>8,000</td>
</tr>
<tr>
<td>Total</td>
<td>$2,580,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two loan applications, among many others, were originated and closed during the year. No. 7439 consumed 3.5 hours in loan underwriting and 1.5 hours in loan closure, for a total of 5.0 hours. No. 7809 also required 5.0 hours of time, subdivided as follows: 2.0 hours in loan underwriting and 3.0 hours in loan closure.

**Required:**
1. Use an activity-based-costing system and determine the cost of processing, underwriting, and closing the two loan applications.
2. Determine the cost of processing the two loans if Heartfelt uses the traditional labor-hour-based system. Conversations with management found that, on average, each application took nine labor hours of processing time, excluding underwriting and closure.
3. Is Heartfelt making a mistake by continuing to use a traditional system that is based on an average labor cost per hour? Why?

**Problem 6**
Consider the nine activities that follow:
1. Microsoft: Developing computer coding for a new spreadsheet package.
2. General Mills: Painting the office of a maintenance supervisor at a plant that produces cereal.
4. American Airlines: The 90 minutes that a Boeing 757 sits idle on the ground between flights.
5. Office Depot: Moving cases of paper from one location to another in the same warehouse.
6. Rolex: Attaching a watch band to the watch’s face.
7. United States Postal Service: Reprocessing mail that had been sorted incorrectly on a malfunctioning sorting machine.
8. Fidelity Investments: Correcting errors made by company personnel in customer accounts.
9. Marriott: Upgrading the quality of bedding used at hotels in very competitive marketplaces.

Required:
Categorize each of the activities as either value-added or non-value-added for the companies noted.
CHAPTER 7
VARIABLE COSTING

After studying this chapter, you should be able to:

1. Explain the meaning and underlying concept of variable costing.
2. Enumerate the advantages and disadvantages of using variable costing as a method of product costing.
3. Describe absorption costing.
4. Compare variable costing with absorption costing.
5. Prepare income statements under variable costing and absorption costing.
6. Reconcile net income computed under absorption costing and net income computed under variable costing.
7. Explain the difference in net operating income, inventory values and treatment of operating costs between variable costing and absorption costing.
8. Know why managers prefer direct costing to absorption costing.
CHAPTER 7
VARIABLE COSTING

Definition

Variable costing (Direct Costing) is a method of recording and reporting costs which regards only the variable manufacturing costs as product costs. Fixed manufacturing costs are written off as period costs.

Underlying Concept

Proponents of this product costing method maintain that the fixed part of factory overhead is more closely related to the capacity to produce than to the production of specific units and therefore should be charged off as expense in the period incurred. Furthermore, the use of this system will permit construction of an income statement which highlights the contribution margin of the product and therefore facilitates managerial decision-making process. The use of variable costing for external reporting is, however, still the center of considerable controversy. It is contended that under this method, assets (inventory) are being understated and that it is not an accepted accounting practice.

Until variable costing becomes a generally accepted accounting practice, companies who wish to use it must convert inventory and cost of goods sold figures to an absorption costing basis for external reporting. This conversion is a relatively simple process in most cases and is no deterrent to the use of variable costing for internal management purpose.

Advantages of Using Variable Costing

On advantage of variable costing is that it meets the three objectives of management control systems by showing separately those costs that can be traced to, and controlled by each strategic business unit (SBU). Also, net income using variable costing is not affected by changes in inventory levels because all fixed costs are deducted from income in the period in which they occur. For this reason appraisal of performance of product line or other segments of the business can be facilitated without the need for arbitrary allocations of fixed cost.
Chapter 7 Variable Costing

Furthermore, cost-volume-profit relationship data needed for profit planning purposes is readily obtained from the regular accounting statements. Analysis of costs relevant to pricing is likewise simplified and enhanced. Variable costing ties in with effective plans for cost control as standard costs and flexible budget.

Disadvantages of Using Variable Costing

1. Variable costing may encourage a shortsighted approach to profit planning at the expense of the long-run situation.
2. Variable costing tends to give the impression that variable costs are recovered first, that fixed costs are recovered later and that finally profits are realized.
3. Variable costing is not acceptable for external reporting and tax purpose.

Absorption Costing

Absorption costing (also known as full, traditional, conventional and normal costing) is a method of product costing in which all manufacturing costs, fixed and variable, are treated as product or inventoriable costs. This method is generally accepted for external reporting purposes.

Comparison between Variable Costing and Absorption Costing

1. As to treatment of the various operating costs:

<table>
<thead>
<tr>
<th>Absorption costing</th>
<th>Variable costing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product cost</strong></td>
<td>Direct materials</td>
</tr>
<tr>
<td></td>
<td>Direct labor</td>
</tr>
<tr>
<td></td>
<td>Variable manufacturing overhead</td>
</tr>
<tr>
<td></td>
<td>Fixed manufacturing overhead</td>
</tr>
<tr>
<td><strong>Period cost</strong></td>
<td>Variable selling and administrative expenses</td>
</tr>
<tr>
<td></td>
<td>Fixed selling and administrative expenses</td>
</tr>
</tbody>
</table>

It will be noted that it is only in the treatment of Fixed Factory Overhead that the two costing methods differ. Under variable
costing, it is considered as period cost while under absorption costing, it is treated as product cost.

2. As to net operating income

Net income is not affected by changes in production under variable costing. Net income, however, is affected by changes in production when absorption costing is in use. Net income goes up under the absorption approach in response to the increase in production for a particular year and goes down when production goes down. The reason for this effect can be traced to the shifting of fixed manufacturing cost between periods under the absorption costing method as explained below:

<table>
<thead>
<tr>
<th>Relationship between Production (P) and Sales (S)</th>
<th>Absorption Costing (AC) and Variable Costing (V) Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) P = S</td>
<td>AC = VC</td>
</tr>
<tr>
<td>b) P &gt; S</td>
<td>AC &gt; VC</td>
</tr>
<tr>
<td>c) P &lt; S</td>
<td>AC &lt; VC</td>
</tr>
</tbody>
</table>

a. When production volume equals sales volume, net income reported under absorption costing and variable costing are the same. The reason is that the amount of fixed overhead charged off to operations is the same under each method and also because there is no change in the amount of fixed overhead in the absorption inventory.

b. When production exceeds sales volume, net income reported under absorption costing will be greater than that under variable costing. This result occurs because part of the period’s production would go to increase in inventory, and under absorption costing, part of the period’s fixed overhead would be deferred along with it.

c. When sales exceed production volume, net income reported under absorption costing will be lesser than that under variable costing. The reason is that part of the period’s sales would come from the beginning inventory.
which, under absorption costing, carries with it a portion of the prior period’s fixed overhead.

3. As to amount of inventory
Inventory value under absorption costing would be higher in amount than that under variable costing. The inventory amount would carry a portion of fixed overhead incurred during the period under absorption costing.

Reconciliation of Net Income under Variable Costing with Net Income under Absorption Costing
The reconciliation of the net income figures under the two product costing methods may be done as follows:

<table>
<thead>
<tr>
<th></th>
<th>Net Income, Absorption Costing</th>
<th>$xx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add:</td>
<td>Fixed overhead in beginning inventory</td>
<td>$xx</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$xx</td>
</tr>
<tr>
<td>Less:</td>
<td>Fixed overhead in ending inventory</td>
<td>$xx</td>
</tr>
<tr>
<td>Net Income, Variable Costing</td>
<td></td>
<td>$xx</td>
</tr>
</tbody>
</table>

Illustrative Problem 7.1 Preparation of Income Statements Under Variable Costing and Absorption Costing
Assume the following facts for Karen Corporation for the months of January and February.

<table>
<thead>
<tr>
<th>Units:</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning inventory</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Production</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Sales</td>
<td>900</td>
<td>1,000</td>
</tr>
<tr>
<td>Finished Goods Ending inventory</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>(There is no work in process inventory)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Costs:

<table>
<thead>
<tr>
<th>Variable manufacturing costs (per unit produced):</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$10</td>
<td>$10</td>
</tr>
<tr>
<td>Direct labor</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fixed manufacturing costs (per month)</td>
<td>8,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Variable marketing costs (per unit sold)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Fixed manufacturing and administrative Costs (per month)</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Price per unit sold</td>
<td>$50</td>
<td>$50</td>
</tr>
</tbody>
</table>
Chapter 7 Variable Costing

REQUIRED:
1. Prepare Income Statement for each month and two-months combined under
   a. Variable Costing
   b. Absorption Costing

2. Reconcile the net income under absorption costing with net income under variable costing.

Solution: Karen Corporation

Requirement 1.

Karen Corporation
Income statement (Variable costing)
For the month ended Jan and Feb

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$45,000</td>
<td>$55,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Less: Variable cost of sales*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct material</td>
<td>$9,000</td>
<td>$11,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>4,500</td>
<td>5,500</td>
<td>10,000</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>2,700</td>
<td>3,300</td>
<td>6,000</td>
</tr>
<tr>
<td>Total</td>
<td>16,200</td>
<td>19,800</td>
<td>36,000</td>
</tr>
<tr>
<td>Manufacturing margin</td>
<td>28,800</td>
<td>36,200</td>
<td>65,000</td>
</tr>
<tr>
<td>Less: Variable marketing costs</td>
<td>1,800</td>
<td>2,200</td>
<td>4,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>27,000</td>
<td>33,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Less: Fixed costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>8,000</td>
<td>8,000</td>
<td>16,000</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>12,000</td>
<td>12,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Total</td>
<td>20,000</td>
<td>20,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$7,000</td>
<td>$13,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

* Variable cost of sales may also be computed as follows:

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory, beginning</td>
<td>$0</td>
<td>$1,800</td>
<td>$0</td>
</tr>
<tr>
<td>Add: Cost of goods manufactured</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct material</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>5,000</td>
<td>5,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>3,000</td>
<td>3,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Total</td>
<td>18,000</td>
<td>18,000</td>
<td>36,000</td>
</tr>
<tr>
<td>Total available for sales</td>
<td>18,000</td>
<td>19,800</td>
<td>36,000</td>
</tr>
<tr>
<td>Less: Inventory: Ending</td>
<td>1,600</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cost of sales</td>
<td>$16,200</td>
<td>$19,800</td>
<td>$36,000</td>
</tr>
</tbody>
</table>
Chapter 7 Variable Costing

Karen Corporation

Income statement (Absorption costing)
For the month ended Jan and Feb

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$45,000</td>
<td>$55,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Less: Cost of goods sold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory: beginning</td>
<td>$0</td>
<td>$2,600</td>
<td>$0</td>
</tr>
<tr>
<td>Add: Cost of goods manufactured</td>
<td>26,000</td>
<td>26,000</td>
<td>52,000</td>
</tr>
<tr>
<td>(1,000 x $26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available for sales</td>
<td>26,000</td>
<td>28,600</td>
<td>52,000</td>
</tr>
<tr>
<td>Less: Inventory: ending</td>
<td>2,600</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total cost of goods sold</td>
<td>23,400</td>
<td>28,600</td>
<td>52,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>21,600</td>
<td>26,400</td>
<td>48,000</td>
</tr>
<tr>
<td>Less: Operating expenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selling and administrative expenses</td>
<td>1,800</td>
<td>2,200</td>
<td>4,000</td>
</tr>
<tr>
<td>Variable</td>
<td>12,000</td>
<td>12,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Fixed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>13,800</td>
<td>14,200</td>
<td>28,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$7,800</td>
<td>$12,200</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

Requirement 2. Reconciliation of Net Income

<table>
<thead>
<tr>
<th></th>
<th>January</th>
<th>February</th>
<th>2-year combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net income, absorption costing</td>
<td>$7,800</td>
<td>$12,200</td>
<td>$20,000</td>
</tr>
<tr>
<td>Add: Fixed OH in beginning inventory</td>
<td>0</td>
<td>800</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>7,800</td>
<td>13,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Less: Fixed OH in ending inventory</td>
<td>800</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Net Income, variable costing</td>
<td>$7,000</td>
<td>13,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

Illustrative Problem 7.2 Preparation of Income Statement under Variable Costing and Absorption Costing with Capacity Variance; Reconciliation of Net Income

The Blasek Company had the following operating characteristics in 20x1 and 20x2.

Basic Production data at standard cost:

- Direct Materials: $1.30
- Direct Labor: 1.50
- Variable overhead: 0.20
- Fixed overhead ($150,000 / 150,000 units of normal volume): 1.00
- Total factory cost at standard: $4.00
- Selling price, $5.00 per unit
Chapter 7 Variable Costing

Selling and administrative expense is assumed for simplicity as being all fixed at $65,000 yearly, except for sales commissions at 5% of peso sales.

In units:

<table>
<thead>
<tr>
<th></th>
<th>20x1</th>
<th>20x2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning inventory</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>170,000</td>
<td>140,000</td>
</tr>
<tr>
<td>Sales</td>
<td>140,000</td>
<td>160,000</td>
</tr>
<tr>
<td>Ending inventory</td>
<td>30,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

There were no variances from the standard variable costs. Any under or overapplied overhead is written-off at year-end as an adjustment to cost of goods sold.

REQUIRED:

1. Income Statement for 20x1 and 20x2 under variable costing and absorption costing.
2. A reconciliation of the difference in net income for 20x1 and 20x2 and the two years as a whole.

Solution: Blasek Company

Blasek Company
Income statement (Variable costing)
For the year ended 20x1 and 20x2

<table>
<thead>
<tr>
<th></th>
<th>20x1</th>
<th>20x2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$700,000</td>
<td>$800,000</td>
</tr>
<tr>
<td>Less: Variable cost of sales*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory, Jan 1</td>
<td>$ 0</td>
<td>$90,000</td>
</tr>
<tr>
<td>Direct material</td>
<td>221,000</td>
<td>182,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>255,000</td>
<td>21,000</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>34,000</td>
<td>28,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>510,000</td>
<td>510,000</td>
</tr>
<tr>
<td>Less: Inventory, Dec 31</td>
<td>90,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Variable cost of sales</td>
<td>420,000</td>
<td>480,000</td>
</tr>
<tr>
<td>Contribution margin – Manufacturing</td>
<td>280,000</td>
<td>32,000</td>
</tr>
<tr>
<td>Less: Sales commission</td>
<td>35,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>245,000</td>
<td>280,000</td>
</tr>
<tr>
<td>Less: Fixed costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>150,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>65,000</td>
<td>65,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>215,000</td>
<td>215,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$30,000</td>
<td>$65,000</td>
</tr>
</tbody>
</table>
## Karen Corporation
### Income statement (Absorption costing)
#### For the year ended 20x1 and 20x2

<table>
<thead>
<tr>
<th></th>
<th>20x1</th>
<th>20x2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sales</strong></td>
<td>$700,000</td>
<td>$900,000</td>
</tr>
<tr>
<td><strong>Less: Cost of goods sold</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory: beginning</td>
<td>$0</td>
<td>$120,000</td>
</tr>
<tr>
<td>Add: Cost of goods manufactured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1,000 x $26)</td>
<td>680,000</td>
<td>560,000</td>
</tr>
<tr>
<td>Available for sales</td>
<td>680,000</td>
<td>680,000</td>
</tr>
<tr>
<td>Less: Inventory: ending</td>
<td>120,000</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>Total cost of goods sold</strong></td>
<td>560,000</td>
<td>640,000</td>
</tr>
<tr>
<td><strong>Adjusted: Over or under applied</strong></td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Adjusted cost of goods sold</td>
<td>540,000</td>
<td>650,000</td>
</tr>
<tr>
<td><strong>Gross profit</strong></td>
<td>160,000</td>
<td>150,000</td>
</tr>
<tr>
<td><strong>Less: Operating expenses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales commission</td>
<td>35,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Selling and administrative - Fixed</td>
<td>65,000</td>
<td>65,000</td>
</tr>
<tr>
<td><strong>Total operating expenses</strong></td>
<td>100,000</td>
<td>101,000</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td>$60,000</td>
<td>$45,000</td>
</tr>
</tbody>
</table>

### Reconciliation:

<table>
<thead>
<tr>
<th></th>
<th>20x1</th>
<th>20x2</th>
<th>2-year combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net income, absorption costing</td>
<td>$60,000</td>
<td>$45,000</td>
<td>$105,000</td>
</tr>
<tr>
<td>Add: Fixed overhead in beginning inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20x1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20x2</td>
<td>0</td>
<td>30,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>60,000</td>
<td>75,000</td>
<td>105,000</td>
</tr>
<tr>
<td>Less: Fixed overhead in ending inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20x1</td>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20x2</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Net Income, variable costing</strong></td>
<td>$30,000</td>
<td>$65,000</td>
<td>$95,000</td>
</tr>
</tbody>
</table>

### Illustrative Problem 7.3 Computation of Inventory values under Variable Costing and Absorption Costing

Question 1 and 2 are based on the following information:

For the year 20x1, the following cost data are available for DEF Company:

- Direct material use: $335,000
- Direct labor: $500,000
- Variable manufacturing overhead: $365,000
- Fixed manufacturing overhead: $300,000
Chapter 7 Variable Costing

The company produced 150,000 units and sold 135,000 units. There are no beginning and ending inventories of work and no beginning inventory of finished goods.

1. The value to be assigned to the finished goods inventory at the end under the variable costing is:
   a. $100,000
   b. $120,000
   c. $150,000
   d. $180,000
   e. None of the above.

2. The value to be assigned to the finished goods inventory at the end under absorption costing is:
   a. $175,000
   b. $200,000
   c. $225,000
   d. $250,000
   e. None of the above.

Solution DEF Company

1. Value to be assigned to the finished goods inventory at the end under the variable costing:

   Direct material used $335,000
   Direct labor $500,000
   Variable manufacturing overhead $365,000
   Total manufacturing cost $1,200,000

   $1,200,000 \times 15,000 = $120,000
   150,000 units

   Answer: b

2. Value to be assigned to the finished goods inventory at the end under absorption costing:
Chapter 7 Variable Costing

Direct materials used $ 35,000
Direct labor 500,000
Manufacturing overhead
  Fixed $365,000
  Variable 300,000  665,000
Total manufacturing cost $ 1,500,000

$1,500,000 x 15,000 = $150,000
150,000 units

Answer: e

Illustrative Problem 7.4 Conversion of Income Statement from Variable Costing method to Absorption Costing method

An income statement for the manufacturing operations of Lucky Industries, Inc. for 20x1 is given below. The company operated at 75% of normal capacity during 20x1 and applied the fixed manufacturing costs to the products at a standard rate per unit of product. The inventory at the beginning of the year consisted of 40,000 units of product and the inventory at the end of the year consisted of 30,000 units. The company sold 88,000 units of product during the year. Inventories and production are stated on a standard cost basis.

Lucky Industries Inc.
Income statement – Manufacturing
For the year ended Dec 31, 20x1

Sales $1,056,000
Cost of goods sold
  Inventory: Jan 1 280,000
  Add: Cost goods manufactured 546,000
  Available for sales 826,000
  Less: Inventory: Dec 31 210,000
Cost of goods sold 616,000
Income from manufacturing operation 440,000
Less: Capacity variance 130,000
Income from manufacturing operation $310,000
REQUIRED:
Recast the statement on a Variable Costing basis.

Solution: Lucky Industries, Inc.

**Luzon Industries, Inc.**
**Income Statement for 2005**
**Variable Costing**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$1,056,000</td>
</tr>
<tr>
<td>Less: Cost of Sales</td>
<td></td>
</tr>
<tr>
<td>Inventory, beginning</td>
<td>(40,000 x $2) $80,000</td>
</tr>
<tr>
<td>Production costs</td>
<td>(78,000 x $2) 156,000</td>
</tr>
<tr>
<td>Total available</td>
<td>$236,000</td>
</tr>
<tr>
<td>Less: Inventory, end</td>
<td>(30,000 x $2) 60,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td></td>
</tr>
<tr>
<td>Less: Fixed costs</td>
<td></td>
</tr>
<tr>
<td>Net Income</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$360,000</td>
</tr>
</tbody>
</table>

**Supporting Computations:**

\[
\text{Fixed costs} = \frac{\text{Capacity variance}}{25\%} = \frac{\$130,000}{25\%} = \$520,000
\]

Normal capacity = 78,000 units = 104,000 units

\[
\text{Fixed cost per unit} = \frac{\$520,000}{104,000} = \$5.00/\text{unit}
\]

**Why Managers Prefer Direct Costing to Absorption Costing**

In variable costing, only variable manufacturing costs are included in a unit's product costs, and thus in the value of inventory and cost of goods sold. Fixed manufacturing overhead is excluded. Fixed manufacturing overhead is excluded. It is reported as a separate expense and deducted from the contribution margin along with fixed selling and administrative expense in determining operating income.
Managers generally prefer variable costing because it separates fixed from variable costs as in cost–volume–profit analysis. As a result, it is easier to compare actual operating income to planned operating income. With absorption costing, actual operating income corresponds well with planned operating income only when inventory levels remain unchanged. With variable costing, income is more closely associated with sales while absorption costing is influenced by units produced and units sold.
Chapter 7 Variable Costing

SHORT QUESTIONS

1. Briefly explain the difference between absorption costing and variable costing.

2. Why do many managers prefer variable costing over absorption costing?

3. Which is more consistent with cost-volume-profit analysis, variable costing or absorption costing? Why?

4. When inventory increases, will absorption costing or variable costing income be greater? Why?

5. Absorption and variable costing are two different methods of measuring income and costing inventory.
   Required:
   A. Product costs are defined as costs associated with the manufacturing process. How does the operational definition of product cost differ between absorption costing and variable costing?
   B. An absorption-costing income statement will report gross profit or gross margin whereas a variable-costing income statement will report contribution margin. What is the difference between these terms?
EXERCISES

Problem 1

The table that follows denotes selected characteristics of absorption costing and/or variable costing:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Absorption costing</th>
<th>Variable costing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct labor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period cost:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable selling and administrative cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed selling and administrative cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Income statement disclosure characteristic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross margin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution margin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower income when inventories rise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External financial statement use</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Required:
Evaluate each product cost, period cost, and income statement disclosure characteristic and determine whether it relates to absorption costing, variable costing, or both methods. Place an “X” in the proper column.

Problem 2
Information taken from Giles Corporation’s May accounting records follows.
Chapter 7 Variable Costing

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials used</td>
<td>$150,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>80,000</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td>30,000</td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td>100,000</td>
</tr>
<tr>
<td>Variable selling and administrative costs</td>
<td>51,000</td>
</tr>
<tr>
<td>Fixed selling and administrative costs</td>
<td>60,000</td>
</tr>
<tr>
<td>Sales revenues</td>
<td>625,000</td>
</tr>
</tbody>
</table>

**Required:**

Assuming the use of variable costing,

1. Compute the inventoriable costs for the month.
2. Compute the month's inventoriable costs by using absorption costing.
3. Assume that anticipated and actual production totaled 20,000 units, and that 18,000 units were sold during May. Determine the amount of fixed manufacturing overhead and fixed selling and administrative costs that would be expensed for the month under (1) variable costing and (2) absorption costing.
4. Assume the same data as in requirement "C." Compute the contribution margin that would be reported on a variable-costing income statement.

**Problem 3**

The following data relate to Ventura Company, a new corporation, during a period when the firm produced and sold 100,000 units and 90,000 units, respectively:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials used</td>
<td>$400,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>200,000</td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td>250,000</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td>120,000</td>
</tr>
<tr>
<td>Fixed selling and administrative expenses</td>
<td>300,000</td>
</tr>
<tr>
<td>Variable selling and administrative expenses</td>
<td>45,000</td>
</tr>
</tbody>
</table>

The company met its original planned production target of 100,000 units. There were no variances during the period, and the firm's selling price is $15 per unit.
Chapter 7 Variable Costing

Required:
1. What is the cost of Ventura's end-of-period finished-goods inventory under the variable-costing method?
2. Calculate the company's variable-costing income.
3. Calculate the company's absorption-costing income.

Problem 4

Kim, Inc. began business at the start of the current year and maintains its accounting records on an absorption-cost basis. The following selected information appeared on the company's income statement and end-of-year balance sheet:

Income-statement data:
- Sales revenues (35,000 units x $22) $770,000
- Gross margin 210,000
- Total sales and administrative expenses 160,000

Balance-sheet data:
- Ending finished-goods inventory (12,000 units) 192,000

Kim achieved its planned production level for the year. The company's fixed manufacturing overhead totaled $141,000, and the firm paid a 10% commission based on gross sales dollars to its sales force.

Required:
1. How many units did Kim plan to produce during the year?
2. How much fixed manufacturing overhead did the company apply to each unit produced?
4. How much variable cost did the company attach to each unit manufactured?
CHAPTER 8
COST-VOLUME-PROFIT RELATIONSHIPS

After studying this chapter, you should be able to:
1. Describe the concept and importance of cost-volume-profit relationship.
2. Compute and explain the meaning of contribution margin and break-even point.
3. Construct and explain the break-even point.
4. State the assumptions and limitations of CVP Analysis.
5. Prepare the break-even graph and profit–volume graph.
6. Apply CVP analysis in decision making.
7. Examine the sensitivity of profits to changes in sales by using either of the following measures:
   (a) margin of safety, or
   (b) operating leverage
CHAPTER 8
COST-VOLUME-PROFIT RELATIONSHIPS

The Basics of Cost-Volume-Profit (CVP) Analysis

Managers are constantly faced with decisions about selling prices, variable costs and fixed costs. To be able to choose from among the alternative actions, it is necessary to have a good estimate of the probable costs that would result from each choice. Furthermore, management needs to know the costs that are likely to be incurred under normal operating conditions and how they might vary if conditions change.

Among the most frequently asked questions that require cost estimates and short run decisions are:

1) How many units will be manufactured?
2) What is the company's break-even sale?
3) Should the selling price be changed?
4) Should the company spend more on advertising?
5) What profit contribution can be realized if the organization performs as expected for the period?
6) Should the product be sold as is or should it be processed further?
7) What would be the effects of the following changes in the next period?
   a) Increase or decrease in the cost of materials?
   b) Increase or decrease in the efficiency of production?

Long-run decisions such as buying new plant and equipment will also hinge on predictions of the resulting cost-volume-profit relationship.

Managers, in making their decisions affecting the business operations must understand the interrelationship of cost, volume and profit through the use of the information and analysis that the cost accounting department will provide to them. They need to understand which costs would stay the same.
Significance of Cost-Volume-Profit Analysis

Cost-volume-profit (CVP) analysis is one of the most powerful tools that managers have at their command. It helps them understand the interrelationship between cost, volume, and profit in an organization by focusing on interactions between the following five elements:

1. Prices of products
2. Volume or level of activity within the relevant range
3. Variable costs per unit
4. Total Fixed costs
5. Mix of products sold

If the above items are known, the following relationships may be established:

a) Contribution margin per unit or marginal income per unit
   This is the excess of unit selling price over unit variable costs and the amount each unit sold contributes toward
   1) covering fixed costs and
   2) providing operating profits.

   **Formula:**
   \[
   \text{CM per unit} = \text{Unit selling price} - \text{unit variable costs}
   \]

b) Contribution Margin ratio
   This is the percentage of contribution margin to total sales. This ratio is computed as follows:

   \[
   \text{CM ratio} = \frac{\text{Contribution Margin}}{\text{Sales}}
   \]

The CM ratio is very useful in that it shows how the contribution margin will be affected by a given dollar change in total sales. For instance, if a company's CM ratio is 40%, it means that for each dollar increase in sales, total contribution margin will increase by $0.40. Net income likewise will increase by $0.40 assuming that there are no changes in fixed costs.
The CM ratio is particularly valuable in those situations where the manager must make trade-offs between change in selling price and change in variable costs.

**CVP Analysis for Breakeven Planning**

The starting point in many business plans is to determine the break-even point.

Break-even point is the level of sales volume where total revenues and total expense are equal, that is, there is neither profit nor loss. This point can be determined by using CVP analysis. Break-even point can be computed as follows:

1) Break-even point (units) = \( \frac{\text{Total Fixed Costs}}{\text{Contribution Margin per unit}} \)

2) Break-even point (Dollars) = \( \frac{\text{Total Fixed Costs}}{[1 - (\frac{\text{Variable Costs}}{\text{Sales}})]} \)

3) a) Break-even sales For multi-products Firm (combined units) = \( \frac{\text{Total Fixed Costs}}{\text{Weighted Average Contribution Margin}} \)

   b) Weighted Contribution Margin per unit = \( \frac{\text{Unit CM} \times \text{No. of units per Mix} + \text{Unit CM} \times \text{No. of units per Mix}}{\text{Total number of units per Sales Mix}} \)

4) a) Break-even sales For multi-products Firm (combined dollars) = \( \frac{\text{Total Fixed Costs}}{\text{Weighted CM ratio}} \)
CVP Analysis for Revenue and Cost Planning

CVP analysis can be used to determine the level of sales needed to achieve a desired level of profit. In revenue planning, CVP analysis assists managers in determining the revenue required to achieve a desired profit level. The equation that may be used to compute for target sales follows:

\[
\text{Sales (units)} = \frac{\text{Total Fixed Costs} + \text{Desired Profit}}{\text{Contribution Margin Per unit}}
\]

Or

\[
\text{Sales (dollar)} = \frac{\text{Total Fixed Costs} + \text{Desired Profit}}{\text{Contribution Margin Ratio}}
\]

Break-even Graph

Under the graphical approach, sales revenue, variable costs and fixed costs are plotted on the vertical axis while volume is plotted on the horizontal axis. The break-even point is the point where the total sales revenue line intersects the total cost line.

Illustrative Problem 8.1 Construction of Break-even Graph

Prepare the break-even graph for MNO Corporation based on the following information:
Chapter 8 Cost-Volume-Profit Relationships

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sales</td>
<td>$500,000</td>
<td>$10</td>
</tr>
<tr>
<td>Variable Costs</td>
<td>300,000</td>
<td>6</td>
</tr>
<tr>
<td>Contribution Margin</td>
<td>200,000</td>
<td>4</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>150,000</td>
<td>3</td>
</tr>
<tr>
<td>Net Profit</td>
<td>$150,000</td>
<td>$1</td>
</tr>
</tbody>
</table>

Number of units sold = 50,000 units

Solution: MNO Corporation (Break-even Graph)

![Break-even Graph](image)

**Revenue and Costs (Dollar)**

- Total Revenue
- Total Cost
- Profit Area
- Loss Area
- BE (Break-even Point)

**Volume (units)**

- TR = TOTAL REVENUE LINE
- FC = FIXED COST LINE
- TC = TOTAL COST LINE
- BE = BREAK-EVEN POINT

**Profit-Volume Chart**

This chart focuses more directly on how profits vary with changes in volume. Profits are plotted on the vertical axis while units of output are...
shown on the horizontal axis. Using the data in Illustrative Problem 8.1, the P/V Graph may be prepared as follows:

Assumptions and Limitations of CVP Analysis

CVP analysis constitutes a very important tool for management planning. Certain underlying assumption upon which it rests, however, place definite limitations on the conclusions which can be drawn from its results. Whenever the underlying assumptions of CVP analysis do not correspond to a given situation, the limitations, of the analysis must be clearly recognized if the break-even tool is to be useful and educational.

In summary, the following static assumptions will limit the precision and reliability of a given break-even analysis:
Chapter 8 Cost-Volume-Profit Relationships

Assumption/Limitation

1. The analysis is valid for a limited range of values – the "relevant" – and a limited period of time.

2. All costs can be categorized as fixed or variable.
   a. Variable costs change proportionately with volume within the relevant volume range.
   b. Fixed costs are constant within the relevant volume range.

3. Revenues change proportionately with volumes with selling price remaining constant.

4. There is a constant product mix.

5. Changes in volume alone are responsible for changes in costs and revenues.

6. There is no significant change in inventories (i.e., in physical units, sales volume equals production volume.)

7. Operation leverage questions can be dealt with in the CVP framework.

Comment

1. Failure to observe these limits would lead to working with unrealistic data.

2. Semi-variable costs present a problem that can be solved by segregating fixed and variable portion.
   a. There is a danger that linear cost and revenue relationship may be used when non-linearities are significant.
   b. Non-linear curves often have optimum quantities: linear ones do not.

3. Price is constant for all volumes within the relevant range.

4. Data should be adjusted for any shifts in product mix.

5. There are other factors affecting costs and revenues, but they are lessened if narrow time and volume limits are applied.

6. Data should be adjusted if inventories change markedly.

7. This should be supported with capital budgeting approaches that consider the time value of money.
Chapter 8 Cost-Volume-Profit Relationships

8. The analysis is deterministic and appropriate data can be found.

Illustrative Problem 8.2 Break-even Analysis

The Income Statement for one of Manhattan Company's product shows:

Sales (100 units at $100 a unit) $10,000
Cost of goods sold:
  Direct labor $1,500
  Direct material used 1,400
  Variable factory overhead 1,000
  Fixed factory overhead 500 4,400
Gross profit 5,600
Marketing expenses:
  Variable 600
  Fixed 1,000
Administrative expenses:
  Variable 500
  Fixed 1,000 3,100
Operating income $2,500

REQUIRED:
1. Compute the break-even point in units.
2. If sales increase by 25% how much will be the new operating income?
3. Compute the new break-even point in pesos if fixed factory overhead will increase by $1,700.

Solution: Manhattan Company

(1) Break-even point = \( \frac{500 + 1,000 + 1,000}{50} \)
= 50 units

(2) Current Net Income $2,500
Add: Incremental contribution
  Margin (25 units x $50) 1,250
Operating Income $3,750
(3) Break-even point = \( \frac{\$2,500 + \$1,700}{50\%} \)

= \$8,400

**Illustrative Problem 8.3 CVP Analysis with Changes in Cost Structure**

The Don Company sold 100,000 units of its product at $20 per unit. Variable costs are P14 per unit (manufacturing costs of $11 and marketing costs of $3) Fixed costs are incurred uniformly throughout the year and amount to $792,000 (manufacturing costs of $500,000 and marketing costs of $292,000)

**REQUIRED:** Compute

1. The break-even point in units and in dollars.
2. The number of units that must be sold to earn an income of $60,000 before income tax.
3. The number of units that must be sold to earn an after-tax income of $90,000 income tax. Rate is 40%
4. The number of units required to break-even if there is a 10% increase in wages and salaries. Labor cost constitutes 50% of variable costs and 20% of fixed costs.

**Solution: Don Company**

(a) \[ \text{BEP} \quad = \quad \frac{\$792,000}{\$6} \]

= 132,000 units

\[ \text{BEP} \quad = \quad \frac{\$792,000}{30\%} \]

= \$2,640,000

(b) Desired net income \quad \$ 60,000
Add: Fixed costs \quad 792,000
Contribution margin \quad $852,000
Divided by: contribution margin/unit \quad $6
Total number of units \quad 142,000

210
(c) Desired net income after tax $90,000
Desired net income before tax
($90,000 / 60%) $150,000
Add: Fixed costs 792,000
Contribution margin $942,000
Divided by: contribution margin/unit $6
Total number of units 157,000

(d) BEP
= $792,000 + [(20% x $792,000) x 10%]
= 152,423 units

Computation of Contribution margin/units:
Selling price per unit $20.00
Variable cost per unit:
Materials, overhead and
Marketing (50% x $14) $7.00
Labor (50% x $14 x 110%) 7.70 14.70
Contribution margin per unit $ 5.30

Illustrative Problem 8.4 CVP Analysis for a Multi-Product Firm

Lor, Inc. produces only two products, A and B. These account for 60% and 40% of the total sales pesos of Lor’s respectively. Variable costs as a percentage of sales are 60% for A and 85% for B. Total fixed costs are $150,000. There are no other costs.

REQUIRED: Compute
1. The weighted contribution margin ratio.
2. The break-even point in sales dollars.
3. The sales dollars necessary to generate a net income of $9,000 if total fixed costs will increase by 30%
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Solution: Lor, Inc.

1. Weighted Contribution margin ratio = (60% x 40%) + (40% x 15%)
   = 30%

2. \[
\text{BEP ($)} = \frac{\text{Fixed costs}}{\text{Weighted CMR}}
\]
   = \$150,000
   \[30\%
\]
   = \$500,000

3. Desired net income
   Add: Total Fixed costs
   \((\$150,000 \times 130\%)\)
   = 195,000
   Contribution margin
   = \$204,000
   Divided by: Weighted CMR
   = 30%
   Sales necessary to generate
   Desired net income
   = \$680,000

Illustrative Problem 8.5 CVP Analysis for Multi-Problem Firm

The Insular Corporation sells two products, D and W at a rate of 2 units and 3 units respectively. The following data are available:

<table>
<thead>
<tr>
<th>D</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Selling Price</td>
<td>$10</td>
</tr>
<tr>
<td>Unit Variable Costs</td>
<td>6</td>
</tr>
<tr>
<td>Total Fixed cost</td>
<td>$420,000</td>
</tr>
</tbody>
</table>

REQUIRED: Determine:

1. Weighted contribution margin per unit.
2. Break-even point in units (combined).
3. Weighted contribution margin ratio.
4. Break-even point in sales dollars (combined).
5. Break-even point in sales dollars for:
   1. Product D
   2. Product W
Solution: Insular Corporation

1. Weighted contribution margin per unit
   \[ \text{Weighted CM per unit} = (\$ 40\% \times \$1) + (\$ 60\% \times \$2) = \$2.80 \]

2. BEP (units)
   \[ \text{BEP (units)} = \frac{\text{Total Fixed Costs}}{\text{Weighted CM per unit}} \]
   \[ = \frac{\$420,000}{\$2.80} = 150,000 \text{ units} \]

3. Total Weighted contribution margin ratio
   \[ = (57.0\% \times 40\%) + (43.0\% \times 40.0\%) = 40.0\% \]

4. BEP ($)
   \[ \text{BEP ($)} = \frac{\text{Total Fixed costs}}{\text{Weighted CMR}} \]
   \[ = \frac{\$420,000}{40\%} = \$1,050,000 \]

5. BEP for:
   - Product D ($1,050,000 \times 57\%) = \$600,000
   - Product W($1,050,000 \times 43\%) = \$450,000

Illustrative Problem 8.6 Preparation of Break-even Graph

The Maling Company has the following income statement when 10,000 units were sold:

\[
\text{Maling Company Income Statement}
\begin{align*}
\text{Sales} & \quad \$20,000 \\
\text{Expenses:} & \\
\text{Variable expenses} & \quad \$12,000 \\
\text{Fixed expenses} & \quad 6,000 \quad 18,000 \\
\text{Net income} & \quad \$2,000 \\
\text{10,000 units were sold.}
\end{align*}
\]
REQUIRED:
(a) Prepare a break-even graph for the company.
(b) From the graph, how many units must be sold to break-even?
(c) What is the margin of safety in units?

Solution: Maling Company

a. Break-even Graph

b. Break-even sales = 7,500 units
c. Margin of Safety = 10,000 – 7,500 = 2,500 units
Illustrative Problem 8.7 preparation of Profit – Volume Graph

The Solimansing Company had the following revenue and cost data when 2,000 units were sold:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling price per unit</td>
<td>$12.00</td>
</tr>
<tr>
<td>Variable cost per unit</td>
<td>6.00</td>
</tr>
<tr>
<td>Fixed cost per unit</td>
<td>4.50</td>
</tr>
</tbody>
</table>

REQUIRED:

(a) Prepare a profit-volume graph for the company.
(b) Determine the break-even point from the graph.
(c) From the graph, determine how many units must be sold to generate a net income of $3,000.

Solution: Solimansing Company

(a) Profit-Volume Graph:

(b) Break-even point is 1,500 units.

(c) To generate net income of $3,000, the company must sell 2,000 units.
Illustrative Problem 8.8 Use of CVP in Decision-Making

The Income Statement for the Woodstock Company for the past year is:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (150,000 units @ $30)</td>
<td>$4,500,000</td>
</tr>
<tr>
<td>Cost of goods sold:</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>$1,050,000</td>
</tr>
<tr>
<td>Labor</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Variable factory overhead</td>
<td>450,000</td>
</tr>
<tr>
<td>Fixed factory overhead</td>
<td>500,000</td>
</tr>
<tr>
<td><strong>Gross profit</strong></td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Variable marketing expenses</td>
<td>$ 135,000</td>
</tr>
<tr>
<td>Fixed marketing expenses</td>
<td>185,000</td>
</tr>
<tr>
<td>Fixed manufacturing expenses</td>
<td>180,000</td>
</tr>
<tr>
<td><strong>Income before income tax</strong></td>
<td>$ 500,000</td>
</tr>
<tr>
<td>Income tax</td>
<td>250,000</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td>$ 250,000</td>
</tr>
</tbody>
</table>

Woodstock is preparing its budget for the coming year and has made the following projections about cost increases: materials, 5%; labor 8%; and all other costs (including fixed), 6%. Production capacity is 200,000 units.

The President has been offered various proposals by the division manager as follows:

a) Maintain the present volume and sales price.
b) Produce and sell at capacity and reduce the unit price to $28.
c) Raise the unit price to $32, spend an extra $300,000 on advertising and produce and sell 180,000 units.

REQUIRED: Recommend action, based on quantification of alternatives.
Chapter 8 Cost-Volume-Profit Relationships

Solution: Woodstock Company

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$4,500,000</td>
<td>$5,600,000</td>
<td>$5,760,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td>3,342,600</td>
<td>4,456,800</td>
<td>4,011,120</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>1,157,400</td>
<td>1,143,200</td>
<td>1,748,880</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>916,900</td>
<td>916,900</td>
<td>1,216,900</td>
</tr>
<tr>
<td>Net income before taxes</td>
<td>$ 240,500</td>
<td>$ 226,300</td>
<td>$ 531,980</td>
</tr>
</tbody>
</table>

Recommendation: Proposal (c) should be adopted because it will yield the highest amount of profit.

Sensitivity Analysis of CVP Results

To examine the sensitivity of profits to changes in sales, either of the measures may be used: the margin of safety or operating leverage.

Margin of Safety

Margin of safety measures the potential effect of the risk that sales will fall short of planned levels. This is the excess of actual or budgeted sales over break-even sales and indicates the amount by which sales could decrease before losses are incurred.

The margin of safety can also be used as a ratio, a percentage of sales:

\[
\text{Margin of safety ratio} = \frac{\text{Margin of Safety}}{\text{Actual or Planned Sales}}
\]

The margin of safety ratio is useful for comparing the risk of two alternative products, or for assessing the riskiness in any given product. The product with a relatively low margin of safety ratio is the riskier of the two products and therefore usually requires more of management’s attention.

Illustrative Problem 8.9 Margin of Safety

Amflor manufacturing Company’s budget for the coming year revealed the following unit data:
Budgeted net income for the year $875,000

Unit costs:

<table>
<thead>
<tr>
<th></th>
<th>Variable</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing cost</td>
<td>$14.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>Selling cost</td>
<td>2.50</td>
<td>5.50</td>
</tr>
<tr>
<td>General cost</td>
<td>0.25</td>
<td>7.00</td>
</tr>
<tr>
<td>Unit selling price</td>
<td>$ 50</td>
<td></td>
</tr>
</tbody>
</table>

REQUIRED:
1. Determine the budgeted sales volume in units.
2. Determine the margin of safety in dollars and percentage.

Solution: Amflor Manufacturing Company
1. Budgeted sales volume (units) = \( \frac{\text{Total Budgeted net income}}{\text{Net income/unit}} \)

\[
\begin{align*}
\text{Budgeted sales volume (units)} &= \frac{\$875,000}{\$8.75} \\
&= 100,000 \text{ units}
\end{align*}
\]

* Supporting Computations for net income/unit

Units selling price $50.00

Less: Unit variable costs:
- Manufacturing $14.00
- Selling 2.50
- General 0.25

Contribution margin/unit = 33.25

Less: Unit Fixed costs = 24.50

Net income/unit = $8.75

2. a. Margin of Safety = Budgeted sales – Break-even sales

\[
\begin{align*}
\text{Margin of Safety} &= \$5,000,000 - \left( \frac{\left(\$24.50 \times 100,000\right)}{66.5\%} \right) \\
&= \$5,000,000 - \$3,684,211 \\
&= \$1,315,789
\end{align*}
\]
b. Margin of Safety ratio = \( \frac{\text{Margin of Safety (in dollars)}}{\text{Budgeted Sales}} \)

\[
= \frac{1,315,789}{5,000,000} = 26\%
\]

**Operating Leverage**

The potential effect of the risk that sales will fall short of planned levels as influenced by the relative proportion of fixed to variable manufacturing costs can be measured by operating leverage. Operating Leverage is the ratio of the contribution margin to profit or

\[
\text{Operating Leverage} = \frac{\text{Contribution margin}}{\text{Profit or Net Operating Income}}
\]

A higher value of operating leverage indicates a higher risk in the sense that a given change in sales will have a relatively greater impact on profit. When sales volume is strong, it is desirable to have a high level of level of leverage, but when sales begin to fall, a lower level of leverage is preferable.

**Illustrative Problem 8.10 Operating Leverage**

These sales and cost data (000s) are for two companies in the transportation industry:

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th></th>
<th>Company B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>% of Sales</td>
<td>Amount</td>
<td>% of Sales</td>
</tr>
<tr>
<td>Sales</td>
<td>$100,000</td>
<td>100%</td>
<td>$100,000</td>
<td>100%</td>
</tr>
<tr>
<td>Variable costs</td>
<td>60,000</td>
<td>60%</td>
<td>30,000</td>
<td>30%</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>40,000</td>
<td>40%</td>
<td>70,000</td>
<td>70%</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>30,000</td>
<td>30%</td>
<td>60,000</td>
<td>60%</td>
</tr>
<tr>
<td>Net income before taxes</td>
<td>$10,000</td>
<td>10%</td>
<td>$10,000</td>
<td>10%</td>
</tr>
</tbody>
</table>

**REQUIRED:**
1. Calculate the operating leverage for each company. If sales increase, which company benefits more? How do you know?

2. Assume sales rise 10 percent in the next year. Calculate the percentage increase in profit for each company. Are the results what you expected?

Solution:
1. Operating leverage \( = \frac{\text{contribution margin}}{\text{net income}} \)

\[
\begin{align*}
\text{A's operating leverage} & = \frac{\$40,000}{\$10,000} = 4 \\
\text{B's operating leverage} & = \frac{\$70,000}{\$10,000} = 7
\end{align*}
\]

If sales increase, company B will benefit more. Company B has a higher proportion of fixed costs in relation to variable costs; therefore it has a higher operating leverage than does Company A. The degree of operating leverage is a measure, at a specific level of sales, of how a percentage change in sales volume will affect profits. The higher the operating leverage, the more sensitive profits are to changes in sales volume.

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th></th>
<th></th>
<th>Company B</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$110,000</td>
<td>100%</td>
<td></td>
<td>$110,000</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Variable costs</td>
<td>6,000</td>
<td>60%</td>
<td></td>
<td>33,000</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Contribution margin</td>
<td>44,000</td>
<td>40%</td>
<td></td>
<td>77,000</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>30,000</td>
<td></td>
<td></td>
<td>60,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NI before taxes</td>
<td>$14,000</td>
<td></td>
<td></td>
<td>$17,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A's change in profits \( = \frac{14 - 10}{10} = 40\% \)

B's change in profits \( = \frac{17 - 10}{10} = 70\% \)
Yes, these results are what we expected. Operating leverage indicates what change in net income can be expected from a change in sales volume. An operating leverage of 4 implies that the change in net income will be 4 times as large as the change in sales volume. Therefore, if sales increased by 10%, net income should increase by 40%. This is precisely what happened. The same logic applies to Company B.
Chapter 8 Cost-Volume-Profit Relationships

SHORT QUESTIONS:

1. What is contribution margin? How can it be expressed?
2. Identify the three ways to determine the break-even point.
3. Define margin of safety, and give the formulas for computing it.
4. Operating leverage is an important concept for many companies.

   a. Define operating leverage.
   b. Assume that a firm pays no income taxes and is planning to increase its selling price. If sales volume in units does not change, what will be the effect on the operating leverage factor? Explain.
   c. Assume that another firm that pays no income taxes is planning to increase total fixed manufacturing costs and decrease variable manufacturing costs per unit. At the present volume of production, the total manufacturing costs will be unchanged. What will this change do to the operating leverage factor? Explain.
Chapter 8 Cost-Volume-Profit Relationships

EXERCISES:

Problem 1:

Henderson Farms reports the following results for the month of November:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (10,000 units)</td>
<td>$600,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td>420,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>180,000</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>110,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$ 70,000</td>
</tr>
</tbody>
</table>

Management is considering the following independent courses of action to increase net income.
1. Increase selling price by 5% with no change in total variable costs.
2. Reduce variable costs to 66% of sales.
3. Reduce fixed costs by $10,000.

Required
If maximizing net income is the objective, which is the best course of action?

Problem 2:

Marvin Co. had a net loss of $150,000 in 2012 when the selling price per unit was $20, the variable costs per unit were $14, and the fixed costs were $600,000. Management expects per unit data and total fixed costs to be the same in 2013. Management has set a goal of earning net income of $150,000 in 2013.

Required

1. Compute the units sold in 2012.
2. Compute the number of units that would have to be sold in 2013 to reach management's desired net income level.
3. Assume that Marvin Co. sells the same number of units in 2013 as it did in 2012. What would the selling price have to be in order to reach the target net income? Use the mathematical equation.
Problem 3:

The income statement for Bradford Machine Company for 2012 appears below.

**BRADFORD MACHINE COMPANY**

**Income Statement**

**For the Year Ended December 31, 2012**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (40,000 units)</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Variable expenses</td>
<td>$700,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>$300,000</td>
</tr>
<tr>
<td>Fixed expenses</td>
<td>$360,000</td>
</tr>
<tr>
<td>Net income (loss)</td>
<td>$(60,000)</td>
</tr>
</tbody>
</table>

**Required**

Answer the following independent questions and show computations using the contribution margin technique to support your answers:

1. What was the company’s break-even point in sales dollars in 2012?
2. How many additional units would the company have had to sell in 2013 in order to earn net income of $45,000?
3. If the company is able to reduce variable costs by $2.50 per unit in 2013 and other costs and unit revenues remain unchanged, how many units will the company have to sell in order to earn a net income of $45,000?

Problem 4:

Tavares Industries developed the following information for the product it sells:

- **Sales price**: $50 per unit
- **Variable cost of goods sold**: $28 per unit
- **Fixed cost of goods sold**: $650,000
- **Variable selling expense**:
  - Price: 10% of sales
- **Variable administrative expense**: $2.00 per unit
- **Fixed selling expense**: $400,000
- **Fixed administrative expense**: $300,000
Chapter 8 Cost-Volume-Profit Relationships

For the year ended December 31, 2013, Taveras produced and sold 100,000 units of product.

Required

1. Prepare a CVP income statement using the contribution margin format for Taveras Industries for 2013.
2. What was the company's break-even point in units in 2013? Use the contribution margin technique.
3. What was the company's margin of safety in dollars in 2013?

Problem 5:
Thomlinson Company is considering the development of two products: no. 65 or no. 66. Manufacturing cost information follows.

<table>
<thead>
<tr>
<th></th>
<th>No. 65</th>
<th>No. 66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual fixed costs</td>
<td>$220,000</td>
<td>$340,000</td>
</tr>
<tr>
<td>Variable cost per unit</td>
<td>33</td>
<td>25</td>
</tr>
</tbody>
</table>

Regardless of which product is introduced, the anticipated selling price will be $50 and the company will pay a 10% sales commission on gross dollar sales. Thomlinson will not carry an inventory of these items.

Required:
1. What is the break-even sales volume (in dollars) on product no. 66?
2. Which of the two products will be more profitable at a sales level of 25,000 units?
3. At what unit-volume level will the profit/loss on product no. 65 equal the profit/loss on product no. 66?

Problem 6
Elmton recently sold 70,000 units, generating sales revenue of $4,900,000. The company's variable cost per unit and total fixed cost amounted to $20 and $2,800,000, respectively. Management is in the process of studying the dollar impact of various transactions and events, and desires answers to the following independent cases:
Chapter 8 Cost-Volume-Profit Relationships

Case no. 1: Management wants to lower the firm's break-even point to 52,000 units. If all other costs remain constant, what must happen to fixed costs to achieve this objective?

Case no. 2: The company anticipates a $2 hike in the variable cost per unit. If all other costs remain constant and management desires to maintain the firm's current break-even point, what must happen to Elmenton's selling price? If selling price remains constant, what must happen to the firm's total fixed costs?

Required:

1. Answer the two cases raised by management.

2. Determine the impact (increase, decrease, or no effect) of the following operating changes on the items cited:

   a) An increase in variable selling costs on income.

   b) A decrease in direct material cost on the unit contribution margin.

   c) A decrease in the number of units sold on the break-even point.

Problem 7

Hatchcox Company is studying the impact of the following:

1. An increase in sales price.
2. An increase in the variable cost per unit.
3. An increase in the number of units sold (note: each unit produces a $6 contribution margin).
4. A decrease in fixed costs.
5. A proposed change in the method of compensation for salespeople, away from commissions based on gross sales dollars and toward higher monthly salaries.

Required:

Determine the impact of each of these operating changes on Hatchcox's per-unit contribution margin and break-even point by completing the chart that follows. Your responses should be Increase (INC), Decrease (DEC), No Effect (NE), or Insufficient Information to Judge (II).
Per-Unit
Contribution
Margin

Break-Even
Point

1. __________
2. __________
3. __________
4. __________
5. __________

Problem 8

Alphabeta Corporation sells three products: J, K, and L. The following information was taken from a recent budget:

<table>
<thead>
<tr>
<th></th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit sales</td>
<td>40,000</td>
<td>130,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Selling price</td>
<td>$60</td>
<td>$80</td>
<td>$75</td>
</tr>
<tr>
<td>Variable cost</td>
<td>40</td>
<td>65</td>
<td>50</td>
</tr>
</tbody>
</table>

Total fixed costs are anticipated to be $2,450,000.

Required:

1. Determine Alphabeta's sales mix.
2. Determine the weighted-average contribution margin.
3. Calculate the number of units of J, K, and L that must be sold to break even.
4. If Alphabeta desires to increase company profitability, should it attempt to increase or decrease sales of product K relative to those of J and L? Briefly explain.

Problem 9

Brice Publications, Inc. produces and sells business books. The results of the company's operations for the year ended December 31, 20x1, are given below.
Sales revenue $400,000
Cost of goods sold (manufacturing costs):
   Fixed 100,000
   Variable 200,000
Selling costs:
   Fixed 10,000
   Variable 20,000
Administrative costs:
   Fixed 24,000
   Variable 6,000

**Required:**
1. Prepare a traditional income statement for the company.
2. Prepare a contribution income statement for the company.
3. Which income statement (traditional or contribution) would an operating manager most likely use to study changes in operating income that are caused by changes in sales? Why?
CHAPTER 9
RESPONSIBILITY ACCOUNTING AND TRANSFER PRICING

After studying this chapter, you should be able to:

1. Explain the concept and objective of responsibility accounting system.
2. Enumerate the advantages of responsibility accounting.
3. Describe the pre-requisites to initiate and maintain an effective responsibility accounting system.
4. Describe the different types of responsibility centers.
5. Evaluate performance of a profit center, cost center, investment center and revenue center.
6. Explain the rationale of transfer pricing.
7. Define transfer price.
8. Discuss the need for transfer price in a decentralized organization.
9. Explain the general approaches in setting transfer price.
10. Compute the transfer price using the various approaches.
11. Explain the concept of distress prices.
12. Discuss the procedure in setting transfer price for service companies.
13. Describe the application of multinational transfer pricing.
CHAPTER 9
RESPONSIBILITY ACCOUNTING AND TRANSFER PRICING

RESPONSIBILITY ACCOUNTING

Decentralization in a Responsibility Accounting System

A decentralized organization is one in which decision making is not confined to a few top executives but rather is spread throughout the organization, with managers at various levels making key operating decisions relating to their sphere of responsibility.

Managers have found that segment reporting is of greatest value in organizations that are decentralized. In segment reporting, costs and revenues are assigned to segments to enable management to see where responsibility lies for control purposes and to measure the performance of segment managers.

Basic Concepts

In a well-managed organization, responsibilities for specific functions among its employees are clearly identified. A responsibility center is a specific unit of an organization assigned to a manager who is held accountable for its operations and resources. Each manager’s performance is judged by how well he or she manages those items under his or her control. In a budgeting program, each manager is assigned responsibility for those items of revenues and costs in the budget that he or she is able to control. Each manager is then held responsible for deviations between budgeted goals and actual results. This concept known as Responsibility accounting is central to any effective profit planning and control system.

Definition

Responsibility accounting is the system that recognizes various decision centers throughout an organization and traces costs (and revenues, assets and liabilities where pertinent) by areas of responsibility. This system is also known as activity accounting and profitability accounting. It operates on the premise that managers should be held
responsible for their performance, the activities of their subordinates and all activities within their responsibility center.

**Objective of Responsibility Accounting**

Through responsibility accounting, managers will be compelled to set managerial targets and formulate strategies to attain the firm's overall objectives. Control mechanism will be provided which will serve as the basis in evaluating actual results or performance.

**Advantages of Responsibility Accounting**

The following are the advantages or benefits that may be derived from Responsibility Accounting:

1. It facilitates delegation of decision-making.

2. It helps management promote the concept of management by objective wherein managers agree on a common set of goals and their performance evaluated on the basis of their attainment of goals.

3. It aids in establishing standards of performance which are used in evaluating the efficiency and effectiveness of the different units in the organization.

4. It permits effective use of management by exception which provides that the manager will maximize his efficiency by concentrating on those operational factors which are deviations from plans.

**Prerequisites to the Initiation and Maintenance of an Effective Responsibility Accounting System**

For an effective responsibility accounting system, the following basic conditions are necessary:

*Well-defined organization structure.* This requires that the spheres of jurisdiction which are set forth in the organization chart must be clearly established and understood and that a manager's financial responsibilities be defined in advance. This means that a *decentralized* approach to decision making is imperative if
responsibility accounting is to achieve the purposes for which it is intended. A decentralized organization is one in which decision making is not confined to a few top executives but rather is spread throughout the organization, with managers at various levels making key operating decisions relating to their sphere of responsibility.

1. **Well-defined and established standards of performance in revenues, costs and investments.** This requires that an integrated plan for the control of operations which would provide for cost standards, expense budgets, sales forecasts, profit planning and programs for capital investment and financing as well as the necessary procedures to effectuate the plan should be established and maintained.

2. **A system of accounting that identifies any revenues, expenses and assets to specific units in the organization.**

3. **A system that provides for the preparation of regular performance reports.** This requires that a system of preparing the regular reports showing the planned results, actual results and the variances should be established. These reports should include only the items that are controllable by the manager of the responsibility center and should highlight those items requiring management function.

**Responsibility Centers and their Evaluation**

An important step in establishing an effective responsibility accounting system is to determine the range of authority and influence the manager is permitted to have control over revenues, costs and investment. This will therefore require the establishment of responsibility centers within the organization. **Figure 14.1** illustrates business segments classified as cost, profit, and investment centers.

A responsibility center is a unit within the organization which has control over costs, revenues and/or investment funds.
The types of responsibility centers are cost center, profit center, investment center, and revenue center. Discussions of the nature, examples and performance evaluation of these centers are shown further.

**Figure 9.1 Business Segments Classified as Cost, Profit, and Investment Centers**

**COST CENTER**
This is a unit within the organization wherein the manager is responsible for minimizing costs subject to some output constraints. A distinguishing feature of a cost center is that it has no control over generating revenue or the use of investment funds. Examples are (1) maintenance department of a manufacturing company; (2) library section of a school; (3) accounting department of a trading concern. The manager of the cost center is responsible for making the projection or budget of costs in his unit based on the expected level of operation for the period. When approved by the higher authorities (board of directors), the budgets will serve as the basis for the transactions or activities for the ensuing period.
Performance of a cost is evaluated using the performance reports or variance analysis reports based on standard costs and flexible budget. The performance or responsibility cost report will show the comparison between the actual costs incurred and the budgeted costs. The difference between the two costs, if any, referred to as the variance will be reported and if significant, will be analyzed. Responsibility for the incurrence of the variance will be pinpointed and the manager concerned will be required to explain or justify the variance. The efficiency of the manager of the cost center to control the costs in his unit will be evaluated on the basis of whether the cause of the variance is within or beyond his control.

A responsibility cost report may be prepared using the format in Figure 9.2

Figure 9.2 Pro-forma Responsibility Cost Report

<table>
<thead>
<tr>
<th>Costs</th>
<th>Actual</th>
<th>Budget</th>
<th>Variance (Favorable)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
</tr>
<tr>
<td>Noncontrollable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
</tr>
<tr>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
</tr>
<tr>
<td>Indirect costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td></td>
</tr>
<tr>
<td>costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Illustrative Problem 9.1. Evaluation of a Cost Center

The department supervisors, at Mayfield, Inc., are authorized to purchase the direct and indirect materials needed in production, hire and assign the
production workers, and incur various overhead costs for their department. The equipment used in the department is acquired at a higher management level, but supervisors are responsible for proper care and maintenance. The salaries of the supervisors are shown under the cost of supervision.

During the year, Department 7 manufactured 40,000 units as budgeted. Budgeted and actual costs for Department 7 are given below:

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$210,000</td>
<td>$208,600</td>
</tr>
<tr>
<td>Direct labor</td>
<td>136,000</td>
<td>137,800</td>
</tr>
</tbody>
</table>

**Department costs:**

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervision</td>
<td>21,000</td>
<td>21,000</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>14,200</td>
<td>14,700</td>
</tr>
<tr>
<td>Repairs and maintenance</td>
<td>2,100</td>
<td>2,200</td>
</tr>
<tr>
<td>Equipment operating cost</td>
<td>3,400</td>
<td>3,300</td>
</tr>
<tr>
<td>Depreciation, equipment</td>
<td>4,000</td>
<td>4,000</td>
</tr>
</tbody>
</table>

**Allocated plant costs:**

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superintendence</td>
<td>19,500</td>
<td>21,000</td>
</tr>
<tr>
<td>Heat, light and power</td>
<td>3,700</td>
<td>3,900</td>
</tr>
<tr>
<td>Taxes and insurance</td>
<td>5,400</td>
<td>6,100</td>
</tr>
<tr>
<td>Other plant occupancy cost</td>
<td>5,000</td>
<td>6,700</td>
</tr>
<tr>
<td>Depreciation, plant</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>431,000</strong></td>
<td><strong>436,300</strong></td>
</tr>
</tbody>
</table>

**REQUIRED:**

(1) Compute the budgeted unit cost of the product and the actual unit cost.

(2) Prepare a responsibility cost report. Show cost variations from the budget.

(3) Does it appear that the supervisor was responsible for large part of the variation between budgeted and actual costs?
Chapter 9 Responsibility Accounting and Transfer Pricing

Solution: Mayfield, Inc.

Requirement 1:

Budgeted cost per unit = $431,300
                      40,000
                      = $10.7825

Actual cost per unit = $436,300
                      40,000
                      = $10.9075
Requirement 2:

Department 7
Responsibility Cost Report
For the Year Ended December 31, 20x1

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Fav) Unf</td>
</tr>
<tr>
<td>Direct costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllable costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td>$208,600</td>
<td>$210,600</td>
<td>$(1,400)</td>
</tr>
<tr>
<td>Direct labor</td>
<td>137,800</td>
<td>136,000</td>
<td>1,800</td>
</tr>
<tr>
<td>Indirect materials</td>
<td>14,700</td>
<td>14,200</td>
<td>500</td>
</tr>
<tr>
<td>Repairs and maintenance</td>
<td>2,200</td>
<td>2,100</td>
<td>100</td>
</tr>
<tr>
<td>Equipment operating cost</td>
<td>3,300</td>
<td>3,400</td>
<td>(100)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$366,600</td>
<td>$365,700</td>
<td>$600</td>
</tr>
<tr>
<td>Non-controllable costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervision</td>
<td>$21,000</td>
<td>$21,000</td>
<td>-</td>
</tr>
<tr>
<td>Depreciation, equipment</td>
<td>4,000</td>
<td>4,000</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25,000</td>
<td>25,000</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total direct costs</strong></td>
<td>$391,600</td>
<td>$390,700</td>
<td>$900</td>
</tr>
</tbody>
</table>

Indirect costs allocated to the department

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superintendence</td>
<td>$21,000</td>
<td>$19,500</td>
<td>$1,500</td>
</tr>
<tr>
<td>Heat, light and power</td>
<td>3,900</td>
<td>3,700</td>
<td>200</td>
</tr>
<tr>
<td>Taxes and insurance</td>
<td>6,100</td>
<td>5,400</td>
<td>700</td>
</tr>
<tr>
<td>Other plant occupancy cost</td>
<td>6,700</td>
<td>5,000</td>
<td>1,700</td>
</tr>
<tr>
<td>Depreciation, plant</td>
<td>7,000</td>
<td>7,000</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>44,700</td>
<td>44,600</td>
<td>4,100</td>
</tr>
</tbody>
</table>

**Requirement 3:**

From the computations shown above, it can be observed that $900 of the total $5,000 unfavorable cost variation are traceable to direct costs over which the department supervisor has control. Therefore, he was
responsible only for the 18% unfavorable cost variation. A larger part of the unfavorable cost variation could be traced to the costs which were allocated to his department and over which he did not have any control or authority. He, therefore should not be made answerable for the unfavorable variances arising from non controllable and indirect costs. Performance of the manager of a cost center is considered satisfactory if he is able to provide quality goods or services within the budgeted costs.

PROFIT CENTER

This is a unit or segment within the organization wherein the manager is responsible for the generation of revenues and control of costs incurred in that center. Examples are (1) loans and discounts department of a commercial bank; (2) ladies wear section of a department store; (3) college department of a university. As in other responsibility centers, the manager of the profit center projections will provide the guidelines and authority for him to enter into transactions for the budget period.

Performance of a profit center is measured by preparing the income statements using the contribution approach, presenting both the actual results and budgeted figures. The statement will show the comparative revenue, direct costs and the profit center's contribution to indirect costs. The operating performance of the profit center is generally considered satisfactory if the profit center is generally considered satisfactory if it is able to generate or even exceed the expected contribution to indirect costs or common costs of the company. Figure 9.3 shows the pro-forma income statement of a profit center.
Figure 9.3 Pro-forma income statement of a profit center.

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Budget</th>
<th>Unfavorable</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Company – Segment A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segmented Income Statement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the month of July, 20x1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
</tr>
<tr>
<td>Sales in units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Revenues</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Variable Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Sales commissions</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Total direct variable</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution Margin</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Direct fixed costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Total direct fixed cost</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Segment margin or costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution to indirect</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Common fixed costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Total common fixed cost</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
<td>$xx</td>
</tr>
<tr>
<td>Operating Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Illustrative Problem 9.2, Evaluation of a Profit Center

The Nicki Company, a wholesaling company, purchases and repackages three products for resale. During recent months, the company has
recommended that the profit picture would improve if Product 3 were dropped since it has been showing loss. An income statement of last month, which is considered to be typical, is given below:

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net sales</strong></td>
<td>$250,000</td>
<td>$120,000</td>
<td>$80,000</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of product</td>
<td>$120,000</td>
<td>$60,000</td>
<td>$30,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Sales commission (5%)</td>
<td>12,500</td>
<td>12,500</td>
<td>4,000</td>
<td>2,500</td>
</tr>
<tr>
<td>Fixed administrative costs allocated to product lines</td>
<td>80,000</td>
<td>40,000</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td>$212,500</td>
<td>$106,500</td>
<td>$54,500</td>
<td>$52,500</td>
</tr>
<tr>
<td><strong>Operating income</strong></td>
<td>$37,500</td>
<td>$14,500</td>
<td>$26,500</td>
<td>$(2,500)</td>
</tr>
</tbody>
</table>

**REQUIRED:**
Do an analysis to show whether the sales manager’s recommendation should be accepted or not. Assume that Product 3 could not be replaced with some other line, and also assume that the fixed costs would not change.

**Solution: Nicki Company**

**Nicki Company**  
**Profitability Analysis of Product 3**

<table>
<thead>
<tr>
<th>Net Sales</th>
<th>$50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Direct Cost and Expenses</td>
<td></td>
</tr>
<tr>
<td>Costs of Product</td>
<td>$30,000</td>
</tr>
<tr>
<td>Sales Commission</td>
<td>2,500</td>
</tr>
<tr>
<td>Contribution to Indirect Expenses</td>
<td>$17,500</td>
</tr>
</tbody>
</table>

**Conclusion:**

Product 3 contributes P17,500 to the recovery of indirect expenses. Therefore, in the absence of any other better alternative, it should not be dropped.
**Illustrative Problem 9.3 Evaluation of Profit Centers**

RTW Fashions Inc. operates with three divisions, A, B, and C. Division A produces revenue of $1,200,000 for the year, Division B produces revenue of $700,000 and Division C produces $600,000. The total costs for the year for each division:

<table>
<thead>
<tr>
<th>Divisions</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials, labor and other direct costs</td>
<td>$680,000</td>
<td>$720,000</td>
<td>$480,000</td>
<td>$1,880,000</td>
</tr>
<tr>
<td>Allocated company costs</td>
<td>200,000</td>
<td>200,000</td>
<td>200,000</td>
<td>600,000</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td><strong>$880,000</strong></td>
<td><strong>$920,000</strong></td>
<td><strong>$680,000</strong></td>
<td><strong>$2,480,000</strong></td>
</tr>
</tbody>
</table>

**REQUIRED:**
1. List the costs by division that can be directly attributed to that division.
2. Do all three divisions provide an amount over their direct costs to the total operation? Identify any division that does not.
3. Is there any division that covers direct costs but does not bear its full share of costs of the total operation? Identify that division, if any.
4. Which division(s) can bear all of its share of the allocated cost?

**Solution:** **RTW Fashions Inc.**

**Supporting Analysis:**

<table>
<thead>
<tr>
<th>Divisions</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$1,200,000</td>
<td>$700,000</td>
<td>$600,000</td>
<td>$2,500,000</td>
</tr>
<tr>
<td>Less: Direct costs</td>
<td>680,000</td>
<td>720,000</td>
<td>480,000</td>
<td>1,880,000</td>
</tr>
<tr>
<td>Contribution to indirect cost</td>
<td>520,000</td>
<td>(20,000)</td>
<td>120,000</td>
<td>620,000</td>
</tr>
<tr>
<td>Less: Allocated company costs</td>
<td>200,000</td>
<td>200,000</td>
<td>200,000</td>
<td>600,000</td>
</tr>
<tr>
<td><strong>Net income (loss)</strong></td>
<td><strong>$320,000</strong></td>
<td><strong>$(220,000)</strong></td>
<td><strong>$(80,000)</strong></td>
<td><strong>$2,480,000</strong></td>
</tr>
</tbody>
</table>

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Chapter 9 Responsibility Accounting and Transfer Pricing

Answer:

(1) Direct costs of the divisions:
   Division A $680,000
   Division B $720,000
   Division C $480,000

(2) No. Not all divisions provide an amount over their direct costs to the total operation. Division B does not cover its direct cost by $20,000.

(3) Division C contributes but cannot cover $80,000 of the allocated cost.

(4) Division A

INVESTMENT CENTER

This is a unit or segment within the organization where the manager is responsible for the control of revenues, costs and investments made in that center.

The objectives of an investment center or business unit are:

(a) Motivate managers to exert a high level of effort to achieve the goals of the firm.

(b) Provide the right incentive for managers to make decisions that are consistent with the goals of top management.

(c) Determine fairly the rewards earned by the managers for their effort and skill.

Advantage of ROI

(1) It is easily understood and has gained wide usage.

(2) It is comparable to interest rates of returns of alternative investments.
Return on Investment (ROI) Formula

\[
ROI = \frac{\text{Net operating income}}{\text{Average operating assets}}
\]

OR

\[
ROI = \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}
\]

OR

\[
ROI = \frac{\text{Operating profit margin}}{(\text{or Return on sales})}
\]

**Net operating income** [sometime referred to as EBIT (earnings before interest and taxes)] is generally used because it is consistent with the base to which it is applied, that is, operating assets.

**Operating assets** include cash, accounts receivable, inventory, plant and equipment (net), and all other assets held for productive use in the organization. Examples of assets that generally would **not** be included in the operating assets category are land held for future use, as investment in another company or a factory building rented to someone else.

**Limitations of ROI**

1. Although ROI is widely used in evaluating performance, this method is subject to some criticisms. One of these criticisms is that ROT tends to emphasize short-run performance rather than long-run profitability. Managers may motivate to reject profitable investment opportunities if the expected rate of return is lower than the current ROI. ROI may not be fully controllable by the division manager due to the presence of committed costs. Hence, the ROI makes it difficult to distinguish between a performance of the division manager and the performance of the division as an investment center.
(2) It results to disincentive for high ROI units to invest in projects with ROI greater than the minimum rate of return but less than unit's current ROI.

It is therefore advisable to use multiple criteria in evaluating performance rather than relying on ROI as a sole measure. These other criteria include (1) growth in market share (2) increase in productivity (3) product innovation (4) dollar profit (5) receivable and inventory turnover and (6) ability to venture into new and profitable areas.

In investment centers, ROI can be improved by either increasing sales, by reducing expenses or by reducing assets.

In investment centers, ROI can be improved by either increasing sales, by reducing expenses or by reducing asset.

Residual Income

Another approach to measuring performance in an investment center is a concept known as Residual Income.

Residual Income is the net operating income that an investment center is able to earn above some minimum return on the operating assets. Generally, the larger the residual income figure, the getter is the performance rating received by the division's manager.

Advantages of Residual Income

1. A unit pursues an investment opportunity costs as long as the return from the investment exceeds the minimum rate of return set by the firm.

2. The firm can adjust the required rates of return for differences in risk and types of assets. For example, units with higher business risk can be evaluated at a higher minimum rate of return. The increased risk might be due to obsolete products, increased completion in the industry or other economic factors affecting the business unit.
3. It is possible to calculate a different investment charge for different types of assets. For example, one might use a higher minimum rate of return for long-lived assets than more likely to be specialized in use and thus not as readily salable.

**Limitations of Residual Income**

While the residual income measure deals effectively with the disincentive problem of ROI it has also certain limitations. These are:

1. Since residual income is not a percentage, it suffers the same problem of profit centers in that it is not useful for composing units of significantly different sizes. It forms larger unit that would be expected to have larger residual income, even with relatively poor performance.

2. It is not as intuitive as ROI.

3. It may be difficult to obtain a minimum rate of return.

**Economic Value Added**

*Economic value added (EVA)* is a business unit’s income after taxes and after deducting the cost of capital. The idea is very similar to what we have explained as residual income. The objectives of the measures are the same – to effectively motivate investment center managers and to properly measure their performance. In contrast to residual income, EVA uses the firm’s cost of capital instead of a minimum rate of return. The *cost of capital* is usually obtained by calculating a weighted average of the cost of the firm’s two sources of funds – borrowing and selling stock. For many firms the minimum desired rate of return and the cost of capital are very nearly the same, with small differences due to adjustments for risk and for strategic goals such as the desired growth rate for the firm.

Another difference is that users of EVA do not follow conventional, conservative accounting policies. Expenses that contribute to the long-term value of the company are capitalized. These expenses usually are expensed under generally accepted accounting policies. Such expenses include research and development, certain types of advertising, and training and employee development.
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The main advantage of using EVA is that it focuses manager’s attention of creating value for shareholders by earning profit greater than the firm cost of capital.

Illustrative Problem 9.4 Performance Evaluation of an Investment Center

Case 1. MNO, division of Aeon Manufacturing, has assets of $450,000 and an operating income of $10,000.
   a. What is the division’s ROI?
   b. If the minimum rate of return is 12%, what is the division’s residual income?

Solution: Aeon Manufacturing

a. 
\[
\text{ROI} = \frac{\text{Net operating income}}{\text{Average operating assets}}
\]
\[
= \frac{110,000}{450,000} = 24.44\%
\]

b. 
\[
\begin{array}{l}
\text{Operating income} = 110,000 \\
\text{Less: Minimum required return (12% x $450,000)} = 54,000 \\
\text{Residual income} = 56,000
\end{array}
\]

Case 2. Consider the following:

<table>
<thead>
<tr>
<th>Division A</th>
<th>Division B</th>
<th>(000's dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating assets</td>
<td>$5,000</td>
<td>$12,500</td>
</tr>
<tr>
<td>Operating income</td>
<td>$1,000</td>
<td>$2,250</td>
</tr>
<tr>
<td>ROI</td>
<td>20%</td>
<td>18%</td>
</tr>
</tbody>
</table>

1. Which is the more successful division in terms of ROI?
2. Using 16 percent as the minimum required rate of return, compute the residual income for each division. Which division is more successful under this rate?
Chapter 9 Responsibility Accounting and Transfer Pricing

Solution:

1. Based on the information given, the more successful division in terms of ROI is division A because it has a higher ROI.

2.  

<table>
<thead>
<tr>
<th></th>
<th>Division A</th>
<th>Division B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating assets</td>
<td>$1,000</td>
<td>$2,250</td>
</tr>
<tr>
<td>Less: Minimum required return:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Division A (0.16 x $5,000)</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Division B (0.16 x $12,500)</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Residual income</td>
<td>$ 200</td>
<td>$ 250</td>
</tr>
</tbody>
</table>

Division B is more successful in terms of residual income.

Case 3. The following data are given for the Blade division:

Return on investment (ROI) 25%  
Sales $1,200,000  
Margin 10%  
Minimum required rate of return 18%

1. Compute the division’s operating assets.  
2. Compute the division’s residual income (RI).

Solution: Blade Division

\[
\text{ROI} = \frac{\text{Net operating income}}{\text{Average operating assets}} \\
25\% = \frac{($1,200,000 \times 10\%) \div \text{Operating assets}}{\text{Operating assets}} = \frac{$480,000}{\text{Operating assets}}
\]

\[
\text{Operating assets} = \frac{$480,000}{25\%} = \frac{$480,000}{0.25} = $1,920,000
\]

b.  

\[
\begin{align*}
\text{Operating income} & = $120,000 \\
\text{Less: Minimum required return (12\% x $450,000)} & = 86,400 \\
\text{Residual income} & = $33,600
\end{align*}
\]

More and more companies are using residual income as a measure of performance. They argue that the residual income approach encourages managers to make profitable investments that would be rejected by managers who are evaluated by the ROI formula.
Illustrative Problem 9.5. Comparison of Performance of Profit Centers

Consider the following data for two comparable divisions, Division A and B of Melo Corporation.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Division A</th>
<th>Division B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average operating assets</td>
<td>$100,000</td>
<td></td>
</tr>
<tr>
<td>Net Operating Income</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>Minimum required rate of return</td>
<td>15%</td>
<td></td>
</tr>
</tbody>
</table>

Division A is evaluated using the ROI while Division B's performance is assessed according to how large or how small the Residual Income is.

Division A's ROI is 20% while Division B's Residual Income is positive $5,000.

Assume that each of the divisions is presented with an opportunity to make an investment of $25,000 in a new project that would generate 18% on invested assets.

REQUIRED: Determine if the project is acceptable to Divisions A and B. Explain the reason for your answer.

Solution: Melo Corporation

1. Division A manager in most probability will reject the project because it will reduce his current ROI figure from 20% to 19% ($24,500 / $125,000)

2. Division B manager will be very anxious to accept the new investment opportunity because her concern is maximizing her residual income. Any project that provides a return greater than the maximum rate required (15%) will be attractive since it will add to the total amount of the residual income figure. The residual income will increase from $5,000 to $5,750

Furthermore, the well-being of both the manager of Division B and the company as a whole will be maximized by accepting all investment opportunities down the 15% cutoff rate.
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REVENUE CENTER

This is a unit or segment within an organization where the manager is responsible for selling budgeted quantities of various products or services at budgeted price.

Examples of managers of revenue centers are: A sales representative selling bread to supermarkets, a sales manager distributing automobile to dealers in specific geographic areas and the manager of the toys department in a local department store.

Such managers may also be responsible for travel, entertainment, and other marketing expenses. If so, they are liable to use flexible budgets to control these expenses. But expense control is a secondary goal in a revenue center.

Managers of revenue centers use variance in sales price and sales mix to monitor or control their operations. Managers of revenue centers are responsible for achieving budgeted levels of contribution margin by controlling the number of units sold, product mix, and selling prices.

Three types of variances and their formulas are useful to revenue center managers in meeting their goals:

1. **Sales Price Variance**

   \[
   \text{Sales Price Variance} = \left( \text{Actual sales price} - \text{Master budget sales price} \right) \times \text{Actual unit sales}
   \]

   This variance shows how much of the difference between actual and budgeted contribution margin is caused by the difference between actual and budgeted sales prices.

2. **Sales Volume Variance**

   \[
   \text{Sales Volume Variance} = \left( \text{Actual unit sold} - \text{Master budget unit sold} \right) \times \left( \text{Master budget average CM per unit} \right) \times \left( \text{Master budget Total CM} / \text{Master budget sales} \right)
   \]

   * Master budget average CM per unit

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This variance measures the difference between actual unit sales and budgeted unit sales.

3. Sales Mix Variance

\[
\text{Sales Mix Variance} = \left( \frac{\text{Flexible Budget average CM per unit}}{\text{Master budget average CM per unit}} \right) \times \text{Actual unit sales}
\]

\[
\text{Flexible Budget average CM per unit} = \frac{\text{Flexible budget total CM}}{\text{Actual unit sales}}
\]

This variance is a measure of the change in contribution margin caused by selling products in proportions (mix) different from those that were budgeted.

Illustrative Problem 9.6 Evaluation of a Revenue Centers

Karen Company's actual and budgeted sales and expense data for April are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Product</td>
<td>Product</td>
</tr>
<tr>
<td></td>
<td>Zim</td>
<td>Zoom</td>
</tr>
<tr>
<td>Sales in units</td>
<td>4,800</td>
<td>5,300</td>
</tr>
<tr>
<td>Selling price per unit</td>
<td>$12.50</td>
<td>$10.00</td>
</tr>
<tr>
<td>Variable expenses per unit</td>
<td>$6.90</td>
<td>$5.65</td>
</tr>
<tr>
<td>Contribution Margin per unit</td>
<td>$5.60</td>
<td>$4.35</td>
</tr>
<tr>
<td>Fixed expenses for the month for both products</td>
<td>$40,360</td>
<td>$40,000</td>
</tr>
</tbody>
</table>

REQUIRED: Determine the following variances and indicate whether they are favorable or unfavorable

1. Sales Price Variance
2. Sales Volume Variance
3. Sales Mix Variance
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Solution: Karen Company

1. Sales Price Variance:
   Product Zim = ($12.50 - $13) x 4,800 units
   = $2,400 unfavorable
   Product Zoom = ($10 - $10) x 5,300 units
   = $0

Total Sales Price Variance
   Zim $ 2,400 unfavorable
   Zoom 0 unfavorable
   $ 2,400 unfavorable

Karen's management may have a pricing problem with Product Zim as shown in the computation of sales price variance.

2. Sales Volume Variance
   = (10,000 units - 10,000 units) x $5.25 per unit*
   = $525 favorable

   * Master budget average CM per unit = \frac{(5,000 \times $6) + (5,000 \times $4.50)}{10,000 \text{ units}}
   = $5.25

The variance is favorable because the total actual number of units sold was greater than the total budgeted sales volume.

3. Sales Mix Variance
   = ($5.2187** - $5.25) x 10,000 units
   = $375 unfavorable

   * Flexible budget average CM per unit = \frac{(4,800 \times $6) + (5,300 \times $4.50)}{10,100 \text{ units}}
   = $5.21287

The sales mix variance is unfavorable because the flexible budget average contribution margin per unit is less than the master budget average contribution margin per unit.
TRANSFER PRICING

Rationale

A problem common to most companies operating with decentralized segments is that of placing a fair value of exchange of goods and services between segments within the company – the problem of Transfer pricing.

When goods or services are transferred from one unit of an organization to another, the transaction is recorded in the accounting records. In the days when all companies were small and management was centralized, accountants transferred goods and services from one cost center to another at the cost of production. Today many companies are giant conglomerates having multiple divisions. Simply transferring goods and services at cost no longer serves the needs of these decentralized organizations. The problems revolve around the question of what transfer price to charge between the segments.

A transfer price is the price charged when one segment of a company provides goods or services to another segment of the company. For example, when the Bakery Division of a department store transfers bread to the Supermarket Division, some transfer price must be agreed upon.

Definition

Transfer price is the value assigned to goods and services transferred between segments within the company.

The transfer price of interdivisional sales will affect the selling divisions’ sales and the buying divisions’ costs but will not have any direct effect on the company’s profit. However, the transfer price policy of the company can have an indirect effect on company profit by influencing decisions of the division manager.

The Need for Transfer Price

Transfer pricing becomes complex because of the need to evaluate an organization’s segments.

To the department selling goods and services, the transfer price is its revenue. To the department buying the goods and services, the transfer
price is its cost. Therefore, transfer prices have a direct bearing on segment margin. Corporate managers should set transfer pricing policies ensuring that divisions do not purchase outside when internal facilities with high fixed cost can provide the product. Allowing these facilities to be idle is detrimental to the overall company. A particular transfer pricing basis may also be an excellent management tool (1) for motivating division managers, (2) for establishing and maintaining cost control systems and for measuring internal performance. The company should likewise establish a transfer pricing policy that encourages decentralized managers to make an economically optimal decision for the company without significantly reducing their autonomy. The transfer pricing policy should allow divisional autonomy yet encourage managers to pursue corporate goals consistent with their own personal goals.

Alternative Transfer Pricing Schemes

In practice, four general approaches are used on setting transfer price.

1. Minimum Transfer Price
2. Market-based Transfer Price
3. Cost-based Transfer Price
   a. Variable Cost
   b. Full Cost
   c. Alternative Cost Measures
4. Negotiated Transfer Price

Discussion:

1. MINIMUM TRANSFER PRICE

A general rule for making transfers to maximize a company's profits in either perfect or imperfect market uses the formula:

\[
\text{Transfer Price} = \text{Differential costs per unit} + \frac{\text{Lost CM per unit on outside sales}}{\text{(or opportunity costs per unit)}}
\]

The price set by the transfer pricing formula is equal to the differential costs (generally the variable costs) of the goods being transferred, plus the contribution margin per unit that is lost to the selling division as a result of giving up outside sales.
It also represents the lower limit since the selling division must receive at least the amount shown by the formula in order to be as well off as if it sold only to outside customers. The transfer price can be more than the amount shown by the formula but for an internal transfer to take place, the transfer price should not exceed the purchase price from the outside supplier.

If the selling division has sufficient idle capacity to meet the demand of another division without cutting into the sales of its regular customers, then it does not have any opportunity costs. Hence, the lowest acceptable transfer price will be equal to the differential or variable costs per unit. From perspective of a buying division, the maximum acceptable transfer price is equivalent to the price offered by the outside supplier.

2. MARKET-BASED TRANSFER PRICE

Under this approach, the transfer price is the price at which the goods are sold on the open market.

The market price approach is designed for situations in which there is an outside market for the transferred product or service; the product or service is sold in its present form to outside customers. If the selling division has no idle capacity, the market price in the outside market is the perfect choice for the transfer price. The reason for this is that if the selling division can sell a transferred item on the outside market instead, then the real cost of the transfer as far as the company is concerned is the opportunity cost of the lost revenue on the outside sale. Whether the item is transferred internally or sold on the outside market, the production costs are exactly the same. If the market price is used as the transfer price, the selling division manager will not lose anything by making the transfer, and the buying division manager will get the correct signal about how much it really costs the company for the transfer to take place.

This is considered the best transfer price because it dovetails well with the profit center concept and makes profit-based performance evaluations feasible at many levels of the organization. By using market prices to control transfers, all divisions or segments are
able to show profits for their efforts – not just the final division in the chain of transfers.

This market price approach is particularly useful in highly decentralized organizations. As a general rule, this policy should contain the following guidelines:

1. The buying division must purchase internally so long as the selling division meets all bona fide outside prices and wants to sell internally.
2. The selling division must be free to reject internal business if it prefers to sell outside.
3. If the selling division does not meet all bona fide outside prices, then the buying division is free to purchase outside.
4. As independent and impartial body must be established to settle disagreements between divisions over transfer prices.

3. COST-BASED TRANSFER PRICE

a. Variable Cost Transfer Price

Under this approach, the transfer price is based only on variable or differential costs. Variable costs approximate differential costs in many situations. But when fixed costs increase because of a transfer of goods between segments, they are differential costs and therefore should be included in the transfer price cost.

The advantage of using this basis is that it ensures in the short-run the best use of total corporate facilities because it focuses attention on the contribution margin a transfer generates and on how it increases short-run profitability.

Among the disadvantages of using Variable Costs or Differential Costs basis in setting transfer price are:

(1) A company must cover all costs before earning a profit. If fixed costs are ignored, a variable cost transfer price may be profitable in the short run, but not in the long run.
(2) It allows one segment manager to make a profit at the expense of another segment manager because the receiving segment receives all the profit.

(3) The use of this method could lead to dysfunctional decisions if a segment must forgo outside sales to make products for other internal segments.

(4) Transfer prices based on differential costs diminish the autonomy in decision-making of the profit centers. If differential cost varies with volume, the selling segment is dependent on the total demands of the buying division and its external customer. This will mean that neither segment can make its output decisions independently.

b. Full Cost Transfer Price

Full cost includes actual manufacturing costs (variable and fixed) plus portions of marketing and administrative costs. Many companies use full cost because of the following reasons:

(1) It is easy and convenient to apply.

(2) It leaves no intercompany profits in inventory to eliminate when preparing consolidated statement.

(3) It allows simple and adequate end-product costing for profit analysis by product lines.

This approach however is not suitable for companies with decentralized structures that measure the profitability of autonomous units. Segments tend to become complacent and less concerned about controlling costs when they know their costs are merely passed along to the next segment. Another criticism of full cost is that it does not create incentives for segment managers to control or reduce costs. It likewise does not provide management with a divisional profit figure for selling division.

Lastly, full-cost method departs from good-congruence. Goal congruence means the correspondence means the correspondence or consistency of individual manager’s sub-goals with the company’s overall goals. The use of full-cost transfer price can lead to decisions that are not goal congruent when the supplying division is not operating at capacity. For instance, a division may want to purchase outside the
company as an apparent savings. However, a reduction of the full-cost transfer price to the outside market purchase price would recover all variable costs and a portion of fixed costs. The company fails to cover these fixed costs because of the decision to purchase outside. To avoid such sub-optimization, top management must order the lowering of transfer prices or require internal purchasing. These solutions will both dilute the authority of individual divisions.

*Standard full cost* may also be used instead of the historical average cost because it eliminates the negative effect of fluctuations in production efficiency in one division on the reported income of another division. Division managers can determine in advance what price they will receive or what price they will pay for transferred goods. The disadvantage mentioned in the previous section will likewise apply in standard full cost basis.

c. *Alternative Cost Measures*
   a) *Full Absorption Cost-based Transfer Price*
      Many manufacturing firms use *full-absorption costs* basis because of the difficulty in determining the opportunity cost to the company of making internal transfer. It must be noted that only the manufacturing costs, variable and fixed, should be included in full absorption cost. Some advantages of this approach are:
      1. Costs are available in the company’s records.
      2. They provide the selling division with a contribution equal to the excess of full-absorption costs over variable costs, which gives the selling division an incentive to transfer internally.
      3. This may be a better measure of the differential costs of transferring internally than the variable costs because other costs such as unknown engineering and design cost are included.

   b) *Cost-Plus Transfer*
      Some companies use cost-plus transfer pricing based on either variable costs or full absorption cost. These methods generally apply a normal markup to costs as a
Chapter 9 Responsibility Accounting and Transfer Pricing

substitute for market prices when intermediate market prices are not available.

4. NEGOTIATED TRANSFER PRICE

Under this system, managers are permitted to negotiate the price for internally transferred goods and services. Managers act much the same as the managers of independent companies and negotiation strategies similar to those employed when trading with outside markets.

A negotiated price is an attempt to simulate an arm's-length transaction between supplying and buying segment. If companies give segment managers autonomous authority to buy and sell as they think necessary and if they bargain in good faith, the result of this bargaining is the equivalent of a market price.

The major advantage of negotiated transfer prices is that they preserve the autonomy of the division manager. However, negotiation may be very time-consuming and require frequent re-examination and revision of prices. Furthermore, negotiated prices eliminate the objectivity necessary to ensure maximization of companywide profits. As a result, the negotiated price may distort segment financial statement and mislead top management in its attempt to evaluate performance and make decisions. Performance measure may depend more on the manager's ability to negotiate than on other factors.

Distress Prices

When supply outstrips demand, market prices may drop well below their historical average. If the drop in prices is expected to be temporary, these low market prices are sometimes called “distress prices.” Deciding whether a current market price is a distress price is often difficult. The market prices of several agricultural commodities, such as wheat and oats, have stayed for many years at what observers initially believed were temporary distress levels.
Which transfer price should be used for judging performance if distress prices prevail? Some companies use the distress prices themselves, but others use long-run average prices, or "normal" market prices. In the short-run, the manager of the selling division should meet the distress price as long as it exceeds the incremental costs of supplying the product or service. If not, the selling division should stop selling the product or service to the buying division which should buy the product or service from an outside supplier. These actions would price is used, forcing the manager to buy internally at a price above the current market price will hurt the buying division's short-run performance and understate its profitability. Using the long-run average market price, however, provides a better measure of the long-run viability of the supplier division. If price remains low in the long run, though, the company should use the distress price as the transfer price. The manager of the selling division must then decide whether to dispose of some manufacturing facilities or shut down and have the buying division purchase the product from an outside supplier.

Transfer Price for Services

Departments of many large organizations may sell services for customers and for each other internally. The department performing the services to a second department generates revenues from such activity. The same transfer is the second department's purchase of services. For example, a company typically bill administrative services, such as computer processing, accounting, payroll and personnel to the departments they support. In each of the cases, equitable transfer prices must be established to appraise the department's performance for its own return on invested capital.

The following steps may be followed in setting transfer price for services:

1. Identify the different departments contributing various services.
2. Evaluate the corresponding skill and experience of personnel involved in delivering services.
3. Estimate the cost involved in providing the service. Factors such as time requirements, qualifications, cost of the facilities needed to provide the service should be considered.
4. Adopt one or any the principles applied to the transfer of products discussed in this chapter (e.g. cost-based transfer price, market-based).
Multinational Transfer Pricing

Transfer pricing is used worldwide to control the flow of goods and services between segments of organizations. However, the objective of transfer pricing change when a multinational corporation is involved and the goods and services being transferred must cross international borders. The objectives of international transfer pricing focus on minimizing taxes, duties, and tariffs, foreign exchange risks along with enhancing a company’s competitive position and improving its relation with foreign government.

Corporations may change a transfer price that will reduce its total tax bill or that will strengthen a foreign subsidiary. For example, a division in a high-income-tax-rate country produces a subcomponent for another division in a low-income-tax rate country. By setting a low transfer price, most of the profit from the production can be recognized in the low-income-tax-rate country, thereby minimizing taxes. On the other hand, items manufactured by divisions in a low-income-tax-rate country and transferred to a division in a high-income-tax-rate country should have a high transfer price to minimize taxes.

Sometimes import duties offset income tax effects. Usually import duties are based on the price paid for an item, whether bought from an outside company or transferred to another division. Therefore, low transfer prices will be used to lessen the import duties.

Managers should be sensitive to the geographics, political and economic circumstances in which they are operating, and set transfer price in such a way as to optimize total company performance and at the same time conform with the laws in various countries where they operate.

Illustrative Problem 9.7

The Lewis Company has two divisions, Production and Marketing. Production manufactures designer pants, which it sells to both the Marketing Division and to other retailers (to the latter under a different brand name). Marketing operates numerous pants stores, and its sells
both Lewis pants and other brands. The following facts also pertain to the Lewis Company:

- Sales price to retailers if sold by Production: $380 per pair.
- Variable cost to produce: $190 per pair.
- Fixed costs: $2,000,000 per month.
- Production is operating far below its capacity.
- Sales price to customers if sold by Marketing: $500 per pair.
- Variable marketing costs: 5 percent of sales price.

Marketing has decided to reduce the sales price of Lewis pants. The company's variable manufacturing and marketing costs are differential to this decision, whereas fixed manufacturing and marketing costs are not.

a. What is the minimum price that can be charged for the pants and still cover differential manufacturing and marketing costs?

b. What is the appropriate transfer price for this decision?

c. What if the transfer price were set at $380? What effect would this have on the minimum price set by the marketing manager?

d. How would you answer to questions a and b change if the Production Division had been operating at full capacity?

Solution: Lewis Company

a. From the company's perspective, the minimum price would be the variable cost of producing and marketing the goods. It would solve for this minimum price as follows:

Let \( X \) = minimum transfer price

\[
X = 190 + 0.05X
\]

\[
= 190 / 0.95
\]

\[
= $200
\]

The minimum price the company should accept is $200. If the company were centralized, we would expect this information to be conveyed to the manager of Marketing, who would be instructed not to set a price below $200.

b. The transfer price that correctly informs the marketing manager about the differential costs of manufacturing is $190. Production is operating below capacity, so there is no opportunity cost of transferring internally.
c. If the production manager sets the price at $380, the marketing manager would solve for the minimum price:

\[
\begin{align*}
X_1 &= \text{minimum price} \\
X_1 &= 380 + 0.05X_1 \\
X_1 &= 380 / 0.95 \\
X_1 &= 400
\end{align*}
\]

So the marketing manager sets the price in excess of $400 per pair, when, in fact, prices greater than $200 would have generated a positive contribution margin from the production and sale of pants.

d. For question a:

If Production is operating at full capacity, the minimum price is

\[
\begin{align*}
X_1 &= 380 + 0.05X_1 \\
0.95X_1 &= 380 \\
X_1 &= 400
\end{align*}
\]

For question b:

If Production Division had been operating at capacity, there would have been an implicit opportunity cost of internal transfer. Production would have foregone a sale in the wholesale market to make the internal transfer. The implicit opportunity cost to the company is the lost contribution margin ($380 - $190 = $190) from not selling in the wholesale market.

Thus, if Production had sufficient sales in the wholesale market so that it would have had to forego those sales to transfer internally, the transfer price should have been

\[
\text{Differential cost to production} + \text{Implicit opportunity cost} = 190 + 190 = 380
\]
Illustrative Problem 9.8

Assume the Speakers Division of MegaAudio Company supplies speakers to outside customers at a price of $350 each. The company has just acquired a radio assembly company. The company has just acquired a radio assembly company. The president believes this newly acquired Radio Division should purchase speakers from the company’s own Speakers Division because this division has excess capacity. Until the acquisition, the radio assembly company had purchased transistors for $350 less a 10 percent discount.

Assume no additional machines or supervisors will be acquired for the internal transfers and the Speakers Division’s unit cost is

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct material</td>
<td>$100</td>
</tr>
<tr>
<td>Direct labor</td>
<td>115</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>50</td>
</tr>
<tr>
<td>Fixed overhead (currently operating at 1,000,000 units activity level)</td>
<td>30</td>
</tr>
<tr>
<td>Total cost</td>
<td>$295</td>
</tr>
</tbody>
</table>

Various members of management have proposed the following transfer prices:

1. **Differential cost** - $265. This is an appropriate transfer price for guiding top management in deciding whether there should be transfers between the two divisions as long as the total differential costs are less than the outside purchase price of the buying division. This transfer price would be appropriate only when the selling division has excess capacity as it does in this example. This transfer price also would be appropriate in situations where there is no outside market. All benefits of using differential costs as the basis for transfer price accrue to the buying division.

2. **Full cost** – $295. This transfer price would be appropriate if the company treats both divisions as cost centers rather than as independent, autonomous profit centers. Speakers Division profits
are reflected in the profits of the Radio Division when using this transfer price.

3. *Market price* - $315 ($350 − $35 discount = $315). This transfer price represents the price that the Radio Division pays an independent, outside supplier and is appropriate if the company treats both divisions as independent units.

4. *Full cost plus markup* - $350. This price is not appropriate because it exceeds the price that the Radio Division pays an outside supplier. In addition, the Speaker Division has excess capacity, and its opportunity cost to differential costs results in $350 transfer price as follows: $265 differential costs per unit + $85 lost contribution margin on outside sales = $350.

5. *Prime cost* - $215. This price would not be appropriate because it does not cover all the differential costs of the Speaker Division.

6. *Negotiated price* - $290. A negotiated price of $290 would be appropriate if the company treats both divisions as profit centers and both divisions share in the benefits. The $50 ($315 − $265) difference between the Speakers Division’s differential cost and the net outside purchase price is divided between the two divisions.

As just illustrated, the transfer price selected should depend on the capacity level at which the selling division is operating, as well as on other factors unique to the situation.

**Illustrative Problem 9.9**

NY Company’s Electrical Division produces a high-quality transformer. Sales and cost data on the transformer follow:

- Selling price per unit on the outside market: $40
- Variable costs per unit: $21
- Fixed costs per unit (based on capacity): $9
- Capacity in units: 60,000

NY Company has a Motor Division that would like to begin purchasing this transformer from the Electrical Division. The Motor Division is currently purchasing 10,000 transformers each year from another company at a
cost of $38 per transformer. NY Company evaluates its division managers on the basis of divisional profits.

REQUIRED:

1. Assume that the Electrical Division is now selling only 50,000 transformers each year to outside customers.
   a. From the standpoint of the Electrical Division, what is the lowest acceptable transfer price for transformers sold to the Motor Division?
   b. From the standpoint of the Motor Division, what is the highest acceptable transfer price for transformers acquired from the Electrical Division?
   c. If left free to negotiate without interference, would you expect the division managers to voluntarily agree to the transfer of 10,000 transformers from the Electrical Division to the Motor Division? Why or why not?
   d. From the standpoint of the entire company, should a transfer take place? Why or why not?

2. Assume that the Electrical Division is now selling all of the transformers it can produce to outside customers.
   a. From the standpoint of the Electrical Division, what is the lowest acceptable transfer price for transformers sold to the Motor Division?
   b. From the standpoint of the Motor Division, what is the highest acceptable transfer price for transformers acquired from the Electrical Division?
   c. If left free to negotiate without interference, would you expect the division managers to voluntarily agree to the transfer of 10,000 transformers from the Electrical Division to the Motor Division? Why or why not?
   d. From the standpoint of the entire company, should a transfer take place? Why or why not?

Solution:

Requirement 1
Chapter 9 Responsibility Accounting and Transfer Pricing

a. The lowest acceptable transfer price from the perspective of the selling division, the Electrical Division, is given by the following formula:

\[
\text{Transfer price} \geq \frac{\text{Variable cost per unit}}{} + \frac{\text{Total CM on lost sales}}{\text{Number of units transferred}}
\]

Since there is enough idle capacity to fill the entire order from the Motor Division, there are no lost outside sales. And since the variable cost per unit is $21, the lowest acceptable transfer price as far as the selling division is concerned is also $21.

\[
\text{Transfer price} \geq \frac{\$21}{1} + \frac{\$0}{10,000} = \$21
\]

b. The Motor Division can buy a similar transformer from an outside supplier for $38. Therefore the Motor Division would be unwilling to pay more than $38 per transformer.

\[
\text{Transfer price} \geq \frac{\text{Cost of buying from outside supplier}}{\text{outside supplier}} = \$38
\]

c. Combining the requirements of both the selling division and the buying division, the acceptable range of transfer prices in this situation is:

\[
\$21 \geq \text{Transfer price} \geq \$38
\]

Assuming that the managers understand their own businesses and that they are cooperative, they should be able to agree on a transfer price within this range and the transfer should take place.

d. From the standpoint of the entire company, the transfer should take place. The cost of the transformers transferred is only $21 and the company saves the $38 cost of the transformers purchased from the outside supplier.
Requirement 2

a. Each of the 10,000 units transferred to the Motor Division must displace a sale to an outsider at a price of $40. Therefore, the selling division would demand a transfer price of at least $40. This can also be computed using the formula for the lowest acceptable transfer price as follows:

\[
\text{Transfer price} \geq \$21 + \frac{($40 - \$21) \times 10,000}{10,000}
\]

\[
= \$21 + ($40 - \$21)
\]

\[
= \$40
\]

b. As before, the Motor Division would be unwilling to pay more than $38 per transformer.

c. The requirements of the selling and buying divisions in this instance are incompatible. The selling division must have a price of at least $40 whereas the buying division will not pay more than $38. An agreement to transfer the transformers is extremely unlikely.

d. From the standpoint of the entire company, the transfer should not take place. By transferring a transformer internally, the company gives up revenue of $40 and saves $38, for a loss of $2.
SHORT QUESTIONS:

1. What is responsibility accounting? Explain with examples.
2. Indicate the features of responsibility reports for cost centers? How it differ from the reports for profit center?
3. What is investment center? Explain the basis and formula used in evaluating performance in investment center.
4. What is the major difference between return on investment and residual income?

EXERCISES:

Problem 1:

Wirefree, Inc. provides a variety of telecommunications services to residential and commercial customers from its massive campus-like headquarters in suburban Orlando. For a number of years the firm's maintenance group has been organized as a cost center, rendering services free of charge to the company's user departments (sales, billing, accounting, marketing, research, and so forth). Requests for maintenance have grown considerably, and demand is approaching the point where quality and timeliness of services provided are becoming an issue. As a result, management is studying whether the maintenance operation should be converted from a cost center to a profit center, with users to be billed for services performed.

Required:

1. Differentiate between a cost center and a profit center. How is each of these centers evaluated?
2. What will likely happen to the number of user service requests if the company makes the switch to a profit-center form of organization? Why?
3. Assume that a user department has requested a particular service, one that is time consuming and costly to perform. The maintenance group's actual cost incurred in providing this service is $17,800, and the user has agreed to pay $20,800 if the switch to a profit center is made. If this case is fairly typical within the firm, which of the two forms of organization (cost center or profit center) will result in a more responsive, service-oriented maintenance group for Wirefree? Why?
Problem 2

Bronze Life Corporation (BLC) manufactures decorative, sculpted accessories that are sold by interior decorators and home furnishing stores. The following situation concerns two BLC employees: Deborah Philbun, head of the company's Billing Department, and Gary Bitner, the firm's general manager. Philbun's Billing Department makes heavy use of hourly employees and is evaluated as a cost center. Understanding the need for prompt collection of receivables, Philbun strives to run a first-class operation. Philbun also understands the need to contribute in a big way to BLC's financial performance so she continually strives to minimize Billing Department expenses.

Unfortunately, Philbun experienced a heated discussion with Bitner several weeks ago, the subject being the shoddy operation that she is running. Bitner complained loudly about the lack of timely billings to customers and the general lack of attention to detail, as many complaints have surfaced about erroneous invoices and customer statements.

Required:

1. What is meant by the term "responsibility accounting?"
2. What measure(s) of performance would companies normally use to evaluate a cost-center manager?
3. Does Bitner have a valid reason to be upset with Philbun? Given the nature of the Billing Department, did Philbun err in her quest to minimize expenses? Explain.
4. Is it likely that the Billing Department could be evaluated as a profit center? Why?

Problem 3
County Cable Services Inc. is organized in three segments: Metro, Suburban, and Outlying. Data for the company and for these segments follow.
<table>
<thead>
<tr>
<th>Cable Services Inc.</th>
<th>Segments of Company Metro</th>
<th>Suburban</th>
<th>Outlying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service revenue</td>
<td></td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>Less: Variable costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment contribution margin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less: Controllable fixed costs</td>
<td></td>
<td>200</td>
<td>160</td>
</tr>
<tr>
<td>Controllable profit margin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less: Noncontrollable fixed costs</td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Segment profit margin</td>
<td>180</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Less: Common fixed costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income before income taxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less: Income tax expense</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net income</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variable costs as a percentage of service revenue are: Metro, 20%; Suburban, 18.75%; and Outlying, 25%.

**Required:**

1. Complete the segmented income statement for County Cable.
2. Evaluate the three segment managers for consideration of a pay raise. Base the managers' performance on (1) absolute dollars of the appropriate profit measure, and (2) the appropriate profit measure as a percentage of service revenue. What causes any difference in rankings between the two approaches?

**Problem 4**

Fog City Retail operates a retail store in Phoenix, Las Vegas, and Portland. The following information relates to the Phoenix facility:

- The store sold 65,000 units at $18.00 each, after having purchased the units from various suppliers for $12.50. Phoenix salespeople are paid a 5% commission based on gross sales dollars.
- Phoenix's sales manager oversees the placement of local advertising contracts, which totaled $54,000 for the year. Local property taxes amounted to $14,500.
The sales manager’s $65,000 salary is set by Phoenix’s store manager. In contrast, the store manager’s $134,000 salary is determined by Fog City’s vice president.

Phoenix incurred $6,800 of other noncontrollable costs

Nontraceable (common) corporate overhead totaled $68,000

Fog City’s corporate headquarters is located in Portland, and the company uses responsibility accounting to evaluate performance.

**Required:**
Prepare a segmented income statement for the Phoenix store, being sure to disclose the segment contribution margin, the segment controllable profit margin, and segment profit margin.

**Problem 5**

Kirsten, Inc. operates a chain of 80 retail stores throughout the Northwest that specializes in the sale of sports equipment. The following costs relate to store no. 19 in Seattle, Washington:
1. Salary of store manager: $58,000
2. Allocated corporate overhead: $55,000
3. Cost of goods sold: $2,560,000
4. Landscaping and grounds costs (yearly contract): $6,800
5. Hourly wages of sales clerks: $343,000
6. Local advertising (negotiated by store manager): $76,000
7. Property taxes: $25,800
8. Sales commissions: $221,000

**Required:**
Which of the preceding costs would be used in computing:

1. Store no. 19's segment contribution margin?
2. Store no. 19's controllable profit margin?
3. Store no. 19's segment profit margin?
4. The net income of Kasten, Inc.?

**Problem 6**

Bluegrass, Inc., which is headquartered in Atlanta, operates a chain of 225 clothing stores throughout the United States. Consider the costs that
appear in the following table, many of which pertain to the company's sole operation in Jacksonville, Florida:

<table>
<thead>
<tr>
<th>Cost</th>
<th>Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacksonville's property taxes</td>
<td></td>
</tr>
<tr>
<td>Sales commissions paid to Jacksonville employees</td>
<td></td>
</tr>
<tr>
<td>Allocated corporate overhead to individual store sites</td>
<td></td>
</tr>
<tr>
<td>Wages of Jacksonville hourly employees</td>
<td></td>
</tr>
<tr>
<td>Salary of Jacksonville's manager</td>
<td></td>
</tr>
<tr>
<td>Jacksonville's cost of goods sold</td>
<td></td>
</tr>
<tr>
<td>Local advertising handled by Jacksonville's manager</td>
<td></td>
</tr>
<tr>
<td>Bluegrass income tax expense</td>
<td></td>
</tr>
<tr>
<td>Jacksonville's store maintenance costs</td>
<td></td>
</tr>
</tbody>
</table>

Specify store maintenance as a fixed costs. Adopt the following language." Jacksonville's store maintenance costs as agreed upon in yearly maintenance contract negotiated by Jacksonville's manager."

**Required:**
Analyze each of the costs and determine whether the cost affects Jacksonville's segment contribution margin, controllable profit margin, and segment profit margin, and/or the net income of Bluegrass, Inc. Place an "X" in the appropriate cell(s).

**Problem 7**
The Real Estate Products Division of McKenzie Co. is operated as a profit center. Sales for the division were budgeted for 2013 at $1,250,000. The only variable costs budgeted for the divisions were cost of goods sold ($610,000) and selling and administrative ($80,000). Fixed costs were budgeted at $130,000 for cost of goods sold, $120,000 for selling and
administrative and $95,000 for noncontrollable fixed costs. Actual results for these items were:

Sales $1,175,000
Cost of goods sold
  Variable 545,000
  Fixed 140,000
Selling and administrative
  Variable 82,000
  Fixed 100,000
  Noncontrollable fixed 105,000

Required:
1. Prepare a responsibility report for the Real Estate Products Division for 2013.
2. Assume the division is an investment center, and average operating assets were $1,200,000. Compute ROI.

Problem 8
The Medford Burkett Company uses a responsibility reporting system to measure the performance of its three investment centers: Planes, Taxis, and Limos. Segment performance is measured using a system of responsibility reports and return on investment calculations. The allocation of resources within the company and the segment managers' bonuses are based in part on the results shown in these reports.

Recently, the company was the victim of a computer virus that deleted portions of the company's accounting records. This was discovered when the current period's responsibility reports were being prepared. The printout of the actual operating results appeared as follows.

<table>
<thead>
<tr>
<th></th>
<th>Planes</th>
<th>Taxis</th>
<th>Limos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service revenue</td>
<td>$ ?</td>
<td>$450,000</td>
<td>$ ?</td>
</tr>
<tr>
<td>Variable costs</td>
<td>5,000,000</td>
<td>?</td>
<td>320,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>?</td>
<td>180,000</td>
<td>380,000</td>
</tr>
<tr>
<td>Controllable fixed costs</td>
<td>1,500,000</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Controllable margin</td>
<td>?</td>
<td>70,000</td>
<td>176,000</td>
</tr>
<tr>
<td>Average operating assets</td>
<td>25,000,000</td>
<td>?</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Return on investment</td>
<td>12%</td>
<td>10%</td>
<td>?</td>
</tr>
</tbody>
</table>
Chapter 9 Responsibility Accounting and Transfer Pricing

**Required:**
Determine the missing pieces of information above.

**Problem 9**
The Atlantic Division of Stark Productions Company reported the following results for 2013:

- Sales: $4,000,000
- Variable costs: $3,200,000
- Controllable fixed costs: $300,000
- Average operating assets: $2,500,000

Management is considering the following independent alternative courses of action in 2014 in order to maximize the return on investment for the division.

1. Reduce controllable fixed costs by 10% with no change in sales or variable costs.
2. Reduce average operating assets by 10% with no change in controllable margin.
3. Increase sales $500,000 with no change in the contribution margin percentage.

**Required:**
1. Compute the return on investment for 2013.
2. Compute the expected return on investment for each of the alternative courses of action.
CHAPTER 10
FUNCTIONAL AND ACTIVITY-BASED BUDGETING

After studying this chapter, you should be able to:

1. Define budgeting and other related terminologies.
2. Describe the functions, purposes, advantages and limitations of budgeting.
3. Distinguish between an operating budget, financial budget and capital budget.
4. Explain the management process of preparing the master budget the master budget and describe the budget cycle.
5. Prepare a sales budget including a computation of expected cash receipts.
6. Prepare a production budget, direct materials budget, direct labor budget including a computation of expected cash disbursement for purchases of material and payment of direct labor.
7. Prepare a manufacturing overhead budget and a selling and administrative expense budget.
8. Prepare a cash budget.
10. Define a flexible budget.
11. Compare fixed and flexible budget variances.
CHAPTER 10
FUNCTIONAL AND ACTIVITY-BASED BUDGETING

Repeated references to budget allowances have been made throughout previous chapters and we have seen how closely accounting and budgeting are related and how one depends on the other. Accounting draws some of its data from planned performances established in the budget; in turn, recorded historical data provide a basis for determining budget estimates.

Budget Defined

A budget is a financial plan of the resources needed to carry out tasks and meet financial goals. It is also a quantitative expression of the goals the organization wishes to achieve and the cost of attaining these goals.

The act of preparing a budget is called budgeting. The use of budgets to control a firm’s activities is known as budgetary control.

The overall or master budget (also known as planning budget or budget plan) indicates the sales levels, production and cost levels, income and cash flows that are anticipated for coming year.

The master budget is a summary of all phases of a company’s plans and goals for the future. In short, it represents a comprehensive expression of management’s plans for the future and how these plans are to be accomplished.

Difference between Planning and Control

Planning and control are two quite distinct concepts. Planning involves developing objectives and preparing various budgets to achieve these objectives. Control involves the steps taken by management to ensure that the objectives set down at the planning stage are attained and to ensure that all parts of the organization function in a manner consistent with organizational policies. An effective budgeting system must provide for both planning and control. Good planning without effective control is
time wasted. On the other hand, unless planes are presented or known in advance, there are no objectives toward which control can be directed.

Functions of Budgeting

Properly conceived, budgeting can mean the difference between a general drift that may or may not lead to a desired goal and a carefully plotted course toward a predetermined objective that holds drift to a minimum. Budgets make the decision-making process more effective by helping managers meet uncertainties. The objective of budgeting is to substitute deliberate, well-conceived business judgment for accidental success in enterprise management. Budgets should not be expressions of wishful thinking but rather descriptions of attainable objectives.

The Purposes of the Budget

A *budget* is a description in quantitative – usually monetary – terms of a desired future result. The process of preparing the budget requires management at all levels to focus on the future of the business entity. The benefits that may be realized form a budgeting program are

1. *Defining* broad objectives and goals and formulating strategies to achieve such objectives;

2. *Coordinating* the activities of the organization by integrating the plans of the various parts thereby pulling every one in the same direction;

3. *Allocating* resources to these parts of the organization where they can be used most effectively;

4. *Communicating* management’s approved plans throughout the organization;

5. *Uncovering* and *preparing* for potential bottleneck in the operations before they occur.

6. *Motivating* managers to achieve the desired results; and
Chapter 10 Functional and Activity-Based Budgeting

7. Setting a standard or benchmark for evaluating actual performance.

Discussion of the Purposes of Budget

1. Planning Function

The first step in a company’s planning process is the establishment of its broad goals or objectives. After the objectives have been defined, strategies to achieve these desired objectives must be formulated, and tentative budgetary schedules must be developed. Each time a budget is prepared, there is a period of critical self-appraisal during which policies and procedures come up for review. When planning is done well in advance, many problems are anticipated long before they arise, and solutions can be sought through deliberative study. Planning ideally should occur at three levels, namely

a) Strategic planning which focuses on long-range horizon and is performed by the highest level of management.

b) Programming or intermediate-range planning which involves identification of broad programs in the functional areas such as marketing plan, a finance plan, and a production plan. This is performed by higher and middle management, and

c) Short-term budget which a quantitative detailed plan covering typically one year established by all managers at all levels. Logically, the budget is an expression of the strategic planning and programming also being conducted.

2. Coordination and Allocating Resources function for Goal Congruence

The budget serves as a tool through which the actions of different parts of an organization can be welded into a harmonious unit working toward a common objective. Goal congruence is the term used to refer to a firm’s striving to achieve a common set of objectives. It is also an ideal that can be attained only to the extent that individuals can be convinced that what is best for the company is also best for them and that their own welfare is congruous or aligned with the welfare of the organization. Individuals when left to themselves may go in different directions believing that he or she is acting in the best interests of the
enterprise as a whole. Budgeting will reconcile the difference between the sales, manufacturing, purchasing, finance and personnel departments for the common good of an organizational system. Limited resources will also be properly allocated for optimum returns.

3. Communication function
If an organization is to operate as an efficient unit, there must be definite lines of communication, so that the employees in the various departments can be kept fully informed of objectives, policies, plans and achievements. Each employee should have a clear understanding of the company's goals and the part that he or she is expected to play in their attainment. To a certain extent the employees can gain understanding of how they can positively contribute toward accomplishing organizational goals. This is achieved through their participation in the budgeting process. Furthermore, everyone who has responsibility under the budget should be informed on how his/her actual performance compares with budget plans. Budgeting also facilitates decentralized decision making. It serves as authorization for a manager to act since it delineates available resources and goals. Decentralized decision making means that higher management is freed from such burdens and has more time to focus on programs and strategic planning.

4. Motivation function
Budgeting can be a force for good and evil. A budgeting approach in which managers prepare their own budget estimates – called a self-imposed budget or participative budget is generally considered to be the most effective method of budget preparation. If a firm's employees have actively participated in budget preparation and if they are convinced that their own personal interests are closely allied with the firm's success, budgets provide motivation in the form of goals to be attained. Most people like to face up to a challenge and take satisfaction in operating efficiently and effectively under a budget they participated in planning. On the other hand, if the budget is dictated from above by top management and poses a threat rather than a challenge to the employees, then it becomes something to
be resisted rather than accepted and it can do more harm than
good from the viewpoint of organizational operating performance.

5. Control function
Budgets represent management’s formal commitment to take
positive actions by making actual events correspond to the formal
plan. Profit plans also contain explicit statements concerning
implementation of management objectives for a period of time;
managers communicate these to all parties with control
responsibility. Comparison of actual results with the profit plan
forms the basis for management control, motivation, and
performance evaluation. Many problems occur when managers
are evaluated on their ability to achieve the budget. The most
serious consequences occur when the budget is the sole or
overriding criterion of performance. In such situation, managers
may reach the budget by devious or shortsighted means. To
alleviate the problems of employing budgets to evaluate
performance, the following should be considered.

1) Flexibility which means that the budget is viewed as a plan,
not set in concrete. A variance (difference between actual and
budget) should merely raise a question as to why we are off
the plan and managers should feel that they have the freedom
to deviate from the plan when necessary;

2) Focus on controllable costs. Managers should be evaluated
only on controllable costs over which they have “significant
influence.” Holding a manager responsible for no controllable
costs or costs which he did not authorize, causes frustration
and mistrust and is demotivating; and

3) Nonpunitive approach. The focus of analysis should not be
solely on unfavorable variances as a punitive device to make
sure that managers do not go over budget) should be
investigated. Examining variances may reveal situations in
which a manager should be praised for strong performance –
a motivating event. Large variances in either direction require
analysis to either alter the plan or take appropriate actions, not
to find fault with managers.
6. Standards in evaluating performance

Management must keep clearly in mind that rather than being used as a pressure device, the budget should be used as a positive instrument to assist in establishing goals, in measuring operating results, and in isolating areas that are in need of extra effort or attention. The ultimate objective must be to develop the realization that the budget is designed to be a positive aid in achieving both individual and company goals.

Advantages and Limitations of Budgets

The advantages of budgeting include:

(1) It forces planning and exposes situations in which plans of subcomponents are inadequate to attain the total organization's objectives.

(2) It allows a reiterative process to bring the goals of the organization and the subcomponents into agreement.

(3) It provides a means of communicating organization goals down through the organization and sub-unit operational limitations up through the organization.

(4) It provides a basis for financial planning, sub-unit coordination, resource acquisition, inventory policy, scheduling and output distribution.

(5) It provides a basis by which activity can be monitored, with actual results being compared to the planned results.

The limitations of budgeting are:

(1) Budgets tend to oversimplify the real situation and fail to allow for variations in external factors. They do not reflect qualitative variables.

(2) It is difficult to prepare a detailed budget for an organization that has never existed or for a new division, product, or department of an existing firm.
(3) There may be lack of higher and lower management commitment because of lack of understanding of the fundamentals of budget preparation and utilization.

(4) The budget is only a representation of future plans or a means to the goal of profitable activity and not an end in itself. It may interfere with the supervisor's style of leadership and can therefore stifle initiative.

(5) Budget reports usually emphasize results, not reasons.

Types of Budgets

The types of budgets or the major composition of the *master budget* are:

1) The *Operating* budget
2) The *Financial* budget
3) The *Capital* budget

The following is a simplified sub classification of the above-mentioned types of budget for a manufacturing firm:

**A. Operating Budget**

1. Budgeted Income Statement
   a. Sales budget
   b. Production budget
      1) Materials cost budget
      2) Direct labor cost budget
      3) Factory overhead budget
      4) Inventory levels

2. Cost of Sales budget

3. Selling and Administrative expenses budget

4. Financial expense budget

**B. Financial Budget**

1. Budgeted Balance Sheet
2. Cash budget

3. Budgeted Statement of Sources and Uses of Funds

**C. Capital Budget**

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Budgeting Terminologies Defined

Budgeted Income Statement
- refers to projection of revenue, expenses, and results of operations for a definite period of time.

Cash Budget
- a period-by-period statement of cash at the start of a budget period, expected cash receipts classified by source; expected cash disbursements, classified by function, responsibility, and form; and the resulting cash balance at the end of the budget period.

Financial Budget
- refers to the budget of the financial resources as resources as reflected in the budgeted balance sheet and cash budget.

Fixed budget
- projection of cost at a particular or one level of production (usually at normal capacity) for a definite time period.

Flexible (variable) budget
- projection of cost at different levels of production for a definite period of time.

Participative budget
- budget prepared using employees at all levels in the organization.

Physical budget
- budget that is expressed in units of materials, number of employees, or number of man-hours, or service units rather than in dollars.

Planning budget (static budget)
- Another term of master budget

Production budget
- production plan of resources needed to meet current sales demand and ensure adequate inventory levels.

Program budget
- budget for the major programs or projects that the company plans to undertake.
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Operating budget
- refers to the plans for the conduct of business for the planning period; it includes the budgeted income statement and all its supporting budgets.

Responsibility budget
- budget for a responsibility center.

Rolling (continuous, progressive) budget
- budget which is prepared throughout the year, that is, an one month elapses, a budget is prepared for one more month in the future.

Sales budget
- budget that shows the quantity of each product expected to be sold

Traditional budgeting
- a system of budgeting which concentrates on the incremental change from the previous year assuming that the previous year's activities are essential and must be continued.

Zero-based budgeting
- a system of establishing financial plans beginning with an assumption of no activity and justifying each program or activity level.

The Management Process of Preparing the Master Budget

Organization for Budget Preparation

It is essential that the manager of an entity assigns the most qualified personnel to the preparation of the budget. A budget committee with representation from the different functional areas (marketing, production, finance, and administration) is generally considered an effective body to oversee preparation and administration of the budget. The controller may be selected to serve as head of the committee for two major reasons:

1. Controller’s position is independent from the operating parts of the organization.
2. Controller has the skills and experiences in coping with the intricacies of setting up a budget.
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The controller acts as a coordinator in the budgeting operation. He recommends how budgets should be prepared, assembles the budgets, prepares periodic reports showing variances of the actual results from the budgeted results, interprets variances and offers suggestions for improvement whenever possible.

The budget committee decides how budgets shall be prepared, passes on the final budget, and settles disputes in one segment of the business and another when differences of opinion arise. The committee also receives budget reports and makes policy decisions with respect to budget revisions and other problems of budget administration.

The Budget Period

As a general rule, the period covered by a budget should be long enough to show the effect of managerial policies but short enough so that estimates can be made with reasonable accuracy. This suggests that different types of budgets should be made for different time spans.

A master budget is an overall financial and operating plan for a coming fiscal period and the coordinated program for achieving the plan. It is usually prepared on a quarterly or an annual basis. Long range budgets called capital budgets, which incorporate plans for major expenditures for major expenditures for plant and equipment or the addition of product lines, might be prepared to cover plans for as long as 5 to 10 years. Responsibility budgets which are segments of the master budget relating to the aspect of the business that is the responsibility of a particular manager are often prepared monthly. Cash budgets may be prepared on a day-to-day or monthly basis. Some companies follow a continuous budgeting plan whereby budgets are constantly reviewed and updated. The updating is accomplished, for example, by extending the annual budget one additional month at the end of each month. A review of the budget may also suggest that the budget be changed as a result of changing business and operating conditions.

Budget Cycle of a Manufacturing Firm

Managerial plans are implemented through budgets that are developed for the various departments of a company. These budgets should be based on the lines of authority and responsibility fixed by the organization.
An overview of the budget cycle is shown in Figure 10.1 which also depicts the sequence and types of budgets commonly found.

**Figure 10.1**

*The Master budget Interrelationships*  
*(Ronald W. Hilton and David E. Platt, 2011)*

---

**Steps in Developing a Master Budget**

The major steps in developing a Master Budget may be outlined as follows:

1. Establish basic goals and long-range plans for the company. These will serve as guidelines in the preparation of budget estimates.
2. Prepare a sales forecast for the budget period.
3. Estimate the cost of goods sold and operating expenses.
4. Determine the effect of budgeted operating results on assets, liabilities and ownership equity accounts. The cash budget is the largest part of this step, since changes in many asset and liability accounts will depend upon the cash flow forecast.
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Summarize the estimated data in the form of a projected income statement for the budget period and the projected balance sheet as of the end of the budget period.

Comprehensive Budget Illustration

Gilbert Manufacturing Company manufactures a special line of tools. As of December 31, 20x1, the Balance Sheet Statement of the firm is as follows:

<table>
<thead>
<tr>
<th>Current assets</th>
<th>Current liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$140,000</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>$150,000</td>
</tr>
<tr>
<td>220,000</td>
<td>Taxes payable</td>
</tr>
<tr>
<td>Inventories</td>
<td>156,000</td>
</tr>
<tr>
<td>592,000</td>
<td>Current portion</td>
</tr>
<tr>
<td>Other current assets</td>
<td>of long term debt</td>
</tr>
<tr>
<td>23,000</td>
<td>83,000</td>
</tr>
<tr>
<td>Total current assets</td>
<td>379,000</td>
</tr>
<tr>
<td></td>
<td>Total current liabilities</td>
</tr>
<tr>
<td></td>
<td>985,000</td>
</tr>
<tr>
<td></td>
<td>Total liabilities</td>
</tr>
<tr>
<td></td>
<td>379,000</td>
</tr>
<tr>
<td>Long term assets</td>
<td>Total liabilities</td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>955,000</td>
</tr>
<tr>
<td>$2,475,000</td>
<td>Stockholders' equity</td>
</tr>
<tr>
<td>Less: Accumulated depreciation</td>
<td>Shares capital</td>
</tr>
<tr>
<td>850,000</td>
<td>350,000</td>
</tr>
<tr>
<td>Net long term assets</td>
<td>Retained earnings</td>
</tr>
<tr>
<td>1,625,000</td>
<td>1,305,000</td>
</tr>
<tr>
<td>Total assets</td>
<td>Total stockholders' equity</td>
</tr>
<tr>
<td>$2,610,000</td>
<td>1,655,000</td>
</tr>
<tr>
<td></td>
<td>Total liabilities and equity</td>
</tr>
<tr>
<td></td>
<td>$2,610,000</td>
</tr>
</tbody>
</table>

The following information is available for the development of 20x2 Master Budget:

- Estimated sales:
  - Units: 6,400
  - Price per unit: $800

- Finished goods inventory:
  - Beginning: 900 units @ $500
  - Ending: 1,000

- Work in process inventory: NONE
Raw materials:

<table>
<thead>
<tr>
<th>Material</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials required per unit of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>finished product</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Beginning inventory</td>
<td>2,200</td>
<td>4,000</td>
</tr>
<tr>
<td>Ending inventory</td>
<td>1,300</td>
<td>4,600</td>
</tr>
<tr>
<td>Unit Cost</td>
<td>$10</td>
<td>$30</td>
</tr>
<tr>
<td>Direct labor</td>
<td>$146 per unit produced</td>
<td></td>
</tr>
</tbody>
</table>

Overhead is estimated as follows:

Variable:
- Indirect materials and supplies: $5.85 per unit produced
- Materials handling: 9.07 per unit
- Other indirect labor: 5.07 per unit

Fixed:
- Supervisor labor: $175,000
- Maintenance & repair: 85,000
- Plant administration: 173,000
- Utilities: 87,000
- Depreciation: 280,000
- Insurance: 43,000
- Property taxes: 117,000
- Other: 41,000

Marketing and Administrative expenses are budgeted as follows:

Variable Marketing Costs:
- Sales commissions: $40,625 per unit sold
- Other marketing costs: $16,250 per unit sold

Fixed Marketing Costs:
- Sales salaries: $100,000
- Advertising: 193,000
- Other: 78,000

Administrative costs (all fixed):
- Administrative salaries: $254,000
- Data processing services: 103,000
- Legal and other professional fees: 108,000
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Depreciation – building, furniture
    and equipment                        94,000
Taxes – other than income             160,000
Other                                   26,000

Additional information:

The treasurer’s office also provided the following information and estimates:

1) All sales are on account and collections from customers are expected to amount to $5,185,000.

2) Equipment costing $00,000 with accumulated depreciation of $275,000 will be sold at its net book value. New equipment costing $320,000 will be purchased during the year.

3) Accounts payable will increase by $15,000 and assumed to be for materials purchases only.

4) Income taxes will be provided at an average rate of 35% of income before taxes while $252,000 will be paid during the year.

5) Dividends amounting to $140,000 will be paid during the year and the current portion of the long-term debt shall also be settled at the end of the year. Interest rate is 8% per annum.

REQUIRED: Prepare the Master Budget for Gilbert Company for the year ending December 31, 20x2.

Based on the above preliminary data, each of Gilbert Company’s budgets will now be discussed and illustrated.

Sales Budget

The sales budget showing what products will be sold in what quantities at what prices, is the foundation on which all other short-term budgets are built. The sales budget triggers a chain reaction that leads to the development of many other budget figures in an organization. The sales budget provides the revenue predictions from which cash receipts from customers can be estimated and supplies the basic data for constructing budgets for production costs and selling and administrative expenses. In short, the sales forecast is the keystone of the budget structure. The
accuracy and reasonableness of the sales data will affect the whole budget. The sales forecast is made after consideration of the following factor:

1. Past sales volume
2. General economic and industry conditions
3. Relationship of sales to economic indicators
4. Relative product profitability
5. Market research studies and competition
6. Pricing, advertising and other promotion policies
7. Production capacity
8. Quality of sales force
9. Seasonal variations
10. Long-term sales trends for various products

For Gilbert Company, the Sales Budget is presented as follows:

Schedule 1

<table>
<thead>
<tr>
<th>Sales Budget For 20x2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price Per Unit</strong></td>
</tr>
<tr>
<td><strong>Total Sales Revenue</strong></td>
</tr>
<tr>
<td><strong>Units</strong></td>
</tr>
<tr>
<td>Estimated sales</td>
</tr>
</tbody>
</table>

Production Budget

After the sales budget has been set, a decision can be made on the level of production that will be needed for the period to support sales and the production budget can be set as well. The production budget becomes a key factor in the determination of other budgets, including the direct materials budget, the direct labor budget and the manufacturing overhead budget. These budgets in turn are needed assist in formulating a cash budget.

Using the data from the previously prepared sales budget as well as the inventory summary information, the following production budget is developed.
Chapter 10 Functional and Activity-Based Budgeting

Schedule 2

Production budget
For 20x2

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit to be sold</td>
<td>6,400</td>
</tr>
<tr>
<td>Add: Desired ending inventory</td>
<td>1,000</td>
</tr>
<tr>
<td>Total</td>
<td>7,400</td>
</tr>
<tr>
<td>Less: Beginning inventory</td>
<td>900</td>
</tr>
<tr>
<td>Unit to be produced</td>
<td>6,500</td>
</tr>
</tbody>
</table>

After determining the number of units to be produced, the Raw materials purchases can now be prepared, as follow:

Schedule 3

Raw Materials Purchase budget
For 20x2

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units required for production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R (6,500 x 3)</td>
<td>19,500</td>
<td>32,500</td>
</tr>
<tr>
<td>S (6,500 x 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add: Desired ending inventory</td>
<td>1,300</td>
<td>4,600</td>
</tr>
<tr>
<td>Total units required</td>
<td>20,800</td>
<td>37,100</td>
</tr>
<tr>
<td>Less: Beginning inventory</td>
<td>2,200</td>
<td>4,000</td>
</tr>
<tr>
<td>Units to be purchased</td>
<td>18,600</td>
<td>33,100</td>
</tr>
<tr>
<td>Unit price</td>
<td>$10</td>
<td>$30</td>
</tr>
<tr>
<td>Total purchases</td>
<td>$186,000</td>
<td>$993,000</td>
</tr>
</tbody>
</table>

Direct Labor Budget

The preliminary data show that the budgeted direct labor cost per unit produced is P146. This must have been arrive at after considering such factors as skills level of the workers, labor rate per hour, time requirement, conditions of union contracts, etc.

The direct labor is therefore budgeted follows:
Schedule 4

Number of units to be produced | 6,500
Multiply by: Direct labor cost per unit | $146
Total budgeted direct labor costs | $949,000

Overhead Costs Budget

Study of past records will show how the cost reacts to changes in volume or in relation to other factors. Some overhead items may be projected on the basis of direct labor hours or on materials costs or on machine hours.

The overhead costs budget for 20x2 is illustrated below using the basic information from the preliminary data previously established.

Schedule 5

Budgeted Manufacturing Overhead

For 20x2

Units needed to produce | 6,500
Variable manufacturing overhead
- Indirect materials and supplies | $38,000
- Materials handling | 59,000
- Other indirect labor | 33,000
  Total | 130,000

Fixed manufacturing overhead
- Supervisor labor | 175,000
- Maintenance & repairs | 85,000
- Plant administration | 173,000
- Utilities | 87,000
- Depreciation | 280,000
- Insurance | 43,000
- Property taxes | 117,000
- Others | 41,000
  Total | 1,001,000

Total manufacturing overhead | $1,131,000
Chapter 10 Functional and Activity-Based Budgeting

**Budgeted Cost of Sale**

The Budgeted Cost of Sales Statement can now be developed using the data from the following:

- Production Budget Schedule 2
- Raw Materials Budget Schedule 3
- Direct Labor Budget Schedule 4
- Overhead Cost Budget Schedule 5
- Budgeted Statement of Cost of Sales Schedule 6

**Schedule 6**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budgeted statement cost of goods sold</strong></td>
<td></td>
</tr>
<tr>
<td>For 20x2</td>
<td></td>
</tr>
<tr>
<td>Beginning work in process inventory</td>
<td>$0</td>
</tr>
<tr>
<td>Manufacturing costs</td>
<td></td>
</tr>
<tr>
<td>Direct materials</td>
<td></td>
</tr>
<tr>
<td>Beginning inventory</td>
<td></td>
</tr>
<tr>
<td>[(2,200 R x $10) + (4,000 S x $30)]</td>
<td>142,000</td>
</tr>
<tr>
<td>Purchases</td>
<td>1,179,000</td>
</tr>
<tr>
<td>Available for used</td>
<td>1,321,000</td>
</tr>
<tr>
<td>Less: Ending inventory</td>
<td></td>
</tr>
<tr>
<td>[(1,300 R x $10) + (1,600 S x $30)]</td>
<td>151,000</td>
</tr>
<tr>
<td>Total direct materials cost</td>
<td>1,170,000</td>
</tr>
<tr>
<td>Direct labor (6,500 x $146)</td>
<td>949,000</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>1,131,000</td>
</tr>
<tr>
<td>Total manufacturing cost</td>
<td>3,250,000</td>
</tr>
<tr>
<td>Less: Ending work in process inventory</td>
<td>0</td>
</tr>
<tr>
<td>Cost of goods manufactured</td>
<td>3,250,000</td>
</tr>
<tr>
<td>Add: Beginning finished goods</td>
<td></td>
</tr>
<tr>
<td>(900 x $500)</td>
<td>450,000</td>
</tr>
<tr>
<td>Available for sales</td>
<td>3,700,000</td>
</tr>
<tr>
<td>Less: Ending finished goods inventory</td>
<td>500,000</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>$3,200,000</td>
</tr>
</tbody>
</table>

**Marketing and Administrative Expense Budget**

As with overhead costs, marketing and administrative expenses are also made up of fixed and marketing variable components. The marketing
and administrative expense budget for 20x2 is shown on the next page. Previously provided data are used.

**Schedule 7**

**Budgeted marketing and administrative costs**

**For 20x2**

<table>
<thead>
<tr>
<th>Variable marketing costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales commission (6,400 x $40.625)</td>
<td>260,000</td>
</tr>
<tr>
<td>Others (6,400 x $16.25)</td>
<td>104,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$364,000</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixed marketing cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales salaries</td>
<td>100,000</td>
</tr>
<tr>
<td>Advertising</td>
<td>193,000</td>
</tr>
<tr>
<td>Others</td>
<td>78,000</td>
</tr>
<tr>
<td><strong>Total marketing costs</strong></td>
<td><strong>$371,000</strong></td>
</tr>
</tbody>
</table>

| Administrative costs (all fixed)              |       |
| Administrative salaries                      | 254,000|
| Data processing services                     | 103,000|
| Legal and other professional fees            | 180,000|
| Depreciation - building, furniture and equipment | 94,000|
| Taxes - other than income                    | 108,000|
| Others                                       | 26,000 |
| **Total Administrative costs**               | **$765,000**|
| **Total marketing and administrative costs**  | **$1,500,000**|

**Cash Budget**

**Cash Receipts**

Normally, the bulk of a firm's cash receipts comes from customers. The possibility of cash from other sources (such as additional investments, sales of assets, borrowings) should likewise be considered when cash receipts are being budgeted.
Chapter 10 Functional and Activity-Based Budgeting

Cash Disbursements

Data converted from individual budgets previously illustrated supply the basic information for the cash disbursements budget. However, various adjustments and additions will have to be made when preparing the budget for prepayments, accruals as well extraneous items (such as the purchase of new equipment, dividend payment) that do not show up in any of the individual budgets already prepared. If the financial policy of the company requires that a minimum cash balance be maintained at all times, the cash budget must be altered to accommodate bank loans and their repayment.

Using the data collected in the various budgets and the information that has been previously provided, the following Cash Budget Statement is developed.

**Schedule 8**

**Gilbert Manufacturing Company**

**Cash Budget**

**For the Budget Year Ending December 31, 20x2**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash balance, Jan 1 20X2</td>
<td>$ 150,000</td>
</tr>
<tr>
<td>Add: Estimated receipts</td>
<td></td>
</tr>
<tr>
<td>Collections from customers</td>
<td>5,185,000</td>
</tr>
<tr>
<td>Sale of assets</td>
<td>25,000</td>
</tr>
<tr>
<td>Total</td>
<td>5,210,000</td>
</tr>
<tr>
<td>Total cash available</td>
<td>5,360,000</td>
</tr>
<tr>
<td>Less: Estimated disbursements</td>
<td></td>
</tr>
<tr>
<td>Payments for material purchases</td>
<td>1,164,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>949,000</td>
</tr>
<tr>
<td>Manufacturing overhead</td>
<td>851,000</td>
</tr>
<tr>
<td>Payments for income tax</td>
<td>1,458,000</td>
</tr>
<tr>
<td>Dividends</td>
<td>252,000</td>
</tr>
<tr>
<td>Reduction in long-term debt</td>
<td>140,000</td>
</tr>
<tr>
<td>Acquisition of new assets</td>
<td>83,000</td>
</tr>
<tr>
<td>Total disbursements</td>
<td>320,000</td>
</tr>
<tr>
<td>Cash balance, Dec 31, 20x2</td>
<td>$5,217,000</td>
</tr>
</tbody>
</table>
Chapter 10 Functional and Activity-Based Budgeting

**Budgeted Income Statement**

After the cash budget has been completed, Gilbert Company prepares the budgeted income statement showing the net income that is to be expected during the budget period. The information needed to prepare the budgeted income statement comes from the previously provided preliminary data as well as from the company's other budgets.

---

**Schedule 9**

Gilbert Manufacturing Company

Budgeted income statement

For the Budget Year Ending December 31, 20x2

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (schedule 1)</td>
<td>$5,120,000</td>
</tr>
<tr>
<td>Less: Cost of goods sold (schedule 6)</td>
<td>3,200,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>1,920,000</td>
</tr>
<tr>
<td>Less: Marketing and administrative costs (Schedule 7)</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Net operating profit</td>
<td>420,000</td>
</tr>
<tr>
<td>Less: Financial cost (Interest expense)</td>
<td>52,000</td>
</tr>
<tr>
<td>Net income before taxes</td>
<td>368,000</td>
</tr>
<tr>
<td>Less: Income taxes</td>
<td>128,000</td>
</tr>
<tr>
<td>Net income after taxes</td>
<td>$240,000</td>
</tr>
</tbody>
</table>

---

**Budgeted Statement of financial position (Budgeted Balance Sheet)**

The budgeted balance sheet is developed by beginning with the current balance sheet and adjusting it for the data contained in the other budgets. Gilbert Company's budgeted balance sheet is presented below:
Chapter 10 Functional and Activity-Based Budgeting

Schedule 10

Gilbert Manufacturing Company
Budgeted statement of financial position
(or Budgeted balance sheet)
For the Budget Year Ending December 31, 20x2

Assets

Current assets
Cash (Schedule 8) $143,000
Accounts receivable 155,000
Inventories 651,000
Other current assets 23,000
Total current assets 972,000

Long-term assets
Property, plant and equipment 2,495,000
Less: Accumulated depreciation 949,000
Net plant assets 1,546,000

Total assets $2,518,000

Liabilities

Current liabilities
Accounts payable $155,000
Taxes payable 32,000
Current portion of long-term debt -
Total current liabilities 187,000

Long-term liabilities 576,000

Total liabilities 763,000

Stockholders’ equity
Share capital 350,000
Retained earnings 1,405,000
Total stockholders’ equity 1,755,000

Total Liabilities and equityEquities $2,518,000
FLEXIBLE BUDGETING

The budgets that have been presented in the first part of this Chapter were essentially static in nature. A static budget has two characteristics. 

1. It is geared toward only one level of activity.
2. Actual results are always compared against budgeted costs as the original budget activity level:

Fixed budgeting is appropriate only if a company can estimate its operating volume within close limits and if the costs are behaving predictably. Few companies are fortunate enough to fall into this group. As a result of these factors, a fixed or static budget is generally not adequate.

A flexible budget is an alternative to the fixed budget. A flexible budget adjusts revenues, costs, and expenses to the actual volume experienced and compares these amounts to actual results. Flexible budgets incorporate changes in volume to provide a valid basis of comparison with actual costs.

The basic steps in preparing a flexible budget are as follows:

1. Determine the relevant range over which activity is expected to fluctuate during the coming period.

2. Analyze the costs that will be incurred over the relevant range in order to determine cost behavior patterns (variable, fixed, or mixed).

3. Separate the costs by behavior, and determine the formula for variable and mixed costs, as discussed in Chapter 9.

4. Using the formula for the variable portion of the costs, prepare a budget showing what costs will be incurred at various points throughout the relevant range.

Fixed and Flexible Budget Variances Compared

Assume the RON Company’s sales budget calls for the production of 10,000 shirts during January. The variable overhead budget that has been set for this level of level of activity is shown in Figure 10.2
Figure 10.2

RON Company
Static Budget
For the month Ended January 31

| Budget production of shirts (in units) | 10,000 |
| Budget variable overhead costs:       |       |
| Indirect materials                    | $4,000 |
| Lubricants                            | 1,000  |
| Power                                 | 3,000  |
| Total                                 | $8,000 |

Assume further that the production goal of 10,000 shirts is not met and the company is able to produce only 9,400 shirts during the month.

If the static budget approach is used, the performance report for the month will appear as shown in Figure 10.3.

Figure 10.3

Static Budget Performance Report
For the month ending January 31

<table>
<thead>
<tr>
<th>Actual</th>
<th>Budget</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of shirts (in units)</td>
<td>18,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Variable overhead costs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect materials</td>
<td>$7,600</td>
<td>$8,000</td>
</tr>
<tr>
<td>Lubricants</td>
<td>1,900</td>
<td>2,000</td>
</tr>
<tr>
<td>Power</td>
<td>5,800</td>
<td>6,000</td>
</tr>
<tr>
<td>Total</td>
<td>$15,300</td>
<td>$16,000</td>
</tr>
</tbody>
</table>

* These costs variances are misleading and useless since they have been derived by comparing actual costs at one level of activity against budgeted costs at a different level of activity.
The main deficiency with the static budget is that it fails completely to distinguish between the production control and the cost control dimensions of a manager's performance.

Under the flexible budget approach, the performance report would appear as shown in Figure 10.4

**Figure 10.4**

**Flexible Budget Performance Report**

For the month ending January 31

<table>
<thead>
<tr>
<th>Budgeted production of shirts (in units)</th>
<th>20,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual production of shirts (in units)</td>
<td>18,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overhead Costs</th>
<th>Actual costs incurred</th>
<th>Budget Based on</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per unit</td>
<td>18,800 units</td>
<td></td>
</tr>
<tr>
<td>Variable Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect materials</td>
<td>$0.40</td>
<td>$7,600</td>
<td>$7,520</td>
</tr>
<tr>
<td>Lubricants</td>
<td>0.10</td>
<td>1,900</td>
<td>1,880</td>
</tr>
<tr>
<td>Power</td>
<td>0.30</td>
<td>5,800</td>
<td>5,640</td>
</tr>
<tr>
<td>Total variable costs</td>
<td><strong>$15,300</strong></td>
<td><strong>$15,040</strong></td>
<td><strong>$260 U</strong></td>
</tr>
</tbody>
</table>

In contrast to the performance report prepared earlier under the static budget approach, this performance report prepared under the flexible budget approach distinguishes clearly between production control and cost control. The production data at the top of the report indicate whether the production goal was met. The cost data at the bottom of the report tell how well costs were controlled for the 18,800 shirts that were actually produced.

It will be observed that all the cost variances in Figure 10.4 are unfavorable, as contrasted to the favorable cost variances on the performance report prepared earlier under the static budget approach. The reason for the change in variances is that by means of the flexible budget approach we are able to compare budgeted and actual costs at the same activity level (18,800 shirts produced). The result shows up in more usable variances.
SHORT QUESTIONS:
1. Discuss the importance of budgeting and identify five purposes of budgeting systems.
2. List several factors that an organization might consider when developing a sales forecast.
3. Budgeting can be an important management tool if implemented properly. Identify several positive results when budgets are used properly. Since budgets affect people, identify several negative aspects if budgets are not implemented properly.
4. Budgeting and long-range planning are both important aids to management in achieving a company's goals and objectives. Briefly distinguish between budgeting and long-range planning and indicate how they help managers perform their functions.
5. What is participative budgeting? What are its potential benefits? What are its potential shortcomings?
6. What is a zero-based budgeting? What are the differences between zero-based and activity-based budgeting? Explain the differences point by point.
EXERCISES:

Problem 1
An university is preparing its master budget for the upcoming academic year (an academic year consists of two semesters). Currently, 12,000 students are enrolled on campus; however, the admissions office is forecasting a 5% growth in the student body despite a tuition hike to $80 per credit hour. The following additional information has been gathered from an examination of university records and conversations with university officials:

- University’s Board of Trustees is planning to award 150 tuition-free scholarships.
- The average class has 30 students, and the typical student takes 15 credit hours each semester.
- Each class is three credit hours.
- Each faculty member teaches five classes during the academic year.

Required:
1. Compute the budgeted tuition revenue for the upcoming academic year.
2. Determine the number of faculty members needed to cover classes.
3. In preparing the university’s master budget, should the administration begin with a forecast of students or a forecast of faculty members? Briefly explain.

Problem 2
Turbon Manufacturing plans to produce 20,000 units, 24,000 units, and 30,000 units, respectively, in October, November, and December. Each of these units requires four units of part no. 879, which the company can purchase for $7 each. Turbon has 35,000 units of part no. 879 in stock on September 30.

Required:
Prepare a direct-material purchases budget for October and November in units and dollars. Management desires to maintain an ending raw-material inventory equal to 40% of the following month's production usage.
Chapter 10 Functional and Activity-Based Budgeting

Problem 3:
Scotch Company plans to sell 400,000 units of finished product in July 20x1. Management (1) anticipates a growth rate in sales of 5% per month thereafter and (2) desires a monthly ending finished-goods inventory (in units) of 80% of the following month's estimated sales. There are 300,000 completed units in the June 30, 20x1 inventory. Each unit of finished product requires four pounds of direct material at a cost of $1.50 per pound. There are 1,600,000 pounds of direct material in inventory on June 30, 20x1.

Required:
1. Prepare a production budget for the quarter ended September 30, 20x1. Note: For both part "A" and part "B" of this problem, prepare your budget on a quarterly (not monthly) basis.
2. Independent of your answer to part "A," assume that Scotch plans to produce 1,200,000 units of finished product for the quarter ended September 30. If the firm desires to stock direct materials at the end of this period equal to 25% of current production usage, compute the cost of direct material purchases for the quarter.

Problem 4:
Jaergin manufactures two products: A and B. The company predicts a sales volume of 10,000 units for product A and ending finished-goods inventory of 2,000 units. These numbers for product B are 12,000 and 3,000, respectively. Jaergin currently has 7,000 units of A in inventory and 9,000 units of B.
The following raw materials are required to manufacture these products:

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Cost per Pound</th>
<th>Required for Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>$2.00</td>
<td>2 pounds</td>
</tr>
<tr>
<td>Y</td>
<td>2.50</td>
<td>1 pound</td>
</tr>
<tr>
<td>Z</td>
<td>1.25</td>
<td>3 pounds</td>
</tr>
</tbody>
</table>

Product A requires three hours of cutting time and two hours of finishing time; B requires one hour and three hours, respectively. The direct labor rate for cutting is $10 per hour and $18 per hour for finishing.
Chapter 10 Functional and Activity-Based Budgeting

Required:
1. Prepare a production budget in units for products A and B.
2. Prepare a materials usage budget in pounds and dollars for materials X, Y, Z.
3. Prepare a direct labor budget in hours and dollars for product A.

Problem 5:
Tiara Company has the following historical collection pattern for its credit sales:

- 70% collected in month of sale
- 15% collected in the first month after sale
- 10% collected in the second month after sale
- 4% collected in the third month after sale
- 1% uncollectible

Budgeted credit sales for the last six months of the year follow.

<table>
<thead>
<tr>
<th>Month</th>
<th>Credit Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>$30,000</td>
</tr>
<tr>
<td>August</td>
<td>35,000</td>
</tr>
<tr>
<td>September</td>
<td>40,000</td>
</tr>
<tr>
<td>October</td>
<td>45,000</td>
</tr>
<tr>
<td>November</td>
<td>50,000</td>
</tr>
<tr>
<td>December</td>
<td>42,500</td>
</tr>
</tbody>
</table>

Required:
1. Calculate the estimated total cash collections during October.
2. Calculate the estimated total cash collections during the year's fourth quarter.

Problem 6:
The accounting records of Backspace, Inc., revealed an accounts receivable balance of $195,000 on January 1, 20x6. Forty percent of the company's sales are for cash, and the remaining 60% are on account. Of the credit sales, 30% are collected in the month of sale and 70% are collected in the following month. Total sales in January and February are expected to amount to $500,000 and $530,000, respectively. Assume that in the latter half of 20x6, Backspace hired a new sales
manager who aggressively tried to maximize the company's market share. She implemented a compensation system for the sales force that was 100% commission based, with the commission calculated on the basis of gross sales dollars. Sales volume increased dramatically in a very short period of time, and the sales and collection patterns changed, as follows:

- **Cash sales:** 20%
- **Credit sales:** 80%
  - Collected in the month of sale: 15%
  - Collected in the month following sale: 75%
  - Uncollectible: 10%

**Required:**
1. Compute the company's cash inflows for January and February, 20x6.
2. Determine the outstanding receivables balance at the end of February.
3. Compare the sales and collection patterns before and after the arrival of the new sales manager. Have things improved or deteriorated? Explain.
4. On the basis of the information presented, determine what likely caused the improvement or deterioration in collection patterns.

**Problem 7:**
Bentson Corporation, a wholesaler, provided the following information:

<table>
<thead>
<tr>
<th>Month</th>
<th>Purchases</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>$142,000</td>
<td>$172,000</td>
</tr>
<tr>
<td>February</td>
<td>148,000</td>
<td>166,000</td>
</tr>
<tr>
<td>March</td>
<td>136,000</td>
<td>165,000</td>
</tr>
<tr>
<td>April</td>
<td>154,000</td>
<td>178,000</td>
</tr>
<tr>
<td>May</td>
<td>160,000</td>
<td>166,000</td>
</tr>
</tbody>
</table>

Customers pay 60% of their balances in the month of sale, 30% in the month following sale, and 10% in the second month following sale. The company pays all invoices in the month following purchase and takes
advantage of a 3% discount on all amounts due. Cash payments for operating expenses in May will be $119,500; Bentson's cash balance on May 1 was $127,800.

Required:
Determine the following:
1. Expected cash collections during May.
2. Expected cash disbursements during May.

Problem 8:
Midwestern University operates a motor pool for the convenience of its faculty and staff. The following budget was prepared for an upcoming period:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline and oil</td>
<td>$40,000</td>
</tr>
<tr>
<td>Minor repairs</td>
<td>$ 6,000</td>
</tr>
<tr>
<td>Insurance</td>
<td>$20,000</td>
</tr>
<tr>
<td>Office help</td>
<td>$24,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$ 3,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$120,000</strong></td>
</tr>
</tbody>
</table>

The budget was based on the assumptions of 20 vehicles, with each vehicle being driven 8,000 miles. Midwestern acquired two additional vehicles early in the period under study. Actual miles driven during the period totaled 180,000.

Discussions with the motor pool manager revealed that pool costs are variable and fixed in nature. The manager believed that miles driven was the most appropriate cost driver for studying gasoline and oil expense. In contrast, the number of vehicles in the pool was the best base to use when studying minor repairs, insurance, and depreciation. Office help is a fixed cost.

Required:
1. Contrast a static budget with a flexible budget.
2. Suppose that the university's budget officer desired to prepare a report that compared budgeted and actual costs. Should the report be based on a static budget or a flexible budget? Why?
3. On the basis of the information presented, determine the budgeted amounts for the five preceding costs that would be used in a flexible budget.

Problem 9
The Marketing Club at Southern University recently held an end-of-year dinner and swim party, which the treasurer declared to be a financial success. "Attendance was an all-time high, 60 members, and the results were much better than expected." The treasurer presented the following performance report at the executive board's June meeting:

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Actual</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$1,575</td>
<td>$2,205</td>
<td>$630F</td>
</tr>
<tr>
<td>Food</td>
<td>$ 675</td>
<td>$ 870</td>
<td>$195U</td>
</tr>
<tr>
<td>Beverages</td>
<td>315</td>
<td>480</td>
<td>165U</td>
</tr>
<tr>
<td>Disc jockey</td>
<td>150</td>
<td>175</td>
<td>25U</td>
</tr>
<tr>
<td>Facility rental</td>
<td>200</td>
<td>200</td>
<td>---</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>$1,340</td>
<td>$1,725</td>
<td>$385U</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td>$ 235</td>
<td>$ 480</td>
<td>$245F</td>
</tr>
</tbody>
</table>

The budget was based on the assumptions that follow.
- Forty-five members would attend at a fixed ticket price of $35.
- Food and beverage costs were anticipated to be $15 and $7 per attendee, respectively.
- A disc jockey was hired via a written contract at $50 per hour.

Required:
1. Briefly evaluate the meaningfulness of the treasurer's performance report.
2. Prepare a performance report by using flexible budgeting and determine whether the end-of-year party was as successful as originally reported.
3. Based on your answer in requirement "B," present a possible explanation for the variances in revenue, food costs, beverage costs, and the disc jockey.
CHAPTER 11
STANDARD COSTS
AND OPERATING PERFORMANCE MEASURES

After studying this chapter, you should be able to:

1. State the nature and rationale of standard costs.
2. Discuss the users of standard cost.
3. Explain the benefits and limitations of standard costs.
4. Describe how standards are set.
5. Explain the process of setting standard costs for direct material, direct labor and overhead.
6. Identify the possible causes of variances and responsibility for them.
7. Compute and analyze the variances between actual costs and standard costs.
Rationale of Standard Costs

Proper control of costs requires a comparison of actual cost results with some base data. Management is interested to know what costs are but also whether they represent an efficient level of productive operations. Comparing actual costs with those incurred in a previous period is one way to evaluate costs. To properly interpret and control costs we can compare actual costs with standard costs so we can study any difference or variance. Thus, standards are yardsticks that measure achievement or lack of achievement.

Standard costs represent what costs should be under attainable, acceptable performance. They do not represent what the cost would be if perfection in performance in performance had actually been attained. Standards establish desirable minimum costs. When actual operations exceed standard, the variances are generally investigated.

The standards relate to the quantity and cost of inputs used in manufacturing goods or providing services. Quantity standards indicate how much of a cost element, such as labor, time or raw materials, should be used in manufacturing a unit of product or in providing a unit of service. Cost standards indicate what the cost of the time or materials should be.

Actual quantities and actual costs of inputs are compared against these standards to see whether operations are proceeding within the limits that management has set. If either the quantity or the cost of inputs exceeds the limits that management has set, management directs its attention to the difference and focuses its efforts where they will do the most good. This process is known as management by exception.

Users of Standard Costs

Manufacturing, service, food, not-for-profit organizations and even financial institution all make use of standards (in terms of either costs or quantities) to some extent.
Chapter 11 Standard Costs and Operating Performance Measures

Auto service centers offer set labor time standards for the completion of certain work tasks and then measure actual performance against these standards. Fast-food outlets, such as McDonalds, have exacting standards as to the quantity of meat going into a sandwich, as well as standard for the cost of the meat. Hospitals have standard costs for laboratory tests, for food, laundry and other items for each occupied bed.

In short, the business student is likely to run into standard costs concepts in almost any line of business that she or he may enter.

**Benefits of Standard Costs**

When standard costs are set carefully and used widely, they provide benefits to an organization such as:

1. Managers and employees become cost conscious because variances between standard costs and actual costs are reported, studied and their causes determined. Thus, these standards provide a measuring device calling attention to cost variations. In turn, these standards serve as a compass that guides managers toward improvement.

2. They aid management planning by providing the unit amount for budgeting. Also in the process of setting standards, managers thoroughly study all factors affecting costs and oftentimes discover how operations can be improved.

3. Standard cost systems integrate managerial, accounting and engineering functions. Coordination is encouraged because all elements of the organization are striving for the same goal.

4. Although initially, standard cost systems might appear to be costly to use because of the start-up investment, using standards can save data processing cost.

**Limitations of Standard Cost**

Although the advantages of using standard costs are significant, certain difficulties can also be encountered by the manager. The following are some of the problems or potential problems in using standard costs:

1. Difficulty may be encountered in determining which variances are material or significant in amount to warrant investigation.
2. Other useful information such as trends may not be noticed at an early stage since attention is focused only on variances above a certain level.

3. Subordinates may be tempted to cover up unfavorable exceptions or not report them at all, particularly when they do not receive reinforcement or commendation for the positive things they do. This is a possible consequence of applying the principle of management by exception.

4. The management by exception technique may also affect supervisory employees in an unsatisfactory manner because they may feel that they are not getting complete review of operations as they are always just keying it in on problems. Also, supervisors may feel they are being constantly critical of their subordinates and this may have a negative impact on their morale.

These possible problems and difficulty suggest that extreme care must be exercised by the manager in adopting a standard cost system. It is particularly important that managers go out of their way to focus on the positive rather than on the negative, and to be aware of possible unintended consequences.

How Standards are Set

The setting of standard costs is more an art than a science because it requires the combined thinking and expertise of all persons who have responsibility over prices and quantities of inputs. In non-manufacturing companies (service and trading firms), this standard-setting activity would involve the controller or managerial accountant, purchasing agent, segment managers, sales personnel such as salesmen or service providers themselves. In a manufacturing setting, this group of persons would include the managerial accountant, purchasing agent, industrial engineer, production supervisors, line managers and the production workers.

The managerial accountant provides great help at the beginning point in setting standard costs by preparing data on the cost characteristics of prior years’ activities at various levels of operation. However, a standard for the future must be more than simply a projection using the historical data. Data must be adjusted for changing economic patterns, changing demand and supply characteristics and changing technology.
Chapter 11 Standard Costs and Operating Performance Measures

Consideration should also be given as to what capacity level will be used for setting standards. Standards set on the basis of theoretical capacity are perfection standard (ideal standards) because they reflect the maximum efficiency. They usually are not attainable because they do allow for any machine breakdowns or other work interruptions and require the most skilled and efficient employees working at peak effort 100% of time. Furthermore, ideal standards tend to discourage even the most diligent workers. When ideal standards are used variances from standards have little meaning because variances will contain elements of “normal” inefficiencies, not just the “abnormal” inefficiencies that managers would like to have isolated and brought to their attention.

Generally, standards are set on a less demanding level. Normal, and expected actual standards, are standards that are “light but attainable.” Also known as practical standards, they allow for normal machine breakdown, normal material loss, expected lost time, employee rest periods and can be attained through reasonable though highly efficient, efforts by the average worker at a task. Variance from such a standard are very useful to management in that they represent deviations that fall outside of normal, recurring inefficiencies that signal a need for management attention. Normal standards however, make no allowance for abnormal loss or waste. Throughout the remainder of this Chapter, the use of practical rather than the ideal standard is assumed.

Setting Direct Material Standards

Standard Quantity

Industrial engineers develop specification for the kinds and quantities of material used in producing the goods budgeted. Operation schedules list the materials and quantities required for the expected volume of production. Traditionally, quantity standards contained an allowance for waste or shrinkage. Nowadays, the popular zero defect philosophy does not include an allowance for waste. Production standards no longer reflect planned scrap, lost material and inefficiencies in the production process. Instead, companies improve control by charging by charging resources lost due to waste directly to the supervisor whose group caused the error.
Chapter 11 Standard Costs and Operating Performance Measures

**Standard Price**

The purchasing department receives the operation schedule and bills of material established jointly by the engineering department, the manufacturing supervisor and the accountant. This information becomes the basis for the material price standard.

Because the purchasing agents are responsible for price variances, they should help set the price standards which should reflect the study of market conditions, vendors’ quoted prices and the optimum size of a purchase order. The just-in-time (JIT) management philosophy which many companies adopt, minimizes inventories, keeping on hand only the amount needed in production until the next order arrives. In so doing, the inventory carrying cost is minimized. In addition, the entire operation associated with acquiring goods including any exhaustive bargaining for the lowest material price should be studied.

The account should also consider cash discounts, material handling costs (freight in, purchasing, receiving and other costs) in the standard price to be established. Lastly, the purchasing department should be made accountable not only for the price of purchased components but also for the specified quality. Otherwise, the purchasing motivation is just to find inexpensive vendors without concern for meeting the material quality specifications. While this may lead to a favorable material price variance, unfavorable materials quantity variance and unfavorable labor efficiency variance may also result because of poor quality of materials and substantial manufacturing rework time.

**Setting Labor Standards**

**Standard Time**

Examination of past payroll and production records can reveal the worker-hours used on various jobs and can help determine standard performance. Time reports from the workers for a limited period will be a good basis for the standard. If possible, time and motion study should be the basis for setting time standards. The time study seeks to develop time standards and piece rates which the average operator can meet daily. A time study breaks up the operating cycle into distinct elements. Manager
who should have expert knowledge and skill, place the rating of the operation and the employees' skill and effort in time study sheets.

**Standard Labor Rate**

Labor rates should be determined by considering the current rates as well as the competitive markets. The company may use any of the following methods in determining the labor rate standards:

1. A company may establish a standard rate for the job; regardless of who performs the job, the rate stays the same, or
2. A company may establish a rate for an individual worker and the worker receives this rate regardless of the work performed.

If labor contracts exist, the wage is relatively fixed and can be used as standard. Labor costs in an automated manufacturing system are largely fixed even though wages are expressed on an hourly basis. Accountants can derive an average salary figure from a schedule showing the number of salaried people and their individual salaries. The average plant salary figure should also include payroll taxes and such employees' benefits as vacation pay, insurance, and pensions.

**Setting Overhead Standards**

Factory overhead cost standards provide a means of allocating factory overhead to cost inventories for pricing decisions and controlling expenses. A standard cost system uses budgeted rates based on standard hours or other cost drivers allowed for actual production. In a cost system not employing standards, there are no standard hours — actual hours or another cost driver is the only means for applying overhead. A standard cost system applies overhead to Work in Process Inventory based on standard hours.

A capacity level is selected as the volume basis or denominator capacity. As previously mentioned, theoretical capacity is rarely chosen because it does not represent an attainable level of performance. Standards set on practical capacity are more likely to be attainable and are more realistic than theoretical standards. Either normal capacity is more likely to be attained and is more realistic than theoretical standards. Either normal capacity or expected actual capacity is the basis for current standards.
Chapter 11 Standard Costs and Operating Performance Measures

After selecting the capacity level, costs are allocated on a volume related or non-volume related base. Commonly used volume-related bases include machine hours, direct labor-hours, direct labor costs, direct materials costs and units of production. An activity-based costing system uses non-volume related activities such as number of scheduled production runs or inspections. After expressing volume based on machine hours, the number of inspection, or another basis, the factory overhead incurred at this level is estimated.

Operating Performance Evaluation

Analysis of Variances

Basically, the variance or difference between actual costs and standard costs can be separated and analyzed into two components: a price variance and an efficiency variance. These may be computed as follows:

\[
\text{Price Variance} = \left( \frac{\text{Actual unit price of input}}{\text{Standard unit price of input}} - 1 \right) \times \frac{\text{Actual quantity of input}}{\text{Standard quantity of input}}
\]

\[
\text{Efficiency Variance} = \left( \frac{\text{Actual quantity of input}}{\text{Standard quantity of input}} - 1 \right) \times \frac{\text{Standard unit of input}}{\text{Actual unit of input}}
\]

Direct Materials Variance Analysis

The difference between actual cost and standard cost of materials used is called a material cost variance. This variance is made up of a price variance and a usage or quantity or efficiency variance. These variances may be computed as follows:
Chapter 11 Standard Costs and Operating Performance Measures

<table>
<thead>
<tr>
<th>Actual</th>
<th>Inputs at standard price</th>
<th>Flexible production budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ x AP</td>
<td>AQ x SP</td>
<td>SQ x SP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price Variance</td>
<td>Quantity Variance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material Variance</td>
</tr>
</tbody>
</table>

AQ = Actual quantity  
SQ = Standard quantity allowed for actual output  
AP = Actual price  
SP = Standard price

Alternative presentation:

**Materials Price Variance**

Actual Price $xx  
Less: Standard Price xx  
Unfavorable (Favorable) $xx  
Multiplied by: Actual Quantity Purchased* xx  
Unfavorable (Favorable) $xx

* or Actual quantity used if quantity purchased is not known.

**Materials Quantity Variance**

Actual Quantity $xx  
Less: Standard Quantity xx  
Unfavorable (Favorable) $xx  
Multiplied by: Standard price xx  
Unfavorable (Favorable) $xx

When the manufacturing process uses several different direct materials that are supposed to be combined in a standard proportion, the materials quantity variance may be broken down into:

a) Materials Mix variance and  
b) Materials Yield variance

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**Materials Mix Variance** may be computed as follows:
Actual quantity x Standard price (per material) $xx
Less: Total actual input x Average standard price xx
Unfavorable (Favorable) $xx

**Materials Yield Variance** may be computed as follows:
Total actual input x Average standard price $xx
Less: Standard quantity x Standard price (per material) xx
Unfavorable (Favorable) $xx

The possible causes of materials price variance are as follows:
1. Fluctuations in market prices of materials.
2. Purchasing from distant suppliers, which result in additional transportation costs.
3. Failure to take cash discounts available.
4. Purchasing materials of substandard quality or in uneconomical lots.
5. Unfavorable purchase contract terms.

**Responsibility:** The Purchasing Department is usually responsible for material price variables. However, the Production Planning Department could be responsible for unfavorable price variance occurring (1) because of a request for rush order due to poor scheduling or (2) when they specify certain brand-name materials or materials of certain grade or quality other than those initially included in the bill of materials.

The possible causes of materials quantity or usage variance are as follows:
1. Waste and loss of material in handling and processing.
2. Substitution of defective or nonstandard materials.
3. Spoilage or production of excess scrap because of inexperienced workers or poor supervision.
4. Lack of proper tools or machines.
5. Variation in yields from materials.

**Responsibility:** Production line supervisors should be held responsible for materials under their control.
Chapter 11 Standard Costs and Operating Performance Measures

Direct Labor Variance Analysis

Labor cost variance is the difference between actual labor cost and standard labor cost. This variance is may be analyzed into two components, namely, the labor rate variance and the labor usage or efficiency variance. These variances may be computed as follows:

\[
\text{Actual} \quad \text{Inputs at standard price} \quad \text{Flexible production budget}
\]

\[
AH \times AR \quad AH \times SR \quad SH \times SR
\]

Rate Variance \quad Efficiency Variance \quad \text{Labor Variance}

AH = Actual hours
SH = Standard hours allowed for actual output
AR = Actual labor rate
SR = Standard labor rate

Alternatives presentation:

**Labor Rate Variance**

Actual labor rate \( $xx \)
Less: Standard labor rate \( xx \)
Unfavorable (Favorable) \( $xx \)
Multiplied by: Actual hours \( xx \)
Unfavorable (Favorable) \( $xx \)

**Labor Efficiency or Time Variance**

Actual hours \( $xx \)
Less: Standard hours \( xx \)
Unfavorable (Favorable) \( $xx \)
Multiplied by: Standard labor rate \( xx \)
Unfavorable (Favorable) \( $xx \)

If several different materials are used in the manufacturing process, the labor usage variance may further be analyzed into:

a) Labor Efficiency variance
b) Labor Yield variance
These Variances may be computed as follows:

**Labor efficiency Variance**
Actual hours x Standard labor rate $ xx
Less: Standard labor hours based on actual input (SHAI) x Standard labor rate xx
Unfavorable (Favorable) $ xx

**Labor Yield Variance**
SHAI x Standard labor rate $ xx
Less: Standard hours based on actual output (SHAO) x Standard labor rate xx
Unfavorable (Favorable) $ xx

The possible causes of labor rate variance are as follows:
1. Inexperienced workers hired.
2. Change in labor rate particularly peak season that has not been incorporated in standard rate.
3. Use of an employee having a wage classification other than that assumed when the standard for a job was set.
4. Use of a greater number of higher-paid employees in the group than anticipated.

Responsibility: If production line supervisors have the authority to match workers and machines to task by hiring the proper grade of labor, line supervisors should be responsible. They will also be responsible if they control the wage rate of their labor force. If they do not, the Personnel Department may be responsible.

The possible causes of labor efficiency variance are as follows:
1. Good or poor training of workers
2. Poor materials or faulty equipment
3. Good or poor supervision and scheduling of work
4. Experience of lack of experience on the job
5. Inefficient equipment
6. Machine breakdown
7. Nonstandard materials being used
**Responsibility:** Production line supervisors should be held responsible for labor under their control. The Production Planning Department or the Purchasing Department should be held responsible for any labor efficiency variance that results from the use of nonstandard material.

**Factory Overhead Variance Analysis**

**Variable Manufacturing Overhead**

Total variable manufacturing overhead variance is the difference between actual variable overhead and standard variable overhead allowed on actual output. This may be broken down into:

- a) Variable overhead spending variance
- b) Variable overhead efficiency variance

These variances are computed as follows:

<table>
<thead>
<tr>
<th>Actual</th>
<th>Inputs at standard price</th>
<th>Flexible production budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH x AVR</td>
<td>AH x SVR</td>
<td>SH x SVR</td>
</tr>
</tbody>
</table>

**Spending Variance**  
**Efficiency Variance**  
**Variable Overhead Variance**

AH = Actual hours  
SH = Standard hours allowed for actual output  
AVR = Actual variable overhead rate  
SVR = Standard variable overhead rate

**Alternative presentation:**

**Variable Overhead Spending Variance**

Actual variable overhead  
Less: Actual hours x Standard variable overhead rate  
Unfavorable (Favorable)  
$xx  
$xx
Variable Overhead Efficiency Variance

Actual hours $ xx
Less: Standard hours Xx
  Unfavorable (Favorable) xx
Multiply by: Standard variable overhead rate xx
  Unfavorable (Favorable) $ xx

If several different materials are used in the manufacturing process, the labor usage variance may

Possible causes of variable overhead spending or price/controllable variance are as follows:
1. Actual costs, for example, machine power, materials handling, supplies were different from those expected because of fluctuations in market prices or rates.
2. Increase in energy costs.
4. Avoidable machine breakdowns.
5. Wrong grade of indirect material and indirect labor
6. Lack of operators or tools.

Responsibility: supervisors of cost centers are responsible because they have some degree of control over these budget or expense factors.

The possible causes of variable overhead efficiency variance are as follows:
This is attributable to efficiency in using the base on which variable overhead is applied. So if the basis of the variable overhead application is direct labor hours, the causes of the labor efficiency variance will also be the causes of the variable overhead efficiency variance.

Responsibility: Production line supervisors are responsible for this variance. This variance shows how much of the factory's capacity has been consumed or released by off-standard labor performance. If machine-hours are the basis for applying factory overhead, the variance measures the efficiency of machine usage.
Fixed Manufacturing Overhead Variance Analysis

In variance analysis, fixed manufacturing costs are treated differently from variable manufacturing costs. It is usually assumed that fixed costs are unchanged when volume changes, so the amount budgeted for fixed overhead is the same in both the master and flexible budgets. This is consistent with the variable costing method of product costing. There are no input-output-relationships for fixed overhead. The difference between the actual fixed overhead and the budgeted fixed overhead at normal capacity falls under the category of a price variance (also called spending or budget variance). While the difference between the budgeted fixed overhead and applied fixed overhead represents the volume or capacity variance.

The possible causes of capacity or volume variance are as follows:

1. Poor production scheduling.
2. Unusual machine breakdowns.
3. Storms or strikes.
4. Fluctuations over time.
5. Decrease in customer demand.
6. Excess plant capacity
7. Shortage of skilled workers.

Responsibility: Line supervisors can control fixed overhead when the costs are discretionary rather than committed. Top sales executives may be held responsible if budgeted volume is matched with anticipated long-run sales. Responsibility usually rests with top management, for the volume variance represents under or overutilization of plant and equipment.

Combined Manufacturing Overhead (variable and Fixed) Variance Analysis:

A. If the company is using a flexible budget, the total overhead variance may be analyzed as follows:
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I. Under the Two-Variance Method

**Controllable Variance**

Actual manufacturing overhead $xx
Less: Budget allowed based on Standard hours xx
   Fixed (at normal capacity) xx
   Variable (Standard hours* x Variable overhead rate) xx
Unfavorable (Favorable) $xx

**Capacity Variance**

**Labor efficiency Variance**

Budget allowed based on Standard hours $xx
Less: Standard hours x Standard overhead rate xx
Unfavorable (Favorable) $xx

* Standard hours = Equivalent production or Allowed hours based on actual production

Standard hours per unit

II. Under the Three-Variance Method

**Spending Variance**

Actual manufacturing overhead $xx

Less: Budget allowed based on Standard hours xx
   Fixed (at normal capacity) xx
   Variable (Actual hours x Variable overhead rate) xx
Unfavorable (Favorable) $xx

**Variable Efficiency Variance**

Budget allowed on Actual hours $xx

Less: Budget allowed based on Standard hours xx
   Fixed (at normal capacity) xx
   Variable (Standard hours x Variable overhead rate) xx
Unfavorable (Favorable) $xx
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Volume Variance

Budget allowed on Standard hours $ xx
Less: Standard hours x Standard overhead rate xx
Unfavorable (Favorable) $ xx

III. Under the Four-Variance Method

Spending Variance

Actual manufacturing overhead $ xx
Less: Budget allowed based on Standard hours xx
Unfavorable (Favorable) $ xx

Variable Efficiency Variance

Budget allowed on Actual hours $ xx
Less: Budget allowed based on Standard hours xx
Unfavorable (Favorable) $xx

Fixed Efficiency Variance

Standard hours $ xx
Less: Standard hours x Standard overhead rate xx
Unfavorable (Favorable) xx
Multiplied by: Fixed overhead rate xx
(Favorable) Unfavorable $ xx

Idle Capacity Variance

Normal capacity hours $ xx
Less: Actual hours xx
Unfavorable (Favorable) xx
Multiplied by: Fixed overhead rate xx
Unfavorable (Favorable) $ xx

The above computational procedures are summarized in Figure 11.1.
Figure 11.1
Manufacturing Overhead (Fixed And Variable) Variance Analysis (Flexible Budget In Use)

<table>
<thead>
<tr>
<th>2 variances</th>
<th>3 variances***</th>
<th>4 variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual overhead cost</td>
<td>Spending</td>
<td>Spending</td>
</tr>
<tr>
<td>Budget allowed based on actual hours*</td>
<td>Controllable</td>
<td>Variable Efficiency</td>
</tr>
<tr>
<td>Budget allowed based on standard hours**</td>
<td></td>
<td>Variable Efficiency</td>
</tr>
<tr>
<td>Actual hours x Standard overhead rate</td>
<td>Capacity or Volume</td>
<td>Capacity or Volume</td>
</tr>
<tr>
<td>Standard hours x Standard overhead rate</td>
<td></td>
<td>Fixed Efficiency: (Actual hours - Standard hours) x Fixed overhead rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Idle capacity: (Normal capacity hours - Actual hours) x Fixed overhead rate</td>
</tr>
</tbody>
</table>

* Budget allowed based on Actual hours: [Fixed overhead = (AH x Std. VOR)]
** Budget allowed based on Standard hours: [Fixed overhead = (SH x Std. VOR)]
*** May also be analyzed using the following presentation:

**Spending Variance**

- Actual overhead costs
- Less: Budget allowed based on actual hours
  - Unfavorable (Favorable) $ xx
- $ xx

**Capacity Variance**

- Budget allowed based on Actual hours $ xx
- Less: Actual hours x SOR $ xx
  - Unfavorable (Favorable) $ xx
- $ xx

**Efficiency Variance**

- Actual hours x SOR $ xx
- Less: Standard hours x SOR $ xx
  - Unfavorable (Favorable) $ xx
- $ xx

Net Unfavorable (Favorable) $ xx
B. If the company is uses fixed or static budget, variance analysis may be done as follows:

I. Under the Two-Variance Method

*Budget Variance*

- Actual manufacturing overhead $xx
- Less: Budgeted overhead (at normal capacity) xx
- Unfavorable (Favorable) $xx

*Capacity Variance*

- Budget overhead $xx
- Less: Standard of applied overhead (Standard hours x Standard overhead rate) xx
- Unfavorable (Favorable) $xx
- Net Unfavorable (Favorable) $xx

II. Under the Three-Variance Method

*Budget Variance*

- Actual manufacturing overhead $xx
- Less: Budgeted overhead xx
- Unfavorable (Favorable) $xx

*Capacity Variance*

- Budget hours x Standard overhead rate $xx
- Less: Actual hours x Standard overhead rate xx
- Unfavorable (Favorable) $xx

*Efficiency Variance*

- Actual hours x Standard overhead rate $xx
- Less: Standard hours x Standard overhead rate xx
- (Favorable) Unfavorable $xx
Chapter 11 Standard Costs and Operating Performance Measures

The above computational procedures are summarized in Figure 11.2.

**Figure 11.2**
Manufacturing Overhead (Fixed And Variable) Variance Analysis (Flexible Budget In Use)

<table>
<thead>
<tr>
<th>2 variances</th>
<th>3 variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual overhead cost</td>
<td>Budget</td>
</tr>
<tr>
<td>Budget hours x Standard overhead rate</td>
<td>Budget</td>
</tr>
<tr>
<td>Actual hours x Standard overhead rate</td>
<td>Capacity</td>
</tr>
<tr>
<td>Standard hours x Standard overhead rate</td>
<td>Efficiency</td>
</tr>
</tbody>
</table>

**Treatment of Variances**

a) If the variances are relatively small, they may be closed to Cost of Goods Sold.

Although inventory may be valued at standard cost for internal reporting purposes, the standard costs must be adjusted to actual costs for financial reporting purposes. This will require prorating the variances to each and every account that has been charged or credited with specific standard cost that is now being adjusted to actual. These accounts may be Cost of Goods Sold, Raw Materials Inventory, Work in Process Inventory and Finished Goods Inventory.

**Illustrative Problem 11.1. Variance Analysis (Standard Variable Costing System in use)**

The following events took place at Certified Containers, Inc., during the month of December
Chapter 11 Standard Costs and Operating Performance Measures

1. Produced and sold 50,000 plastic water containers at a sales price of $10 each. (Budgeted sales were 45,000 units at $10.15).

2. Standard variable cost per unit:
   - Direct materials: 2 lbs. at $1 $2.00
   - Direct labor: 0.10 hours at $15 1.50
   - Variable manufacturing overhead:
     - 0.10 hours at $5 0.50
   - **Total** $4.00 per unit

3. Fixed manufacturing overhead cost:
   - Monthly budget $80,000

4. Actual production costs
   - Direct materials purchased:
     - 200,000 pounds at $1.20 $240,000
   - Direct materials used:
     - 110,000 pounds at $1.20 132,000
   - Direct labor:
     - 6,000 hours at $14 84,000
   - Variable overhead 28,000
   - Fixed overhead 83,000

**REQUIRED:**

1. Compute the direct materials, labor and variable manufacturing overhead price and efficiency variances.
2. Compute the fixed manufacturing overhead price (spending) variance.

**Solution: Certified Containers, Inc.**

1. a. Direct materials price variance
   - Actual materials purchased $240,000
   - Less: Actual Quantity at Standard price (200,000 x $1) 200,000
   - Unfavorable 40,000

   b. Direct materials efficiency variance
   - Actual quantity used at standard price (110,000 x $1) $110,000
   - Less: Standard quantity at Standard price (100,000 x $1) 100,000
   - Unfavorable 10,000

   c. Direct labor rate variance
   - Actual labor cost 84,000
   - Less: Actual hours at standard rate (6,000 x $15) 90,000
   - Favorable $(6,000)
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d. Direct labor efficiency variance
   Actual hours at standard rate $ 90,000
   Less: standard hours at standard rate
   [(50,000 x 0.10) x $15] 75,000
   Unfavorable $ 15,000

e. Variable overhead spending variance
   Actual variable overhead $ 28,000
   Less: Actual hours at standard variable
   overhead rate (6,000 x $5) 30,000
   Favorable $(2,000)

f. Variable overhead efficiency variance
   Actual hours 6,000
   Less: standard hours 5,000
   Unfavorable 1,000
   Multiplied by: Std. VOR $ 5
   Unfavorable $(5,000)

2. Fixed overhead price (spending) variance
   Actual fixed overhead $ 83,000
   Less: Budgeted fixed overhead 80,000
   Unfavorable $ 3,000

Illustrative Problem 11.2. Variance Analysis (Standard Full-Absorption Costing System in use)

During the past month, the following events took place at Reliance, Inc.:

1. Produced 50,000 and sold 40,000 plastic minicomputer cases at a sales price of $10 each (Budgeted sales were 45,000 units at $10.15).

2. Standard variable costs per unit (that is, per case)
   Direct materials: 2 pounds at $1 $2.00
   Direct labor: 0.10 hours at $15 1.50
   Variable manufacturing overhead
   0.10 hours at $5 0.50
   $4.00 per case

3. Fixed manufacturing overhead cost:
   Monthly budget $80,000
   Estimated monthly production
   Cases
   Or
   4,000 hours
   Fixed overhead application rate $20 per hours

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4. Actual production costs:
   Direct materials purchased:
   200,000 pounds at $1.20 $240,000
   Direct materials used:
   110,000 pounds at $1.20 132,000
   Direct labor: 6,000 hours at $14 84,000
   Variable overhead 28,000
   Fixed overhead 83,000

REQUIRED:
Using a standard full-absorption costing system:
   a) Record the transactions using journal entries.
   b) Prorate the variance.

Solution: Reliance, Inc.
   a) (1) Direct Materials Inventory 200,000
      Materials Price Variance 40,000
      Accounts Payable 240,000
      To record the purchase of 200,000 pounds of materials at an actual cost of $1.20 per pound and to record the transfer to Direct Materials Inventory at the standard cost of $1 per pound.

      (2) Work in Process Inventory 100,000
      Materials Efficiency Variance 10,000
      Direct Materials Inventory 110,000
      To record the requisition of 110,000 pounds of materials at the standard cost of $1 per pound and to charge Work in Process Inventory with the standard usage of $100,000 pounds of materials at the standard price

      (3) Work in Process Inventory 75,000
      Labor Efficiency Variance 15,000
      Labor Price Variance 6,000
      Accrued Payroll 84,000
      To charge Work in Process Inventory for the standard cost of direct labor at $15 per hour times 5,000 standard hours allowed and to record the actual cost of $14 per hour times the 6,000 hours actually worked.
(4) Work in Process Inventory
    Variable Overhead Applied
    To apply overhead to production at $5 per standard direct labor-hour times the 5,000 hours allowed.

(5) Variable Overhead (actual)
    Miscellaneous accounts (Cash Accounts Payable, etc.)
    To record actual variable overhead.

(6) Variable Overhead Applied
    Variable Overhead Efficiency Variance
    Variable Overhead Price Variable
    Variable Overhead (actual)
    To record variable overhead variances and to close the Variable Overhead Applied and Variable Overhead (actual) accounts.

(7) Work in Process Inventory
    Fixed Overhead Applied
    To record fixed overhead at a standard cost of $20 per direct labor-hour times the 5,000 standard hours. ($80,000/4,000 hours = $20)

(8) Fixed Overhead (actual)
    Miscellaneous accounts
    To record actual fixed overhead.

(9) Fixed Overhead Applied
    Fixed Overhead Price Variance
    Fixed Overhead Production Variable Variance
    Fixed Overhead (Actual)
    To record fixed OH variances and to close the Fixed OH Accounts.
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(10) Finished Goods Inventory 300,000
Word in Process Inventory 300,000
To record the transfer of 50,000 units of finished goods at the standard cost of $6 per unit.

(11) Cost of Goods Sold 240,000
Finished Goods Inventory 240,000
To record the sale of 40,000 units at the standard cost of $6 per unit.

b) Proration of variances:

*Materials price variance:*

<table>
<thead>
<tr>
<th>Account</th>
<th>Cost in account</th>
<th>Percent of total cost</th>
<th>Variance to be prorated (Column 2 x $40,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Materials Inventory</td>
<td>$90,000</td>
<td>45</td>
<td>$18,000</td>
</tr>
<tr>
<td>Materials Efficiency</td>
<td>10,000</td>
<td>5</td>
<td>2,000</td>
</tr>
<tr>
<td>Variance</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Work in Process Inventory</td>
<td>20,000</td>
<td>10</td>
<td>4,000</td>
</tr>
<tr>
<td>Finished Goods Inventory</td>
<td>80,000</td>
<td>40</td>
<td>16,000</td>
</tr>
<tr>
<td>Cost of Goods Sold</td>
<td></td>
<td></td>
<td>$200,000</td>
</tr>
</tbody>
</table>

\[ \text{Material Efficiency Variance} \]

<table>
<thead>
<tr>
<th>Account</th>
<th>Cost in account</th>
<th>Percent of total cost</th>
<th>Variance to be prorated (Column 2 x $40,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in process Inventory</td>
<td>-0-</td>
<td>-0-</td>
<td>-0-</td>
</tr>
<tr>
<td>Finished goods inventory</td>
<td>$ 24,000</td>
<td>20</td>
<td>$ 2,400</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>96,000</td>
<td>80</td>
<td>9,600</td>
</tr>
<tr>
<td></td>
<td>$120,000</td>
<td>100</td>
<td>$12,000</td>
</tr>
</tbody>
</table>

*Labor and overhead variances:*

- Labor price variance: $ 6,000 F
- Labor efficiency variance: 15,000 U
- Variable overhead price variance: 2,000 F
- Variable overhead efficiency variance: 5,000 U
- Fixed overhead price variance: 3,000 U
- Fixed overhead volume variance: 20,000 F

Net total: $ 5,000 F

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$12,000 equals $10,000 variance before proration plus $2,000 materials price variance prorated to materials efficiency variance.

### Illustrative Problem 11.3. Computation of Standard Cost Per Unit; Variance Analysis

X Department uses a standard-cost system and a flexible budget.

**Denominator activity is:**
- Machine-hours: 140
- Finished pieces produced: 2,800

The standard costs in connection with this production are:

- Direct materials @ $1.20: $3,360
- Direct labor @ $0.1125: 325
- Factory overhead (including an allowance for variable overhead at the rate of $0.30 per piece): 1,400

Total: $5,075

The actual production for a month was:
- Machine-hours: 130
- Finished pieces produced: 2,860

The actual cost of this production was:
- Direct materials: $3,575
- Direct labor: 286
- Factory overhead, including $573 of fixed overhead: 1,573

Total: $5,434

Direct labor hours and machine-hours are proportional.
REQUIRED:

Answer the following questions:
1. What was the standard cost per finished piece?
2. What is the total material variance? Indicate whether the variance is favorable or unfavorable. Give the dollar amount.
3. Compute and analyze the direct labor costs variances.
4. Compute and analyze the factory overhead variances.
   a. Two-variance method
   b. Three-variance method
   c. Four-variance method

Solution: X Department

1. Standard cost per finished piece is computed as follows:
   Direct materials  ($3,360 / 2,800)  $1.2000
   Direct labor       ($315 / 2,800)    0.1125
   Factory overhead  ($1,400 / 2,800)    0.5000
   Total              $1.8125

2. Total material variance
   Actual materials cost   $3,575
   Standard materials cost ($1.20 x $2,860)  3,432
   Unfavorable material variance  $ 143

3. Direct labor costs variance
   Actual labor costs   $286.00
   Less: Standard labor costs (2,860 x $0.1125) 321.75
   (Favorable) Unfavorable Variance  ($35.75)

   Analysis:
   Direct labor rate variance
   Actual labor costs   $286.00
   Less: Actual labor hours x Standard labor rate (130 x $0.225) 292.50
   Favorable variance   $ (6.50)
   Direct labor efficiency variance
   Actual labor hours x standard labor rate $292.50
   Less: Standard hours x Standard labor rate (143 x $2.25) 321.75
   Favorable variance  (29.25)
   Total favorable variance  ($35.75)

4. Factory overhead variance
   Actual factory overhead $1,573
   Less: Standard factory overhead (2,860 x $0.50) 1,430
   Unfavorable variance  $ 143
Analysis:

a. Two-variance method

Controllable variance

Actual factory overhead $1,573
Less: Budget allowed based on standard hours $560
Fixed Variable (143 x $6) 858 1,418
Unfavorable variance 155

Volume or Idle Capacity variance

Budget allowed on standard hours $1,428
Less: Standard hours x Standard overhead rate (143 x $10) 1,430
Favorable variance (12)
Total unfavorable variance 143

b. Three-variance method

Spending variance

Actual factory overhead $1,573
Less: Budget allowed based on actual hours
Fixed $560
Variable 760 1,340
Unfavorable variance $233

Efficiency variance (variable)

Budget allowed based on actual hours $1,340
Less: Budget allowed based on standard hours
Fixed $560
Variable 858 1,18
Favorable variance $(78)

Volume variance

Budget allowed based on actual hours $1,418
Less: Standard hours x standard Overhead rate (143 x $10) 1,430
Favorable Variable (12)
Total unfavorable variance $143

c. Four-variance method

Spending variance

Actual manufactory overhead $1,573
Less: Budget allowed based on actual hours
Fixed $560
Variable 780 1,340
Unfavorable variance $233
Variable Efficiency variance

Budget allowed based on actual hours $1,340
Less: Budget allowed based on standard hours
    Fixed $560
    Variable 858 1,418
Favorable variance $(78)

Fixed Efficiency variance

Actual hours 130
Less: Standard hours 143
    Difference 13
Multiplied by: Fixed Overhead rate $4
    (Favorable) Unfavorable variance (52)

Idle Capacity variance

Normal capacity hours 140
Less: Actual hours 130
    Difference 10
Multiplied by: Fixed Overhead rate $4
    (Favorable) Unfavorable variance 40

Total Unfavorable Manufacturing Overhead Variance $143

Illustrative Problem 11.4. Combined Variance Analysis: Fixed Budget in Use

The following fixed budget estimated for the month of April apply to the machinery department of the Norton Company:

Estimated factory overhead $16,750
     Estimated direct labor hours 3,350

Overhead is applied on the basis of direct labor hours. On April 30, the following account balances in the books of the company:

Factory overhead $18,250
    Applied factory overhead 17,500

REQUIRED:

Compute and analyze the spending (Budget) variance and idle capacity variance.
Solution: Norton Company

NORTON COMPANY
Variance Analysis For April

Actual Factory Overhead $18,250
Applied Factory Overhead 17,500
Unfavorable Variance $750

Spending Variance
Actual Factory Overhead $18,250
Budgeted Factory Overhead 16,750
Unfavorable $1,500

Idle Capacity Variance
Budgeted Overhead at normal capacity $16,750
Applied Factory Overhead 17,500
Favorable $(750)

Illustrative Problem 11.5 Mix; Yield Variance Analysis
The Chicleros Company, Inc. manufacturer of chewing gum, uses a standard cost system. Standard product and cost specifications for 1,000 lbs. of chewing gum are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Price/lb</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gumbase</td>
<td>800 lbs.</td>
<td>$0.25/lb</td>
<td>$200</td>
</tr>
<tr>
<td>Corn Syrup</td>
<td>200 lbs.</td>
<td>$0.40/lb</td>
<td>800</td>
</tr>
<tr>
<td>Sugar</td>
<td>200 lbs.</td>
<td>$0.10/lb</td>
<td>20</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>1,200 lbs</td>
<td></td>
<td>$300</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>1,000 lbs</td>
<td></td>
<td>$300</td>
</tr>
</tbody>
</table>

Materials records indicate:

<table>
<thead>
<tr>
<th>Item</th>
<th>Opening Inventory</th>
<th>Purchases in January</th>
<th>Ending Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gumbase</td>
<td>10,000 lbs.</td>
<td>162,000 @ $0.24</td>
<td>15,000 lbs.</td>
</tr>
<tr>
<td>Corn Syrup</td>
<td>12,000 lbs.</td>
<td>30,000 @ $0.42</td>
<td>4,000 lbs.</td>
</tr>
<tr>
<td>Sugar</td>
<td>15,000 lbs.</td>
<td>32,000 @ $0.11</td>
<td>11,000 lbs.</td>
</tr>
</tbody>
</table>
Chapter 11 Standard Costs and Operating Performance Measures

To convert 1,200 lbs. of raw materials into 1,000 lbs. of finished product requires 20 hours at $3 per hour, or $0.06 per lb. Actual direct labor hours and cost for January are 3,800 hours at $11,552.

Factory overhead is applied on a direct labor hour basis at a rate of $5 per hour ($3 fixed, $2 variable), or $0.10 per lb. Normal overhead is $20,000 with 4,000 direct labor hours. Actual overhead for the month of January is $22,000. actual finished production for the month of January is 200,000 lbs.

The standard cost per pound of finished chewing gum is:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>$0.30</td>
</tr>
<tr>
<td>Labor</td>
<td>0.06</td>
</tr>
<tr>
<td>Factory overhead</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$0.46</strong></td>
</tr>
</tbody>
</table>

per pound

REQUIRED:
Analyze Variances in:
1. Materials
2. Direct Labor
3. Factory Overhead

Solution: Chicleros Company, Inc.

1. Materials Cost Variance
   - Actual Materials Cost: $57,600
   - Less: Standard Materials Costs: 60,000
   - Favorable: $(2,400)

Analysis:
Materials Price Variance

<table>
<thead>
<tr>
<th></th>
<th>Gumbase</th>
<th>Corn Syrup</th>
<th>Sugar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Inventory</td>
<td>10,000</td>
<td>12,000</td>
<td>15,000</td>
<td></td>
</tr>
<tr>
<td>Purchases</td>
<td>162,000</td>
<td>30,000</td>
<td>32,000</td>
<td></td>
</tr>
<tr>
<td>Total available</td>
<td>172,000</td>
<td>42,000</td>
<td>47,000</td>
<td></td>
</tr>
<tr>
<td>Ending</td>
<td>15,000</td>
<td>4,000</td>
<td>11,000</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>157,000</td>
<td>38,000</td>
<td>36,000</td>
<td></td>
</tr>
<tr>
<td>Difference Between actual and Std price</td>
<td>$(0.01)</td>
<td>$0.02</td>
<td>$0.01</td>
<td></td>
</tr>
<tr>
<td>(Favorable) Unfavorable</td>
<td>$(1,570)</td>
<td>$760</td>
<td>$360</td>
<td>$(450)</td>
</tr>
</tbody>
</table>
Chapter 11 Standard Costs and Operating Performance Measures

Materials Usage Variance

Mix Variance
Actual quantity (per raw material) at standard price
Gumbase (157,000 x $0.25) $39,250
Corn Syrup (38,000 x $0.40) 15,200
Sugar (38,000 x $0.10) 3,600
Total $58,050
Less: Total actual input at average standard price 
(231,000 x $0.25) $57,750
(Favorable) Unfavorable $300

Yield Variance
Total actual input at average standard price $57,750
Less: Total Actual Output x Standard materials cost (200,000 x P0.30) 60,000
Favorable (Unfavorable) $(2,250)

Favorable Materials Variance $(1,950)*
Net Favorable Variance $(2,400)

* Proof:
Actual Quantity at Standard Price
$58,050

Standard Quantity (based on actual output)
at Standard Price (240,000 x $25) or
Gumbase (160,000 lbs. x $225) = 40,000
Corn Syrup (40,000 lbs. x $40) = 16,000
Sugar (40,000 lbs. x $10) = 4,000
60,000
Favorable $(1,950)

2. Labor Costs Variance
Actual payroll $11,552
Less: Standard labor costs (200,000 x $0.06) 12,000
(Favorable) Unfavorable $(48)
Analysis:

**Labor Rate Variance**

<table>
<thead>
<tr>
<th>Actual payroll</th>
<th>$11,552</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Actual hours x standard rate</td>
<td></td>
</tr>
<tr>
<td>(3,800 hrs. x $3)</td>
<td>11,400</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>152</td>
</tr>
</tbody>
</table>

**Labor Efficiency Variance**

<table>
<thead>
<tr>
<th>Actual hours at standard rate</th>
<th>$11,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Standard hours based on actual input x standard rate ($231,000/1,200) x 20 x $3</td>
<td>11,550</td>
</tr>
<tr>
<td>Favorable variance</td>
<td>(150)</td>
</tr>
</tbody>
</table>

**Labor Yield Variance**

<table>
<thead>
<tr>
<th>Standard hours based on actual input x standard rate</th>
<th>$11,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Standard hours based on actual output x standard rate</td>
<td></td>
</tr>
<tr>
<td>(200,000/1,000) x 20 x $3</td>
<td>12,000</td>
</tr>
<tr>
<td>Favorable variance</td>
<td>(450)</td>
</tr>
<tr>
<td>Net Favorable variance</td>
<td>$ (448)</td>
</tr>
</tbody>
</table>

3. **Factory Overhead Variance**

<table>
<thead>
<tr>
<th>Actual factory overhead</th>
<th>$22,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Standard factory overhead (200,000 x $0.10)</td>
<td>20,000</td>
</tr>
<tr>
<td>(Favorable) Unfavorable</td>
<td>$ 2,000</td>
</tr>
</tbody>
</table>

**Analysis:**

**Controllable Variance**

<table>
<thead>
<tr>
<th>Actual factory overhead</th>
<th>$22,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Budget for standard hours based on actual input:</td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td>$12,000</td>
</tr>
<tr>
<td>Variable (3,850 x $2)</td>
<td>7,000</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>2,300</td>
</tr>
</tbody>
</table>

**Volume Variance**

<table>
<thead>
<tr>
<th>Budget for standard hours based on actual input</th>
<th>$19,700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Standard hours based on actual input x standard rate (3,850 hrs x $5)</td>
<td>19,250</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>450</td>
</tr>
</tbody>
</table>

**Yield Variance**

<table>
<thead>
<tr>
<th>Standard hours based on actual input x standard rate</th>
<th>$19,250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less: Standard hours based on actual input x standard rate (4,000 hrs x $5)</td>
<td>20,000</td>
</tr>
<tr>
<td>Favorable</td>
<td>(750)</td>
</tr>
<tr>
<td>Total unfavorable overhead variance</td>
<td>$2,000</td>
</tr>
</tbody>
</table>
SHORT QUESTIONS

1. Explain the similarities and differences between standards and budgets.

2. Contrast the accounting for standard and budgets.

3. Star Industries computes variances as a basis for evaluating the performance of managers responsible for controlling costs. For several months, the labor efficiency variance has been unfavorable. Briefly explain what could be causing the unfavorable labor efficiency variance and indicate what type of corrective action, if any, might be taken.

4. In reviewing the activities of the Mixing Department for the month of June, the manager of the department notices that there was an unfavorable materials price variance for the month and there was an unfavorable materials usage variance. Under what circumstances, if any, can the responsibility for each variance be placed on (a) the purchasing department and (b) the production department?

5. Vincent Bassani has come to the accounting department for help in interpreting his variance report. He says that he understands that last month was not a very good one for output, but he really thought everyone put forth good effort, so he is confused about the existence of an unfavorable labor efficiency variance. He cites as an example of the workers’ effort their willingness to work extra hours to get full output, even when a whole week’s worth of production had to be scrapped. He knew that his materials costs would be higher, and that overtime would make his rate variance unfavorable, but he certainly didn’t think his workers had been inefficient. Write a short note to Vincent explaining the probable cause of the unfavorable labor efficiency variance.
EXERCISES

Problem 1
Vanderhaus Corporation manufactures a variety of liquid lawn fertilizers, including a very popular product called Lush 'N Green. Data about Lush 'N Green and Proctol, a major ingredient, follow.

Expected operations:

- Proctol is purchased in 55-gallon drums at a cost of $65 per drum. A 2% cash discount is offered by Proctol's manufacturer for prompt payment of invoices, and Vanderhaus takes advantage of all discounts offered.
- Vanderhaus normally purchases 200 drums of Proctol at a time, paying shipping fees of $2,660 per shipment.
- Each gallon of Lush 'N Green requires three quarts of Proctol; however, because of evaporation and spills, Vanderhaus loses 4% of all Proctol that enters production. (Recall that there are four quarts in a gallon.)

Actual operations:

- For the period just ended, Vanderhaus purchased 1,500 drums of Proctol at a total cost of $118,100, which reflects discounts and shipping. There was no beginning inventory, but an end-of-period inventory revealed that 30 drums were still on hand.
- Manufacturing activity output totaled 104,000 gallons of Lush 'N Green.

Assume that the company computes variances at the earliest point in time.

Required:
1. Compute the standard purchase price for one gallon of Proctol.
2. Compute the standard quantity of Proctol to be used in producing one gallon of Lush 'N Green. Express your answer in quarts.
3. Compute the direct-material price variance for Proctol.
4. How much Proctol was used in manufacturing activity and how much should have been used? Express your answer in quarts.
Chapter 11 Standard Costs and Operating Performance Measures

Problem 2
Quicksilver Company has set the following standards for one unit of product:

<table>
<thead>
<tr>
<th>Direct material</th>
<th>Direct labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity: 6.2 pounds per unit</td>
<td>Quantity: 6 hours per unit</td>
</tr>
<tr>
<td>Price per pound: $11 per pound</td>
<td>Rate per hour: $23 per hour</td>
</tr>
</tbody>
</table>

Actual costs incurred in the production of 2,800 units were as follows:
- Direct material: $194,350 ($11.50 per pound)
- Direct labor: $393,750 ($22.50 per hour)

All materials purchased were consumed during the period.

Required:
Calculate the direct-material price and quantity variances, and the direct-labor rate and efficiency variances. Indicate whether each variance is favorable or unfavorable.

Problem 3:
Roberto Ventura operates a commercial painting business in Sacramento, which has a very tight labor market. Much of his work focuses on newly constructed apartments and townhouses.

The following data relate to crew no. 5 for a recently concluded period when 85 apartment units were painted:

- Three new employees were assigned to crew no. 5. Wages averaged $18.80 per hour for each employee; the crew took 2,550 hours to complete the work.
- Based on his knowledge of the operation, articles in trade journals, and conversations with other painters, Ventura established the following standards:
  - Typical hourly wage rate of crew personnel: $15
  - Anticipated crew time for each unit: 34 hours
  - The paint quantity variance was $6,070F. The operation did not go as smoothly as planned, with customer complaints and problems being much higher than expected.
Chapter 11 Standard Costs and Operating Performance Measures

Required:
1. Compute Ventura's direct-labor variances.
2. Is the direct-labor rate variance consistent with what you might expect in a tight labor market? Explain.
3. Analyze the information given and that you calculated, and determine what likely happened that would give rise to customer complaints.

Problem 4:
Halo Enterprises recently experienced a fire, forcing the company to use incomplete information to analyze operations. Consider the following data and assume that all materials purchased during the period were used in production:

Direct materials:
- Standard price per pound: $9
- Actual price per pound: $8
- Price variance: $20,000F
- Total of direct-material variances: $2,000F

Direct labor:
- Actual hours worked: 40,000
- Actual rate per hour: $15
- Efficiency variance: $28,000F
- Total of direct-labor variances: $12,000U

Halo completed 12,000 units.

Required:
Determine the following:
1. actual materials used,
2. direct-material quantity variance,
3. direct-labor rate variance,
4. standard labor rate per hour, and
5. standard labor time per finished unit.
Chapter 11 Standard Costs and Operating Performance Measures

Problem 5:
Platt Company produces one product, a putter called PAR-putter. Platt uses a standard cost system and determines that it should take one hour of direct labor to produce one PAR-putter. The normal production capacity for this putter is 100,000 units per year. The total budgeted overhead at normal capacity is $500,000 comprised of $200,000 of variable costs and $300,000 of fixed costs. Platt applies overhead on the basis of direct labor hours.

During the current year, Platt produced 85,000 putters, worked 89,000 direct labor hours, and incurred variable overhead costs of $160,000 and fixed overhead costs of $300,000.

Required
1. Compute the predetermined variable overhead rate and the predetermined fixed overhead rate.
2. Compute the applied overhead for Platt for the year.
3. Compute the total overhead variance.

Problem 6:
Dart Company developed the following standard costs for its product for 20x1:

<table>
<thead>
<tr>
<th>Cost Elements</th>
<th>Standard Quantity</th>
<th>Standard Price</th>
<th>Standard Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>4 pounds</td>
<td>$5</td>
<td>$20</td>
</tr>
<tr>
<td>Direct labor</td>
<td>2 hours</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>2 hours</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Fixed overhead</td>
<td>2 hours</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

The company expected to work at the 120,000 direct labor hours level of activity and produce 60,000 units of product.

Actual results for 20x1 were as follows:
- 56,800 units of product were actually produced.
- Direct labor costs were $1,092,000 for 112,000 direct labor hours actually worked.
Chapter 11 Standard Costs and Operating Performance Measures

- Actual direct materials purchased and used during the year cost $1,108,800 for 231,000 pounds.
- Total actual manufacturing overhead costs were $680,000.

Required:

Compute the following variances for Dart Company for 20x1 and indicate whether the variance is favorable or unfavorable.

1. Direct materials price variance.
2. Direct materials usage variance.
3. Direct labor rate variance.
4. Direct labor efficiency variance.
5. Overhead controllable variance.

Problem 7

More Hits Company manufactures aluminum baseball bats that it sells to university athletic departments. It has developed the following per unit standard costs for 20x1 for each baseball bat:

<table>
<thead>
<tr>
<th>Overhead</th>
<th>Direct Materials</th>
<th>Direct Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Quantity</td>
<td>2 Pounds (Aluminum)</td>
<td>1/2 hour</td>
</tr>
<tr>
<td>Standard Price</td>
<td>$4.00</td>
<td>$10.00</td>
</tr>
<tr>
<td>Unit Standard Cost</td>
<td>$8.00</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

In 20x1, the company planned to produce 120,000 baseball bats at a level of 60,000 hours of direct labor. Actual results for 20x1 are presented below:

- Direct materials purchases were 246,000 pounds of aluminum which cost $1,020,900.
- Direct materials used were 220,000 pounds of aluminum.
- Direct labor costs were $575,260 for 58,700 direct labor hours actually worked.
- Total manufacturing overhead was $352,000.
- Actual production was 114,000 baseball bats.
Required
1. Compute the following variances:
   a) Direct materials price.
   b) Direct materials usage.
   c) Direct labor rate.
   d) Direct labor efficiency.
   e) Total overhead variance.
2. Prepare the journal entries to record the transactions and events in 20x1.

Problem 8
Pepper Industries uses a standard cost accounting system. During March, 20x1, the company reported the following manufacturing variances:

<table>
<thead>
<tr>
<th>Variance</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials price variance</td>
<td>$1,600  F</td>
</tr>
<tr>
<td>Materials usage variance</td>
<td>2,400   U</td>
</tr>
<tr>
<td>Labor rate variance</td>
<td>600     U</td>
</tr>
<tr>
<td>Labor efficiency variance</td>
<td>2,200   U</td>
</tr>
<tr>
<td>Overhead controllable variance</td>
<td>500     F</td>
</tr>
<tr>
<td>Overhead volume variance</td>
<td>3,000   U</td>
</tr>
</tbody>
</table>

In addition, 15,000 units of product were sold at $18 per unit. Each unit sold had a standard cost of $14. Selling and administrative expenses for the month were $15,000.

Required
Prepare an income statement for management for the month ending March 31, 20x1.
CHAPTER 12
RELEVANT COSTS FOR DECISION MAKING

After studying the Chapter, you should be able to:

1. Describe the decision making process.
2. State the general rule for distinguishing between relevant and irrelevant cost in a decision-making situation.
3. Identify sunk costs and explain why they are not relevant in decision making.
4. Identify opportunity costs as well as out-of-pocket costs.
5. Apply the incremental analysis approach in decision making.
6. Apply the total project analysis approach in decision making.
7. Prepare an analysis whether a part should be manufactured or purchased or purchased.
8. Prepare an analysis showing whether a product line or other segments should be dropped or retained.
9. Prepare an analysis showing whether joint products should be sold at the split-off point or processed further.
10. Evaluate whether a special order should be accepted or rejected.
11. Make appropriate computations to determine the optimum utilization of scarce resources.
12. Evaluate whether the company continue operations or temporarily shutdown.
CHAPTER 12
RELEVANT COSTS FOR DECISION MAKING

Managers must constantly make decisions. In making these decisions, they must estimate how each decision could affect operating income.

The management accountant’s role in this process is to supply information on changes in costs and revenues to facilitate the decision process. How does the accountant decide which information to present?

Managers often select the course of action that maximizes expected operating income over the period affected by the decision. To do this, they analyze relevant information. Relevant information is the expected future date that differs among alternative courses of action.

In decision making, revenue and costs are often the key factors. These revenues and costs of one alternative must be compared against the revenues and costs of other alternatives as one step in the decision making process. The problem is that some costs associated with an alternative may not be relevant to the decision to be made. A relevant cost can be defined as a cost that is applicable to a particular decision in the sense that it will have a bearing on which alternative the manager select.

The Decision Making Process

Decision making is the process of studying and evaluating two or more available alternatives leading to a final choice. This selection process is not automatic; rather, it is a conscious procedure. Intimately involved with planning for the future, decision making is directed toward a specific objective or goal.

Although there are innumerable variables or factors that exist and should be considered in making decisions in the real word, in textbook problems only a few variables that affect decision results will be taken into account. Therefore, an organized and systematic approach may be helpful to managers in making decisions. The steps are outlined as follows:

1. Define strategies: business goals and tactics to achieve them.
2. Identify the alternative choices or courses of action.
3. Collect and analyze the relevant data on the choices.
4. Choose the best alternative to achieve goals.
Chapter 12 Relevant Costs for Decision Making

Consideration should also be given not only to quantitative analysis but also major qualitative issues in applying the above steps.

Identifying Relevant Costs

Any cost that is *avoidable* is relevant for decision purposes.

**Avoidable cost** can be defined as a cost that can be eliminated (in whole or in part) as a result of choosing one alternative over another in decision-making situation. *All* costs are considered avoidable, except:

1. Sunk costs
2. Future costs that do not differ between the alternatives at hand.

**Relevant costs** are expected future costs which differ between the decision alternatives. These are costs that will be increased or decreased as a result of a decision.

Under the concept of relevant cost, decision-making process involves the following analytical steps:

1. Determine all costs associated with each alternative being considered.
2. Drop those costs that are sunk or historical.
3. Drop those costs that do not differ between alternatives.
4. Make a decision based on the remaining costs. These costs will be the future differential or avoidable costs, and hence the costs relevant to the decision to be made.

**Sunk or historical costs** are never relevant in decisions because they are not avoidable and therefore they must be eliminated form the manager's decision framework. Depreciation relating to the book value of old equipment is not relevant in decision making. However, it is not correct to assume that depreciation of *any* kind is irrelevant in the decision making process. Depreciation is *irrelevant* in decision only if it relates to a sunk cost. Depreciation on a new machine is not correct to assume that depreciation of *any* kind is irrelevant in the decision making process. Depreciation is *irrelevant* in decision only if it relates to a sunk cost. Depreciation on a new machine is relevant because the investment in the new machine *has not yet been made* and therefore it does not represent depreciation of a sunk cost.
Chapter 12 Relevant Costs for Decision Making

The resale of disposal value of an existing asset will be relevant in any decision that involves disposing of the asset.

Lastly, any future cost that does not differ between the alternatives in a decision situation is not a relevant cost so far as that decision is concerned.

Opportunity costs are the profits lost by the diversion of an input factor from one use to another. They are the net economic benefit given up when an alternative is rejected. They are relevant when a company is considering eliminating one activity and using plant facilities advantageously in another activity. Usually formal accounting systems do not record opportunity costs because such costs do not involve cash receipts or outlays and only data concerning the alternative selected are recorded. However, these rejected alternatives do have significance in decision making. For example, a single proprietor has foregone the opportunity to earn a salary elsewhere by owning a company. In deciding to own a business, the proprietor weighs the salary that would have been earned if he worked elsewhere.

Out-of-pocket costs involve either an intermediate or near-future cash outlay; they are usually relevant to decisions. Frequently, variable costs fall into this classification. For example, the direct materials needed to fill additional orders are both relevant and out-of-pocket cost are important in decision making because management should determine whether a proposed project would, at the minimum return is initial cash outlay.

Consider the following example:

On December 31, 20x1, Company A completed the construction of a new $900,000 machine. On January 3, 20x2, a salesman from an equipment supplier offered to sell the company an $800,000 machine that can replace the constructed years (the life of both machines). The machine built by Company A has no salvage value. Which costs are relevant?

The relevant costs in his example are the $800,000 potential outlay for the new machine and the resulting operating savings of $200,000 per year. The book value of the old machine is irrelevant. However, it is used in determining the gain or loss on disposal for tax purposes and the effect of taxes on cash flow is a relevant cost. For Company
Chapter 12 Relevant Costs for Decision Making

A. a 32% tax rate on the loss of $900,000 could mean a tax benefit of $288,000; it is the tax benefits that would be the relevant mount.

Illustrative Problem 12.1 Identification of Relevant and Irrelevant Costs

Rosal Company owns a rice milling machine that was purchased three years ago for $250,000 with five years remaining life. Its present book value is $156,250 and resale value is $100,000. The new machine will generate the same amount of revenue as the old one but will substantially decrease the variable operating costs. Based on normal sales volume of 20,000 units, the annual sales and operating costs of the old machine and the proposed replacement are estimated as follows:

<table>
<thead>
<tr>
<th></th>
<th>Old Machine</th>
<th>New Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales @ $30</td>
<td>$600,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td>$350,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>$250,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>Fixed Costs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation (straight-line)</td>
<td>31,250</td>
<td>100,000</td>
</tr>
<tr>
<td>Insurance, taxes, salaries, etc.</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Total</td>
<td>71,250</td>
<td>140,000</td>
</tr>
<tr>
<td>Net operating income</td>
<td>$178,950</td>
<td>$260,000</td>
</tr>
</tbody>
</table>

At first glance, it appears that the new machine will provide an increase in net income of $81,050 annually. The book value of the old machine however, is a sunk cost and is not relevant to this decision. In addition, sales and fixed costs (insurance taxes, salaries, etc.) are also not relevant since they do not differ between the two alternatives being considered. If the irrelevant costs, taxes and time value of money can be disregarded, the alternatives can be analyzed as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings in variable cost for 5 years (50,000 x 5)</td>
<td>$750,000</td>
</tr>
<tr>
<td>Purchase cost of new machine</td>
<td>(500,000)</td>
</tr>
<tr>
<td>Resale value of old machine</td>
<td>100,000</td>
</tr>
<tr>
<td>Net cash inflow</td>
<td>$350,000</td>
</tr>
</tbody>
</table>

The above computation will indicate that it would be a good move to buy the new machine because it would result to a net cash flow of $350,000 for the 5 – year period.
Approaches in Analyzing Alternatives in Non-routine Decision Making

The two commonly used approaches in evaluating alternative courses of action are

1) Incremental or Differential analysis approach
2) Total Project Analysis approach or Comparative Statements approach.

Incremental, Differential, or Relevant Cost analysis contrasts choices by comparing differential revenues, differential costs and differential contribution margins. It has the advantage of showing only relevant amounts. All sunk and non-differential items are disregarded. The following steps are followed in using this approach:

1. Gather all cost associated with each alternative.
2. Drop the sunk costs and non-differential costs.
3. Select the best alternative based on the remaining cost data.

Total Project Analysis approach shows all the items of revenues and cost data (whether they are relevant or not) under the different alternatives and compares the net income results. Comparative income statements under this approach are prepared in a Comparative income statements under this approach are prepared in a Contribution format.

These approaches are illustrated in the following case problem on Special Sales Order.

Illustrative Problem 12.2. Special Sales Order

Parton, Inc., a manufacturer of rattan baskets, ordinarily sells regular baskets for $32.00 each. At the beginning of the year 20x2, an exporter has offered Parton $875000 for 50,000 baskets or $17.50 per basket. This sale will not affect regular business in any way. Furthermore, it will not change fixed costs nor require additional variable selling and administrative expense and it will put to use idle manufacturing capacity. Parton’s manufacturing product cost of a basket is $20 of which $12 is variable cost. The income statement for the year just ended, December 31, 20x1 showed the following results:
Chapter 12 Relevant Costs for Decision Making

Sales (250,000 x $32) $8,000,000
Less: Variable expenses
  Manufacturing 3,000,000
  Selling and Administrative 750,000
  Total 3,750,000
Contribution Margin $4,250,000
Less: Fixed expenses
  Manufacturing 2,000,000
  Selling and Administrative 1,250,000
  Total 3,250,000
Operating Income $1,000,000

Should Parton accept the special order at a sale price of $17.50?

A. Using the Differential Analysis approach, the following can be gathered:

Incremental sales revenue (50,000 x $17.50) $875,000
Incremental variable manufacturing costs (50,000 x $12) 60,000
Expected increase in operating income $275,000

B. Under the Total Project Analysis approach, the outcome will be as follows:

<table>
<thead>
<tr>
<th>(1) Without Special Order (250,000 units)</th>
<th>(2) With Special Order (300,000 Units)</th>
<th>(3) Special Order (50,000 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$8,000,000</td>
<td>$8,875,000</td>
</tr>
<tr>
<td>Variable Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>3,000,000</td>
<td>3,600,000</td>
</tr>
<tr>
<td>Selling &amp; Adm.</td>
<td>750,000</td>
<td>750,000</td>
</tr>
<tr>
<td>Total</td>
<td>3,750,000</td>
<td>4,350,000</td>
</tr>
<tr>
<td>Cont Margin</td>
<td>4,250,000</td>
<td>4,525,000</td>
</tr>
<tr>
<td>Fixed Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2,000,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Selling &amp; Adm.</td>
<td>1,250,000</td>
<td>1,250,000</td>
</tr>
<tr>
<td>Total</td>
<td>3,250,000</td>
<td>3,250,000</td>
</tr>
<tr>
<td>Operating Income</td>
<td>$1,000,000</td>
<td>$1,275,000</td>
</tr>
</tbody>
</table>
Chapter 12 Relevant Costs for Decision Making

Based on the analyses made (differential/total project), the Parton Company may accept the special sales order because it will yield incremental income of $175,000.

Short Run vs. Long Run: Other Factors to Consider

Our special sales order analysis focused only on short-run factors the expected effect on operating income. In making the final decision, however, long-run factors should be such as:

1. What will be the impact on customers?
2. Should regular customers find out about the special price? Will they complain at paying more?
3. How will competitors react?

It is therefore possible that although the order will yield additional income of $275,000, the sales manager may reject the order to protect its long-run market position. Rejecting the order is like “investing” $275,000 in the company’s long run future.

Types of Decisions

This Chapter examines groups of decisions that require particular decision rules, relevant data and formats. These decisions that commonly occur in all business activities are as follows:

1. Make or Buy
2. Add or Drop a Product or Other Segments
3. Sell Now or process Further
4. Special Sales Pricing
5. Utilization of Scarce Resources
6. Shut-down or Continue Operations
7. Pricing

Make or Buy Decision

Differential cost analysis is appropriate for short-run make-or-buy decisions involving the construction of plant assets or component parts of the finished product on the company premises rather than acquiring them outside.
Chapter 12 Relevant Costs for Decision Making

The make-or-buy decision is a management decision about whether an item should be made internally or bought from an outside supplier. To put idle capacity to use, firms or bought from an outside supplier. To put idle capacity to use, firms often consider manufacturing a part or subassembly they are currently purchasing. For example, a watch company might use its idle capacity to produce its own watch bands or bracelet. Or a company that manufactures cars might use its idle capacity to manufacture its own stock absorbers instead of buying them from an outside supplier.

When these opportunities arise, the managerial accountant is often asked to compare the cost of manufacturing a part internally with the cost of purchasing it.

**Illustrative Problem 12.3. Make or buy decision**

Assume that KLM Company is purchasing 2,000 parts from an outside suppliers for $170 a part. If the company makes the part internally, costs will be assigned to the part as follows:

- Direct materials: $120,000
- Direct labor: $100,000
- Variable overhead: $60,000
- Fixed overhead: $80,000

**Total Manufacturing Costs:** $360,000

Manufacturing costs per unit will amount to $180 ($360,000 / 2,000).

Should the company manufacture the parts or buy them from an outside supplier?

If KLM managers simply compare the total manufacturing costs of $360,000 with total purchase costs of $340,000, they will in most probability decide to buy the part.

But looking more closely at the individual cost components, we will find the inclusion of overhead which will be incurred regardless of whether or not it makes or buys the part. Hence, these costs are not relevant.

For 2,000 units, the relevant costs under “make” alternative will be as follows:
Chapter 12 Relevant Costs for Decision Making

<table>
<thead>
<tr>
<th></th>
<th>Per unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$160</td>
<td>$120,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>50</td>
<td>100,000</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>30</td>
<td>60,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$140</strong></td>
<td><strong>$280,000</strong></td>
</tr>
</tbody>
</table>

While relevant purchase costs remain at $170 per unit or a total of $340,000.

All things being equal therefore, it would be advisable for the KLM Company to manufacture the part internally because the company will realize cost savings of $60,000.

Before making the final decision, the company should consider other factors, both quantitative and qualitative.

The other quantitative factor to be considered is the effect on the company's required production level. The analysis done was based on a 2,000-part level. What if the company feels that the needed production level is different? To guide management in making decision should the production requirement be different from the 2,000 units originally used, the accountant can determine the point of indifference cost volume. This is the production level at which the cost of buying an item equals the cost of making it. In KLM Company's case the point of indifference cost volume is calculated as follows:

\[
\text{Total costs to make} = \text{Total costs to buy} = 40,000 + 140X = 170X
\]

where \(X\) representing the production volume

\[
X = 1,333 \text{ units.}
\]

The indifference cost volume is 1,333 units. If expected production volume is below 1,333, purchasing the part will be advisable because it is the least costly alternative. If expected production volume is above 1,333, making the part is less costly.

Opportunity costs or earnings the company could have made if it had applied the capacity to some alternative use are relevant and should therefore be added to the relevant costs of "make" alternative. Examples are rent offered for the use of idle facilities, avoidable fixed costs if parts are purchased from outside suppliers.
Chapter 12 Relevant Costs for Decision Making

Adding or Dropping Products/Segments

Over time, consumers' preferences change. Some products become obsolete and are dropped from product lines, others are developed to replace them. When management is considering dropping a product line or customer group, the only relevant costs are those that a company would avoid by dropping the product or customer. An important factor in deciding whether to add or drop a product is the decision's effect on operating income.

Illustrative Problem 12.4. Eliminate or Retain a Product line

Suppose a company furnishes the following recent operating statement for its three product lines, A, B and C:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$400,000</td>
<td>$360,000</td>
<td>$300,000</td>
<td>$1,060,000</td>
</tr>
<tr>
<td>Variable expenses</td>
<td>280,000</td>
<td>216,000</td>
<td>240,000</td>
<td>736,000</td>
</tr>
<tr>
<td>Fixed expenses:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary of product line supervisor</td>
<td>30,000</td>
<td>32,000</td>
<td>40,000</td>
<td>102,000</td>
</tr>
<tr>
<td>Marketing cost allocated to product line on basis of sales Administratives costs allocated equally</td>
<td>8,000</td>
<td>7,200</td>
<td>6,000</td>
<td>21,200</td>
</tr>
<tr>
<td>Total expenses</td>
<td>340,000</td>
<td>277,200</td>
<td>308,000</td>
<td>925,200</td>
</tr>
<tr>
<td>Operating income</td>
<td>$60,000</td>
<td>$82,000</td>
<td>$(8,000)</td>
<td>$134,800</td>
</tr>
</tbody>
</table>

Management is considering discontinuing Product C operations. The company can sell assets used in Product C operations at book value. They would lay off the Product C supervisor with no termination pay.

a) Assuming no other changes are expected, should the company drop Product C?
Chapter 12 Relevant Costs for Decision Making

Analysis: Product C has a positive contribution to indirect costs of $20,000 ($300,000 – $240,000 – $40,000) and therefore should not be eliminated. Overall income will decrease by $20,000 if the company will drop Product C.

b) Assuming that in addition to the data given, the following changes are expected:

1. Sales of Product A and Product B increase by 10% and 15% respectively.
2. Marketing costs will remain unchanged.
3. Salaries of Product A and B’s product line supervisors would increase by 8% and 10% respectively due to the increased sales.
4. No increase in total assets is required.

Should the company drop Product C?

Analysis: The following schedule shows the projected operating statement assuming the company discontinued Product C operations.

<table>
<thead>
<tr>
<th>Product Lines</th>
<th>A</th>
<th>B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$440,000</td>
<td>$414,000</td>
<td>$854,000</td>
</tr>
<tr>
<td>Variable expenses</td>
<td>308,000</td>
<td>248,400</td>
<td>556,400</td>
</tr>
<tr>
<td>Fixed expenses:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries of product line supervisors</td>
<td>32,400</td>
<td>35,200</td>
<td>67,600</td>
</tr>
<tr>
<td>Marketing costs</td>
<td>10,923</td>
<td>10,277</td>
<td>21,200</td>
</tr>
<tr>
<td>Administrative costs</td>
<td>33,000</td>
<td>33,000</td>
<td>66,000</td>
</tr>
<tr>
<td>Total</td>
<td>384,323</td>
<td>326,877</td>
<td>711,200</td>
</tr>
<tr>
<td>Operating income (loss) before taxes</td>
<td>$55,677</td>
<td>$87,123</td>
<td>$142,800</td>
</tr>
</tbody>
</table>

Based on the computations, the company may decide to drop Product C.

As shown above, overall net income will be $142,800. This is slightly higher than the present overall income of $134,800 with no increase in total assets required. However, management should consider other factors, such as the future sales of product C and whether the increased sales of Product A and B will continue or would occur without eliminating Product C operations.
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Sell Now or Process Further

In some industries, a number of end products are produced from a single or common raw material input. For example, in the meat-packing industry, a variety of end products – ham, bacon, spare ribs, pork roasts, and so on are produced from a common input are referred to as joint products. Firms that produce from a common input are referred to as joint products. Firms that produce several end products from a common input are faced with the problem of deciding how the joint product cost of that input is going to be divided among the joint products. Joint product costs are producing the joint products up to the split-off point. The split-off point is that point in the manufacturing process at which the joint product can be recognized as separate products.

Joint product costs are irrelevant in decisions regarding what to do with a product from the split-off point forward because they have already been incurred and therefore are sunk costs.

Costs incurred after the split-off point for the benefit of only one particular product are called separable costs. They are relevant costs in the sell-or-process-further decision.

In sell-or-process-further decision, it will always be profitable to continue processing a joint product after the split-off so long as the incremental revenue from such processing exceeds the processing costs.

Illustrative Problem 12.5. Sell Now or Process Further

Assume that three products are derived from a single raw material input. Cost and revenue data relating to the products are presented before (along with an analysis of which products should be sold at the split-off point and which should be processed further.)

<table>
<thead>
<tr>
<th></th>
<th>Product</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Sales value at the split-off point</td>
<td>$60,000</td>
<td>$75,000</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>Sales value after further processing</td>
<td>80,000</td>
<td>120,000</td>
<td>45,000</td>
<td></td>
</tr>
<tr>
<td>Allocated joint product costs</td>
<td>40,000</td>
<td>50,000</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>Cost of further processing</td>
<td>25,000</td>
<td>30,000</td>
<td>5,000</td>
<td></td>
</tr>
</tbody>
</table>
Which of the product lines should be processed further and which should be sold at the split-off point?

**Analysis:** The following evaluation should be made using the relevant data:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental revenue from further processing*</td>
<td>$20,000</td>
<td>$45,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Incremental cost of further processing</td>
<td>25,000</td>
<td>30,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Profit (loss) from further processing</td>
<td>$(5,000)</td>
<td>$15,000</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

* Sales value after further processing minus Sales value at the split-off point

As shown in the above schedule, Products B and C should be processed further; Product A should be sold at the split-off point.

**Special Sales Pricing**

Managers of ten must evaluate whether a *special order* should be accepted, or if the order is accepted, the price that should be charged. A *special* order is a one time order that is not considered part of the company’s ongoing business. Managers may be asked to consider accepting a special order for their product at a reduced price to make use of the *excess*, or *idle* facilities. Such orders are worth considering, provided they will not affect regular sales of the same product.

**Illustrative Problem 12.6. Accept or Reject a Special Order**

Vina Enterprises, Inc. has an annual plant capacity to produce 2,500 units. Its predicted operations for the year are:

- **Sales revenue (2,000 units at $40 each)**: $80,000
- **Manufacturing costs:**
  - Variable: $24, per unit
  - Fixed: $17,000
- **Selling and administrative costs:**
  - Variable (commissions on sales): $2.50 per unit
  - Fixed: $2,500
Chapter 12 Relevant Costs for Decision Making

REQUIRED:
Should the company accept a special order for 400 units at a selling price of $32 each, which is subject to half the usual commission rate per unit? Assume no effect on regular sales at regular prices.

Analysis:
The special order should be accepted as shown by the following two alternative analysis:

**Differential Approach:**
- Incremental revenue from special order (400 x $32) $12,800
- Less: Incremental costs
  - Manufacturing (400 x $24) 9,600
  - Sales commission (400 x $1.25) 500
- Total $10,100
- Incremental profit $2,700

**Total Project Approach:**

<table>
<thead>
<tr>
<th></th>
<th>Status Quo</th>
<th>Alternative</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$80,000</td>
<td>$92,800</td>
<td>$12,800</td>
</tr>
<tr>
<td>Less: Variable Costs</td>
<td>53,000</td>
<td>63,100</td>
<td>10,100</td>
</tr>
<tr>
<td>Contribution Margin</td>
<td>$27,000</td>
<td>$29,700</td>
<td>$2,700</td>
</tr>
<tr>
<td>Less: Fixed costs</td>
<td>19,500</td>
<td>19,500</td>
<td>-</td>
</tr>
<tr>
<td>Operating profit</td>
<td>$7,500</td>
<td>$10,200</td>
<td>$2,700</td>
</tr>
</tbody>
</table>

The company may accept the special order because operating profit will increase by $2,700.

**Utilization of Scarce Resources**

Choosing which products to manufacture and sell is a common managerial decision. Managers are routinely faced with the problem of deciding how scarce resources are going to be utilized. For example, a department store has a limited amount of floor space and therefore cannot stock every product that may be available. A small CPS firm, due to a shortage of personnel may have to choose between performing work for client A or for client B. A manufacturing firm has a limited number of machine hours and a limited number of direct labor-hours at its disposal.

When capacity becomes pressed because of a scarce resource, the firm is said to have a *constraint*. Because of the constrained scarce resource,
the company cannot fully satisfy demand, so the manager must decide how the scarce resource should be used. Fixed costs are usually unaffected by such choices, so the manager should select the course of action that will maximize the firm’s *total* contribution margin. This is based on the assumption that the product choices as short-run decisions because we have adopted the definition that in the short run, capacity is fixed, while in the long-run, capacity can be changed.

**Contribution in Relation to Scarce Resources**

To maximize total contribution margin, a firm should not necessarily promoter those products that have the highest contribution margins per unit. With a single constrained resource, the important measure of profitability is the *contribution margin per unit of scarce resource uses*.

**Illustrative Problem 12.7 Production Decision**

Aeon Company makes two kinds of bread – hard rolls and soft rolls. Assume that the company can sell all the company can sell all the bread it produces. Aeon’s cost and revenue information is presented below:

<table>
<thead>
<tr>
<th></th>
<th><strong>Hard rolls</strong></th>
<th><strong>Soft rolls</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue per unit</td>
<td>$10.00</td>
<td>$9.00</td>
</tr>
<tr>
<td>Less variable costs per unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>4.00</td>
<td>2.50</td>
</tr>
<tr>
<td>Labor</td>
<td>1.50</td>
<td>2.00</td>
</tr>
<tr>
<td>Variable overhead</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6.00</strong></td>
<td><strong>5.00</strong></td>
</tr>
<tr>
<td>Contribution margin per unit</td>
<td><strong>$4.00</strong></td>
<td><strong>$4.00</strong></td>
</tr>
</tbody>
</table>

Fixed manufacturing costs $800,000 per month
Marketing and administrative costs (all fixed) $200,000 per month

In this case, the contribution margin of each product is the same, and assuming that the production time per unit is uniform, the profit-volume relationship is the same regardless of the mix of products produced and sold. For instance, Aeon can sell 25,000 hard rolls or 25,000 soft rolls or any combination of the two products totaling 25,000 to break-even per month.

Suppose that Aeon’s capacity is limited to 720 machine hours per month and the machines may be used to produce either 300 hard rolls per
Chapter 12 Relevant Costs for Decision Making

machine-hour or 500 soft rolls per machine-hour. Which product should Aeon produce to maximize its profit?

This problem could be analyzed as follows:
1) Determine the contribution margin per machine-hour of each product
2) Rank the product lines according to contribution margin per machine hour.
3) Consider market limitations if any.
4) Compute the units to be produced based on the profitability ranking made.

Solution:

1. Contribution margin per machine hour:

   Hard rolls : $1,200 ($4.00 x 300 units)
   Soft rolls  : $2,000 ($4.00 x 500 units)

2. Ranking:
   1. Soft rolls
   2. Hard rolls

3 & 4. Since there is no market limitation, the company should produce 360,000 soft rolls (720 hours x 500 units) and generate $1,440,000 contribution margin (360,000 x $4) and $440,000 operating profit ($1,440,000 - $1,000,000 fixed costs).

If only hard rolls are produced, Aeon would generate $864,000 (216,000 x $4) contribution margin and incur $136,000 loss ($864,000 - $1,000,000 fixed cost).

The Problem of Multiple Constraints

If a firm is operating under several scarce resource constraints, what should it do? Constraints may refer to limited availability of raw materials, limited direct labor-hours available, limited capital available for investments and many more. As more constraints and products are added, solving product mixes becomes more complex. Although it is
possible to solve these problems by hand, they are typically solved by computer. The optimal proper combination of product “mix” can be found by use of a quantitative method known as linear programming.

Shut down or Continue operations

Illustrative Problem 12.8 Shut down or continue operations

The ABC Company, now operating below 50% of its practical capacity expects that the volume of sales will drop below the level of 5,000 units per month. An operating statement prepared for the monthly sales of 5,000 units shows the following.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (5,000 units at $3)</td>
<td>$15,000</td>
</tr>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Variable costs (5,000 units at $2)</td>
<td>$10,000</td>
</tr>
<tr>
<td>Non-variable costs</td>
<td>5,000</td>
</tr>
<tr>
<td>Net Income</td>
<td>0</td>
</tr>
</tbody>
</table>

Management is concerned with the fact that a further drop in sales volume will create a loss. This concern has been intensified by the sales manager’s opinion that the selling price of the company’s product will soon have to be adjusted to meet the increasing pressure of competition. Since all costs, as the president puts it, have been cut to the bones, management has under consideration a recommendation that operations be suspended until favorable conditions can be attained and a better selling price can be set.

Before making their final decision, the company executives must recognize that not all of the non-variable costs will be eliminated by a temporary closing of the plant. Key personnel cannot be discharged lest they seek employment elsewhere; a skeleton staff must be maintained; maintenance costs of building and equipment will continued, taxes and insurance premiums must be paid during the shut-down period. As a first step, an estimate of the shutdown costs must be made.

Assume that a conservative estimate of costs if plant operations are suspended indicates a shut-down cost of $2,000 per month. Since there is no immediate possibility of profit under present conditions, the problem of the company is the possibility of minimizing the loss.
REQUIRED:
Determine if the company should shut down temporarily or continue operations.

Analysis:

The decision to continue operations or shut down will depend upon the expected sales of the company in comparison with the shutdown point of 3,000 units computed as follows:

\[
\text{Shut down point} = \frac{\text{Fixed costs if operations are continued} - \text{Shutdown cost}}{\text{Contribution margin per unit}}
\]

\[
= \frac{($5,000 - $2,000)}{\$1} = 3,000 \text{ units}
\]

If the expected demand exceeds 3,000 units but below 5,000 units (break-even volume) operating loss will be lesser than shutdown loss and therefore the company can continue operations. If expected demand is less than 3,000 units, the company should discontinue operations on a temporary basis until favorable conditions prevail.

Pricing Products and Services

Some businesses have no pricing problems at all. They may be making a product for which a market price already exists. Under these circumstances, no price calculations are necessary because every firm charges whatever is the prevailing market price. This usually is true for basic raw materials such as farm products, minerals, etc.

In many situations however, the firm is faced with the problem of selling its own prices. The pricing decision can be critical because

1. the prices charged for a firm's products largely determine the quantities customers are willing to purchase and
2. the prices should be high enough to cover all the costs of the firm.
Chapter 12 Relevant Costs for Decision Making

Cost-Plus Pricing

The most basic approach in pricing decision is that the price of the product or service should cover all the costs that are traceable to the product and service, variable as well as fixed. If revenues are not sufficient to cover these traceable costs, then the firm would be better off without the product or service. In addition to the traceable costs, all products and services must assist in covering the common costs of the organization. These common costs may include general factory, selling and administrative costs. And of course, the selling price should not only cover all the costs of the organization but also provide a return on invested capital.

In practice, the most common approach to pricing of products is to use some type of cost-plus pricing formula. The formula is expressed as follows:

\[ \text{Target selling price} = [\text{Cost} + (\text{Markup percentage} \times \text{Cost})] \]

Products however, may be costed in at in least two different ways:

1. By the *absorption approach* where the cost based is defined as the cost to manufacture one unit and therefore excludes all selling general and administrative expenses.

2. By the *absorption approach* where the cost based consists of all the variable costs associated with a product including variable selling, general and administrative expenses. (SGA).

In both approaches, expenses not included in the cost base are provided for through the markup which should be high enough to provide the company also with a satisfactory profit margin.

**Illustrative Problem 12.9 Pricing Decision**

Assume that Knox Company is in the process of setting a selling price on a product that has just undergone some modifications in design. The following cost estimates for the redesigned product have been provided by the Accounting Department:
Chapter 12 Relevant Costs for Decision Making

<table>
<thead>
<tr>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
</tr>
<tr>
<td>Direct labor</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
</tr>
<tr>
<td>Variable selling, general and adm expenses</td>
</tr>
<tr>
<td>Fixed selling, general and adm expenses</td>
</tr>
</tbody>
</table>

The costs above are based on an anticipated volume of 10,000 units produced and sold each period. The company uses cost-plus pricing, and it has the policy of obtaining target selling prices by adding a markup of 50% of unit manufacturing cost or by adding a markup of 100% of variable costs.

Assuming that the company uses absorption costing approach to cost-plus pricing, how much will target selling price for one unit of product be?

The selling price per unit using the absorption cost to cost-plus pricing is computed as follows:

| Direct materials                     | $12 |
| Direct labor                         | 8   |
| Variable manufacturing overhead      | 6   |
| Fixed manufacturing overhead (based on 10,000 units) | 14 |
| Unit manufacturing cost              | $40 |
| Markup to cover selling, general and administrative expenses and desired profit 50% of unit manufacturing cost | 20 |
| Target selling price                 | $60 |

Assuming that the company uses the contribution approach to cost-plus pricing, what will be the unit selling price of the product?

Under this approach, the unit selling price will be as follows:

| Direct materials                     | $12 |
| Direct labor                         | 8   |
| Variable manufacturing overhead      | 6   |
| Variable selling and administrative expense | 4 |
| Unit variable costs                  | $30 |
| Markup to cover fixed cost and desired profit 100% of variable cost | 30 |
| Target selling price                 | $60 |
The contribution margin approach is essentially the approach recommended by economists who advocate "set marginal revenue equal to marginal cost"

**Determining the markup percentage**

To facilitate the computation of selling price, formulas can be used to determine the appropriate markup percentage assuming that the desired Return on investment (ROI) and unit sales volume are given:

Under the absorption approach to cost-plus pricing:

\[
\text{Markup percentage on absorption cost} = \frac{\text{Desired return on assets employed}}{\text{Volume in units}} \times \frac{\text{Selling and Adm. expense}}{\text{Unit manufacturing costs}}
\]

Under the contribution approach to cost-plus pricing:

\[
\text{Markup percentage on absorption cost} = \frac{\text{Desired return on assets employed}}{\text{Volume in units}} \times \frac{\text{Fixed costs}}{\text{Unit variable costs}}
\]

**Target costing**

This pricing approach is used when company will already know what price should be charged and the problem will be to *produce* the product that can be marketed profitably. **Target costing** is the process of determining the maximum allowable cost for a new product and then developing a sample that can be profitably manufactured and distributed for that maximum target cost figure. The target cost is computed as follows:

\[
\text{Target cost} = \text{Anticipated selling price} - \text{Desired profit}
\]

**Illustrative Problem 12.10 Target Costing**

Karate Auto Supply, Inc., is a producer and distributor of auto supplies. The company desires to enter a rapidly growing market for long-life batteries that is based on a newly discontinued technology. Management
believes that to be fully competitive, the new battery that the company is planning can not be priced at more than $1,300. At this price, management is confident that the company can sell 12,500 batteries per year. The batteries would require permanent in vestment of $5,000,000 and the desired ROI is 20%. Compute the target cost of one battery.

The target cost per unit is computed as follows:

\[
\text{Target cost} = \text{Anticipated selling price} - \text{Desired profit} \\
= \$1,300 - \$80 \\
= \$1,220
\]

The income statement will appear as follows:

\[
\begin{align*}
\text{Sales} & \quad (12,500 \times \$1,300) & \quad \$16,250,000 \\
\text{Less: Cost and expenses} & \quad (12,500 \times \$1,220) & \quad 15,250,000 \\
\text{Net income} & & \$1,000,000 \\
\text{Desired net income} & \quad ($5,000,000 \times 20\%) & \quad \$1,000,000
\end{align*}
\]
SHORT QUESTIONS

1. Define the following term: sunk cost, relevant information, and differential cost. Are there any relationship among them?
2. Management is often faced with the alternative of continuing to make a product or component internally, or going to an external source and purchasing the product or component. In gathering relevant information for these two alternatives, briefly identify the quantitative factors that should be considered. Are there any qualitative factors that should also be considered?
3. Define the term "opportunity cost." How may this cost be relevant in a make-or-buy decision?
4. What is avoidable and unavoidable cost? How they are used in decision making?
5. Define the term “Special order”. Should a special order be accepted if the acceptance of the order will affect the market of the company?

EXERCISES

Problem 1:
Roland Company operates a small factory in which it manufactures two products: A and B. Production and sales result for last year were as follow:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units sold</td>
<td>8,000</td>
<td>16,000</td>
</tr>
<tr>
<td>Selling price per unit</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>Variable costs per unit</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Fixed costs per unit</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

For purposes of simplicity, the firm allocates total fixed costs over the total number of units of A and B produced and sold.

The research department has developed a new product (C) as a replacement for product B. Market studies show that Roland Company could sell 11,000 units of C next year at a price of $80, the variable costs per unit of C are $39. The introduction of product C will lead to a 10% increase in demand for product A and discontinuation of product B. If the company does not introduce the new product, it expects next year's result to be the same as last year's.
Chapter 12 Relevant Costs for Decision Making

Required
Should Roland Company introduce product C next year? Explain why or why not. Show calculations to support your decision.

Problem 2
Felter Company produced and sold 50,000 units of product and is operating at 70% of plant capacity. Unit information about its product is as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales price</td>
<td>$70</td>
</tr>
<tr>
<td>Variable manufacturing cost</td>
<td>$45</td>
</tr>
<tr>
<td>Fixed manufacturing cost ($500,000 + 50,000)</td>
<td>10 55</td>
</tr>
<tr>
<td>Profit per unit</td>
<td>$15</td>
</tr>
</tbody>
</table>

The company received a proposal from a foreign company to buy 10,000 units of Felter Company's product for $50 per unit. This is a one-time only order and acceptance of this proposal will not affect the company's regular sales. The president of Felter Company is reluctant to accept the proposal because he is concerned that the company will lose money on the special order.

Required
Prepare a schedule reflecting an incremental analysis of this proposal and indicate the effect the acceptance of this order might have on the company's income.

Problem 3
Carney Company manufactures cappuccino makers. For the first eight months of 20x1, the company reported the following operating results while operating at 80% of plant capacity:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (500,000 units)</td>
<td>$90,000,000</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>54,000,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>36,000,000</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>24,000,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$12,000,000</td>
</tr>
</tbody>
</table>

An analysis of costs and expenses reveals that variable cost of goods sold is $95 per unit and variable operating expenses are $35 per unit.
Chapter 12 Relevant Costs for Decision Making

In September, Carney Company receives a special order for 40,000 machines at $135 each from a major coffee shop franchise. Acceptance of the order would result in $10,000 of shipping costs but no increase in fixed expenses.

**Required**
1. Prepare an incremental analysis for the special order.
2. Should Carney Company accept the special order? Justify your answer.

**Problem 4**
Gregg Company supplies schools with floor mattresses to use in physical education classes. Gregg has received a special order from a large school district to buy 600 mats at $45 each. Acceptance of the special order will not affect fixed costs but will result in $1,200 of shipping costs.

For the first 6 months of 20x1, the company reported the following operating results while operating at 80% capacity:

- Sales (100,000 units) $7,000,000
- Cost of goods sold 4,200,000
- Gross profit 2,800,000
- Operating expenses 2,000,000
- Net income $ 800,000

Cost of goods sold was 75% variable and 25% fixed; operating expenses were 70% variable and 30% fixed.

**Required**
1. Prepare an incremental analysis for the special order.
2. Should Gregg Company accept the special order? Justify your answer.

**Problem 5**
Coyle Company manufactured 6,000 units of a component part that is used in its product and incurred the following costs:
Chapter 12 Relevant Costs for Decision Making

<table>
<thead>
<tr>
<th>Cost</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct materials</td>
<td>$35,000</td>
</tr>
<tr>
<td>Direct labor</td>
<td>15,000</td>
</tr>
<tr>
<td>Variable manufacturing overhead</td>
<td>10,000</td>
</tr>
<tr>
<td>Fixed manufacturing overhead</td>
<td>20,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$80,000</strong></td>
</tr>
</tbody>
</table>

Another company has offered to sell the same component part to the company for $13 per unit. The fixed manufacturing overhead consists mainly of depreciation on the equipment used to manufacture the part and would not be reduced if the component part was outsourced from the outside firm. If the component part is outsourced from the outside firm, Coyle Company has the opportunity to use the factory equipment to produce another product which is estimated to have a contribution margin of $22,000.

**Required**
Prepare an incremental analysis report for Coyle Company which can serve as informational input into this outsource decision.

**Problem 6**
Kuhn Bicycle Company has been manufacturing its own seats for its bicycles. The company is currently operating at 100% capacity, and variable manufacturing overhead is charged to production at the rate of 60% of direct labor cost. The direct materials and direct labor cost per unit to make the bicycle seats are $8.00 and $9.00, respectively. Normal production is 50,000 bicycles per year.

A supplier offers to make the bicycle seats at a price of $21 each. If the bicycle company accepts this offer, all variable manufacturing costs will be eliminated, but the $30,000 of fixed manufacturing overhead currently being charged to the bicycle seats will have to be absorbed by other products.

**Required**
1. Prepare the incremental analysis for the decision to make or buy the bicycle seats.
2. Should Kuhn Bicycle Company buy the seats from the outside supplier? Justify your answer.
Problem 7
A company manufactures three products using the same production process. The costs incurred up to the split-off point are $200,000. These costs are allocated to the products on the basis of their sales value at the split-off point. The number of units produced, the selling prices per unit of the three products at the split-off point and after further processing, and the additional processing costs are as follow:

<table>
<thead>
<tr>
<th>Product</th>
<th>Number of Units Produced</th>
<th>Selling Price at Split-off</th>
<th>Selling Price after Processing</th>
<th>Additional Processing Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>5,000</td>
<td>$10.00</td>
<td>$15.00</td>
<td>$14,000</td>
</tr>
<tr>
<td>Y</td>
<td>10,000</td>
<td>11.60</td>
<td>16.20</td>
<td>21,000</td>
</tr>
<tr>
<td>Z</td>
<td>4,000</td>
<td>19.40</td>
<td>21.60</td>
<td>12,000</td>
</tr>
</tbody>
</table>

Required
1. Which product(s) should be processed further and which should be sold at the split-off point?
2. Would your decision be different if the company was using the quantity of output to allocate joint costs? Explain.

Problem 8
Spencer Chemical Corporation produces an oil-based chemical product which it sells to paint manufacturers. In 2013, the company incurred $344,000 of costs to produce 40,000 gallons of the chemical. The selling price of the chemical is $12.00 per gallon. The costs per unit to manufacture a gallon of the chemical are presented below:

- Direct materials: $6.00
- Direct labor: $1.20
- Variable manufacturing overhead: $.80
- Fixed manufacturing overhead: $.60
- Total manufacturing costs: $8.60

The company is considering manufacturing the paint itself. If the company processes the chemical further and manufactures the paint itself, the following additional costs per gallon will be incurred: Direct materials $1.70, Direct labor $.60, Variable manufacturing overhead $.50. No increase in fixed manufacturing overhead is expected. The company can sell the paint at $15.50 per gallon.
Chapter 12 Relevant Costs for Decision Making

**Required**
Determine the incremental per gallon increase in net income and the total increase in net income if the company manufactures the paint.

**Problem 9**
Harris Timber Corporation uses a machine that removes the bark from cut timber. The machine is unreliable and results in a significant amount of downtime and excessive labor costs. The management is considering replacing the machine with a more efficient one which will minimize downtime and excessive labor costs. Data are presented below for the two machines:

<table>
<thead>
<tr>
<th></th>
<th>Old Machine</th>
<th>New Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original purchase cost</td>
<td>$340,000</td>
<td>$370,000</td>
</tr>
<tr>
<td>Accumulated depreciation</td>
<td>230,000</td>
<td>—</td>
</tr>
<tr>
<td>Estimated life</td>
<td>5 years</td>
<td>5 years</td>
</tr>
</tbody>
</table>

It is estimated that the new machine will produce annual cost savings of $85,000. The old machine can be sold to a scrap dealer for $8,000. Both machines will have a salvage value of zero if operated for the remainder of their useful lives.

**Required**
Determine whether the company should purchase the new machine. Support your answer with the computation.

**Problem 10**
Milwaukee, Inc. has three divisions: Bud, Wise, and Er. The results of May, 20x1 are presented below.

<table>
<thead>
<tr>
<th></th>
<th>Bud</th>
<th>Wise</th>
<th>Er</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units sold</td>
<td>3,000</td>
<td>5,000</td>
<td>2,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Revenue</td>
<td>$70,000</td>
<td>$50,000</td>
<td>$40,000</td>
<td>$160,000</td>
</tr>
<tr>
<td>Less variable costs</td>
<td>32,000</td>
<td>26,000</td>
<td>16,000</td>
<td>74,000</td>
</tr>
<tr>
<td>Less direct fixed costs</td>
<td>14,000</td>
<td>19,000</td>
<td>12,000</td>
<td>45,000</td>
</tr>
<tr>
<td>Less allocated fixed costs</td>
<td>6,000</td>
<td>10,000</td>
<td>4,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$18,000</td>
<td>$(5,000)</td>
<td>$8,000</td>
<td>$21,000</td>
</tr>
</tbody>
</table>

All of the allocated costs will continue even if a division is discontinued. Milwaukee allocates indirect fixed costs based on the number of units to be sold. Since the Wise division has a net loss, Milwaukee feels that it
Chapter 12 Relevant Costs for Decision Making

should be discontinued. Milwaukee feels if the division is closed, that sales at the Bud division will increase by 12%, and that sales at the Er division will stay the same.

Required
1. Prepare an analysis showing the effect of discontinuing the Wise division.
2. Should Milwaukee close the Wise division? Briefly indicate why or why not.
CHAPTER 13
CAPITAL BUDGETING DECISIONS

After studying this chapter, you should be able to:

1. Define capital budgeting.
2. State the characteristics of a capital investment decision.
3. Describe the categories of capital investment.
4. State and explain the elements of capital budgeting.
5. Compute initial investment, annual net cast returns/savings of an investment proposal.
6. Discuss the process of capital budgeting.
7. Enumerate and explain the categories of project cash flow.
8. Apply the techniques in evaluating capital investment projects such as payback period, accounting rate of return and discounted cash flow analysis (net present value, internal rate of return, profitability index).
9. Explain the process of ranking investment projects.
10. Explain the effect of inflation in capital investment analysis.
CHAPTER 13
CAPITAL BUDGETING DECISIONS

Implementing long-range plans usually requires capital expenditures. Plans for expansion may call for new production facilities or new products. Since all firms have limited capital, a manager must often choose between several competing investments and his skill in selecting investments ultimately determines how well an organization performs over the long run.

Capital Budgeting Defined

Capital budgeting is the process of deciding whether or not to commit resources to projects whose costs and benefits are spread over several time periods. It involves:

1) the preparation of annual budget for capital investment
2) the assessment of funding capacities and
3) the allocation of resources to renewal and projects which most clearly conform with the company's priorities.

Capital budgeting is used to describe actions relating to the planning and financing capital outlays for such purposes as the purchase of new machinery, the modernization of plant facilities or the introduction of new product lines. Capital budgeting is an investment concept, since it involves a commitment of funds now in order to receive some desired return in the future in the form of additional cash inflows or reduced cash outflows.

Characteristics of a Capital Investment Decision

Capital expenditures are long-term commitments of resources to realize future benefits and budgeting for them is one of the most important areas of managerial decision. They deserve penetrating analysis and attention of top management because of the following reasons:

1) Substantial amount of funds are required in capital projects.
2) Because of the length of time spanned by a capital investment decision, the element of uncertainty becomes more critical.
3) The effect of managerial errors will be difficult to reverse.
4) Plans must be made well into an uncertain future.
5) Success or failure of the company may depend upon a single
or relatively few investment decisions.

One of the most difficult steps involved in the decision-making process
relates to the identification of cost relevant to the problem. Because the
alternatives lie in the future, the only costs which are relevant are future
costs. Historical costs arising from past decisions are sunk costs and so
cannot affect future alternatives. Such considerations as monetary
advantage of an alternative, its effect on employee relations, company
image and relations with other companies are usually evaluated in
choosing from among the alternatives.

Categories of Capital Investments

The two general types of capital investment decisions are:

A. Independent capital investment projects or Screening
decisions

1. These are projects which are evaluated individually and
reviewed against predetermined corporate standards of
acceptability resulting in an "accept" or "reject" decision.
Examples are:
2. Investment in long-term assets such as property, plant and
equipment.
3. New product development.
4. Undertaking a large scale advertising campaign.
5. Introduction of a computer.
6. Corporate acquisitions (such as purchase of shares in
subsidiaries or affiliate).

B. Mutually exclusive capital investment projects or Preference
decisions

1. These are projects which are require the company to
choose from among specific alternatives. The project to
be acceptable must pass the criteria acceptability set by
the company and be better than the other investment
alternatives. Examples are:
2. Replacement against renovation of equipment or facilities.
3. Net Initial Investment of Project Cost
4. Rent or lease against ownership of facilities.
5. Manual bookkeeping system against computerized system.
6. Preventive maintenance against periodic overhaul of machineries.
7. Purchase of machinery form an outside supplier against assembly of the company's own staff.

Elements of Capital Budgeting

The elements or factors to be considered in evaluating capital investment proposals are:

1. The net amount of the investment.
2. The operating cash flows or returns from the investment.
3. The minimum acceptable rate of return on the investment.

Net Initial Investment or Project Cost

In some cases, net investment represents the initial cash outlay that is required to obtain future returns or the net cash outflow to support a capital investment project. This may be computed as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>$ xx</td>
</tr>
<tr>
<td>Add: Additional cash outlay related to the assets</td>
<td>$xx</td>
</tr>
<tr>
<td>Additional working capital</td>
<td>xx</td>
</tr>
<tr>
<td>Total</td>
<td>xx</td>
</tr>
<tr>
<td>Less: Cash inflow arising from sales of</td>
<td>$xx</td>
</tr>
<tr>
<td>old assets being replaced</td>
<td>xx</td>
</tr>
<tr>
<td>Avoidable costs</td>
<td>xx</td>
</tr>
<tr>
<td>Net investment</td>
<td>$xx</td>
</tr>
</tbody>
</table>

In certain cases, the net investment is the sacrifice of an inflow of cash, that is, the opportunity cost that arises when a benefit is rejected. An example is when a company has in its possession fixed assets no longer used in operation and is awaiting disposal through sale. If it should happen that these assets can be put to good use on a proposed capital project rather than be disposed of, then the estimated project cost or investment should include the net amount to be realized from the sale of the assets.
Illustrative Problem 13.1 Determination of Net Initial Investment

The management of Maingat Company plans to replace a sorting machine that was acquired several years ago at a cost of $60,000. The machine has been depreciated to its residual value of $10,000.

A new sorter can be purchased for $96,000. The dealer will grant a trade-in allowance of $16,000 on the old machine. If a new machine is not purchased, Maingat Company will spend $10,000 to repair the old machine. Gains and losses on trade-in transactions are not subject to income taxes. The cost to repair the old machine can be deducted in computing income taxes. Income taxes are estimated at 40% of the income subject to tax. Additional working capital required is $50,000.

REQUIRED: Compute the net initial investment in this project.

Solution: Maingat Company

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase price of new sorter</td>
<td>$96,000</td>
</tr>
<tr>
<td>Add: Additional cash outlay related to the assets</td>
<td>50,000</td>
</tr>
<tr>
<td>Total</td>
<td>146,000</td>
</tr>
<tr>
<td>Less: Trade in allowance on old sorter</td>
<td>$16,000</td>
</tr>
<tr>
<td>Avoidable repairs costs on old sorter (net of increase in income taxes of $4,000)</td>
<td>6,000</td>
</tr>
<tr>
<td>[Tax rate (Annual cash inflow before taxes – Depreciation)]</td>
<td>$xx</td>
</tr>
<tr>
<td>Annual net cash inflow after taxed</td>
<td>$xx</td>
</tr>
</tbody>
</table>

Net Cash Returns

The cash returns are the inflows of cash expected from a project reduced by the cash cost that can be directly attributed to the project. This is computed as follows:

- Annual incremental revenue from the project: $xx
- Less: Incremental cash operating costs: xx
- Annual cash inflow before taxes: $xx
- Less: Taxes: xx
- [Tax rate (Annual cash inflow before taxes – Depreciation)]: xx
- Annual net cash inflow after taxed: $xx
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or

Annual incremental revenue from the project $\ xx$
Less: Incremental cash operating costs $\ xx$
Annual cash inflow before taxes $\ xx$
Less: Income taxes $\ xx$
Net income after taxes $\ xx$
Add: Incremental depreciation $\ xx$
Annual net cash inflow after taxes $\ xx$

Some projects however are expected to produce an inflow of cash but will yield returns in the form of cash savings. This is determined as follows:

Annual incremental revenue $\ xx$
Less: Incremental cash operating costs $\ xx$
Annual cash inflow before taxes $\ xx$
Less: Taxes $\ xx$

\[
\text{Tax rate} \times (\text{annual cash inflow before taxes - depreciation})
\]
Annual net cash inflow after taxes $\ xx$

OR

Annual incremental revenue from the project $\ xx$
Less: Incremental cash operating costs $\ xx$
Annual cash inflow before taxes $\ xx$
Less: Incremental depreciation $\ xx$
Net income before taxes $\ xx$
Less: Income taxes $\ xx$
Net income after taxes $\ xx$
Add: Incremental depreciation $\ xx$
Annual net cash inflow after taxes $\ xx$

Illustrative Problem 13.2. Determination of Annual Cash Returns

Alalay Company is considering the acquisition of a machine which will cost $120,000. It has an expected useful life of five years at the end of which its scrap value will be $20,000. The company expects to be able to generate annual cash flow before taxes of $40,000. Estimated income tax rate is 30% What is the annual cash flow after taxes on this investment?
Solution: Alalay Company

Annual cashflow before taxes $40,000
Less: Depreciation (($120,000 - $20,000) / 5) 20,000
Net income before taxes 20,000
Less: Income taxes (30%) 6,000
Net income aftertaxes 14,000
Add: Depreciation 20,000
Annual cashflow after taxes $34,000

Illustrative Problem 13.3. Determination of Annual Cash Savings

The Visayan Division of Marlow Supply Company has been considering a new production method that can reduce materials costs by an estimated amount of $52,000 a year. The new method is also expected to result in an annual savings of labor and overhead methods is estimated at $40,000 a year over a period of ten years. Income taxes are estimated at 30% of income before income taxes. What are the annual net returns (or savings) expected from the new production method?

Solution: Marlow Supply Company

Annual savings in direct materials costs $52,000
Annual saving in direct labor and overhead cost 64,000
Total average saving before depreciation 116,000
Less: Depreciation 40,000
Saving after depreciation 76,000
Less: Incremental income taxes (30%) 16,800
Net income after taxes 59,200
Add: Depreciation 40,000
Net cash return (saving) $99,200

Minimum or Lowest Acceptable Rate of Return

The minimum or lowest acceptable rate of return or opportunity cost many equal the average rate of return that the company will earn from alternative investment opportunities or the cost of capital which is the average rate of return that the firm mush pay to attract investment fund. The cost of capital according to source may be computed as follows:
1. Cost of Debt:
   Interest rate \times (1 - \text{Corporate Tax Rate})

2. Cost of Preference Shares:
   \[
   \text{Dividends per share} \quad \frac{\text{Market value per share of preferred stock}}{}
   \]

3. Cost of Ordinary Shares:
   a. Stock price-based
   \[
   \frac{\text{Expected cash dividends per share}}{\text{Current price per share of ordinary shares}} + \text{Dividend growth}
   \]
   b. Book-value based*
   \[
   \frac{\text{Next year's projected earnings per share}}{\text{Current price per share of ordinary shares}}
   \]

4. Cost of Retained Earnings => same cost of ordinary equity
   * This is used when dividend growth rate is not known.

To compute for the overall or weighted average cost of capital, multiply the cost of each type of capital by their respective weights (percentage of each source to the firm's total capital structure) and add up the individual weighted cost of capital.

**Illustrative Problem 13.4 Computation of Weighted Average Cost of Capital**

The following information on Bettina Corporation's capital structure is available from the latest financial statement:

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>6% Bank loan</td>
<td>$300,000</td>
<td>30%</td>
</tr>
<tr>
<td>5% Preferred stock</td>
<td>100,000</td>
<td>10%</td>
</tr>
<tr>
<td>Ordinary shares</td>
<td>200,000</td>
<td>20%</td>
</tr>
<tr>
<td>Retained earnings</td>
<td>400,000</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$1,000,000</td>
<td>100%</td>
</tr>
</tbody>
</table>
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Additional data:
Current market price per share
  Preferred shares $62.50
  Ordinary shares $40
Dividends per share
  Preferred shares $5
  Ordinary shares $2
Dividend growth rate 4%
Corporate taxes rate 32%

COMPUTE:
  a. The individual cost of capital according to source.
  b. The weighted average cost of capital.

Solution: Bettina Corporation

a. Cost of Capital
  1. Bank loan
     = 6% x (1 - 32%) = 4.08%
  2. Preference shares
     = $5 / $62.50 = 8%
  3. Ordinary shares
     = ($2 / $40) + 4% = 9%
  4. Retained Earnings (same as ordinary shares)

b. Weighted Average Cost of Capital:

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
<th>Proportion</th>
<th>Cost</th>
<th>Weighted Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank loan</td>
<td>$ 300,000</td>
<td>30%</td>
<td>4.08%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Preference shares</td>
<td>100,000</td>
<td>10%</td>
<td>8.00%</td>
<td>0.8</td>
</tr>
<tr>
<td>Ordinary shares</td>
<td>200,000</td>
<td>20%</td>
<td>9.00%</td>
<td>1.8</td>
</tr>
<tr>
<td>Retained Earnings</td>
<td>400,000</td>
<td>40%</td>
<td>9.00%</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>$1,000,000</td>
<td>100%</td>
<td>9.00%</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

Answer: 7.4%
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Process of Capital Budgeting
The capital budgeting can be divided into seven significant phases:

1. Finding Investment Opportunities
   Many capital expenditures proposals can be identified during the strategic or long-term planning process. Since the long-term profitability of most companies depends on the nature and quality of their capital investments, these investment opportunities should be carefully analyzed and evaluated.

2. Collect Relevant Information about Opportunities
   To effectively evaluate any investment opportunity, the expected cash flow from the project must be estimated and the total cash outlay necessary to project must be determined. A plan for implementing the opportunity must be developed and other nonfinancial information must be assembled.

3. Select Discount Rate
   Before the cash flow can be evaluated, the discounted (cost of capital) must be established if the discounted cash flow approach is to be applied (These techniques will be discussed later).

   The techniques of capital budgeting are applied to the estimated cash flows developed in the second phase.

5. Decision
   Many factors, quantitative as well as qualitative, should be given consideration before the final decision is made as to the selection of a particular investment. They will include among others, relationship of the company operations and long-term goals, the timing of the cash flows, the availability of funds for investment purposes, the impact on the financial structure of the company, social impact of the opportunity, and legal ramifications.

6. Project Implementation
   Once the decision has been made to invest funds, more detailed plans for making the project operational are developed.
7. Project Evaluation and Appraisal

This last phase involves the assessment of how effective the investment actually is. The evaluation may be in the form of continuous monitoring of the project, so that corrective action can be taken. Regardless of how difficult this may be, it is important that not only the effectiveness of the project be determined, but that the overall decision-making process be appraised for possible improvement.

The stages just described give us only some indication or summary from, of the capital investment process. The way they are implemented depends on the nature of the project, size of the capital outlay and length of time to place the project in operation.

Categories of Project Cash Flows

This section of the Chapter outlines a method of estimating cash flows for investment projects. The major categories of cash flows for a project are as follows:

**Cash Inflows:**

1. Periodic cash inflows from operations, net of taxes
2. Investment tax credit
3. Proceeds from sale of old asset being replaced, net of taxes
4. Avoidable costs, net of taxes
5. Return of some working capital invested in the project*
6. Cash inflow from salvage of the new long-term asset at the end of its useful life. This will be net of tax consequence.*

**Cash Outflows:**

1. Acquisition cost of purchasing and installing assets (e.g., new equipment or machinery)
2. Additional working capital
3. Other cash flows such as severance payments, relocation costs, restoration costs and similar costs.

* The end of a project’s life will usually result in some cash flows. These cash flows are referred to as disinvestment flows.

A brief discussion of the foregoing items follows:

1. Periodic net cash returns or inflows from operations, net of taxes.
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To generate positive periodic operating cash flows is usually the primary reason for acquiring long-term assets. These positive flows may result from such revenue generating activities as new products or they may stem from cost-saving programs.

2. Investment-Tax Credit

The *investment tax credit* allows a credit against a company's income tax liability based on the cost of an acquired asset. If the present income tax laws allow investment tax credit, it would reduce the cost of making investments by giving companies a credit against their corporate income taxes equal to (say) 10% of the cost of assets.

3. Proceeds from sale of old assets being replaced, net of taxes

If old equipment is to be sold, the proceeds from such sale is treated as a reduction from cost of initial investment. If the old asset is sold at a gain, the incremental income tax should be deducted from the proceeds. If the old asset is sold at a loss that is, its book value exceed the selling price, the tax savings will be added to the proceeds.

4. Avoidable costs, net of taxes

In some instances, purchase of new asset may result to the avoidance of incurring expenses to repair the old asset. The avoidable repairs costs, net of incremental tax will be treated as a deduction in computing the cost of initial investment.

5. Return of working capital

When a project ends, there are usually some leftover inventories, cash or other working capital items that were used to support operations. These working capital items are then freed for use elsewhere and treated as a cash inflow.

6. Cash inflow from salvage of the new long-term asset at the end of its useful life

Ending a project will usually require disposal of its assets. In some cases, more money is spent in disassembling the assets and disposing these than is gained from their sale. Any net
outflows from the disposal of a project’s assets become tax deductions in the year of disposal. The net salvage value of an asset is listed as a cash inflow at the time it is expected to be realized. If the net salvage value of the asset is negative, then it is listed as cash outflow also at the time it is expected to be incurred.

7. Acquisition costs of purchasing and installing assets

These acquisition costs represent the primary outflows for most capital investments. They are listed as cash outflows in the years in which they are incurred.

8. Additional working capital

Many projects require fund for working capital needs (for example, to build up inventories, additional cash balance to handle increased level of activities). These cash flows often occur before the project is in operation.

SCREENING CAPITAL INVESTMENT PROPOSALS

Several methods are available for the evaluation of alternative capital investment proposals. One method may be used exclusively or in combination with another. The most commonly used methods of evaluating capital investment projects are:

A. Non-discounted cash flow (unadjusted) approach
   1. Payback period
   2. Accounting rate of return (book value rate of return)
   3. Payback reciprocal

B. Discounted cash flow (time-adjusted) approach
   1. Net present value
   2. Discounted rate of return or internal rate of return
   3. Profitability index
   4. Discounted payback period
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Payback Period

Payback period (also known as payoff and payout period), measures the length of time required to recover the amount of initial investment. It is the time interval between time of the initial outlay and the full recovery of the investment.

When the periodic cash flows are uniform, payback period is computed as follows:

Investment / Annual cash return

When the periodic cash flows are not uniform, payback period is computed by cumulating the estimated annual cash inflows and determining the point in time at which they equal the investment outlay.

Decision Rule:
The desirability of the project is determined by comparing the project’s payback period against the maximum acceptable payback period as predetermind by management. The project with shorter payback period than the maximum will be accepted. In short:

If : PB period ≤ Maximum allowed PB period; Accept
If : PB period > Maximum allowed PB period; Reject

Advantages of Payback period method:

1. It is easy to compute and understand.
2. Generally, the longer the payback period, the higher the risk.
3. It is used to select projects which provide a quick return of invested funds.

Disadvantages of the payback period method:

1. It does not recognize the time value of money.
2. It ignores the impact of cash inflows after the payback period.
3. It does not distinguish between alternatives having different economic lives.
4. The conventional payback computation fails to consider savage value, if any.
5. It does not measure profitability – only the relative liquidity of the investment.
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Illustrative Problem 13.5 Determination of Payback Period

Assume the following cash flows for two alternative investment proposals:

<table>
<thead>
<tr>
<th>Proposal</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Investment in equipment</td>
<td>$150,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>Annual cash returns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years 1 to 3</td>
<td>75,000</td>
<td>75,000</td>
</tr>
<tr>
<td>Years 4 to 5</td>
<td>100,000</td>
<td></td>
</tr>
<tr>
<td>Salvage value of equipment at the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>end of useful life</td>
<td>15,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Economic life</td>
<td>3 yrs</td>
<td>5 yrs</td>
</tr>
</tbody>
</table>

**REQUIRED:** Determine the payback payback period of the two proposals.

**Solution:**

Proposal A:

Payback period = $150,000 / $75,000
= 2 years

Proposal B:

Payback period = 3 years + \[ \frac{\$310,000 - \$225,000(a)}{\$100,000(b)} \times 1 \text{ year} \]
= 3.75 years

(a) cumulative returns for 3 years
(b) cash returns in the 4th year

**Bail-out Period**

In conventional payback computations, investment savage value is usually ignored. An approach which incorporates the salvage value in payback computations is the "Bail-out period". This is reached when the cumulative cash earnings plus the savage value at the end of a particular year equals the original investment.
Illustrative Problem 13.6. Determination of Bail-out period

An investment of $150,000 is expected to produce annual cash earnings of $50,000 for 5 years. Its estimated salvage value is $70,000 during the first year and this is expected to decrease by $15,000 annually.

REQUIRED: What is the bail-out payback period?

Solution:
Bail-out payback period may be determined using the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Cash Return</th>
<th>Salvage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$50,000</td>
<td>$70,000</td>
</tr>
<tr>
<td>2</td>
<td>50,000</td>
<td>55,000</td>
</tr>
<tr>
<td>3</td>
<td>50,000</td>
<td>40,000</td>
</tr>
<tr>
<td>4</td>
<td>50,000</td>
<td>25,000</td>
</tr>
<tr>
<td>5</td>
<td>50,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Bail-out payback period  
= 1 year + [ ($150,000 - $105,000(a) $50,000 (b)) x 1 year ]  
= 1.9 years  
(a) Cash returns during the 1st year  + Salvage value;  
     2nd year  
(b) cash returns during the 2nd year

Accounting (or Simple) Rate of Return

Simple rate of return or Accounting rate of return (ARR) also known as book value rate of return, measure profitability from the conventional accounting standpoint by relating the required investment to the future annual net income. This is computed as follows:

\[ AAR = \frac{\text{Average annual net income}}{\text{Investment}} \]

or, if a cost reduction project is involved, the formula becomes

\[ AAR = \text{Cost savings} - \text{Depreciation on new equipment} \]
Chapter 13 Capital Budgeting Decisions

Decision Rule:

Under the ARR method, choose the project with the highest rate of return. Accept the project if the ARR is greater than the cost of capital. Thus:
If:  ARR ≥ Required rate of return; Accept
If:  ARR <  Required rate of return; Reject

Advantages of using the ARR:

1. It is easily understood by investors acquainted with financial statements.
2. It is used as a rough preliminary screening device of investment proposals.

Disadvantages of using the ARR:

1. It ignores the time value of money by failing to discount the future cash inflows and outflows.
2. It does not consider the timing component of cash inflows.
3. Different averaging techniques may yield inaccurate answers.
4. It utilizes the concepts of capital and income primarily designed for the purposes of financial statements preparation and which may not be relevant to the evaluation of investment proposals.

Illustrative Problem 13.7  Determination of Accounting Rate of Return

Consider the following information about a proposed project:

- Initial investment required: $85,000
- Estimated life: 20 years
- Annual cash inflows: $10,000
- Salvage value of the asset at the end of 20 years: $0
- Straight-line method of depreciation will be used

REQUIRED:
Compute the Accounting rate of return (ARR)

a) based on initial investment
b) based on average investment

Solution:

a) ARR on initial investment
   \[
   = \frac{10,000 - 3,250}{85,000}
   = \frac{6,750}{85,000}
   = 0.08
   = 8.00%
   \]
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b) ARR on average investment

\[
\text{ARR} = \frac{\$10,000 - \$3,250}{(\$65,000 + \$0) / 2} = 20.8\% \\
\]

\[
\text{Average investment} = \frac{\text{Initial investment}}{2} + \frac{\text{Salvage value of the assets at the end of economic life}}{2}
\]

Discontinued Cash Flow Techniques

Under the discounted cash flow decision criterion, also frequently called the present-value approach, cash outlays and cash inflows are both discounted back to the present period using an appropriate discount rate. The variations in the DCF techniques are as follows:

1) Net present value or excess present method.
2) Discount rate of return or internal rate of return.
3) Profitability index.
4) Discounted payback period.

The Table for Present Value of $1 is shown in Appendix and the Table for Present Value of an Annuity of $1 in Arrears is presented in Appendix.

Advantages of the DCF Method:

1. It is more reliable because the time value of money is taken into account.
2. Income over the entire life of the project is considered.
3. It is more objective and life relevant because it focuses on cashflow.

Disadvantages of the DCF Method are:

1. It is not easily understood.
2. It is more complex and difficult to apply.
3. It requires detailed long-term forecasts of incremental cash flow data.
4. It requires pre-determination of the cost of capital or the discount rate to be used.
Net Present Value (NPV)

Net Present Value is the excess of the present value of cash inflows generated by the project over the amount of the initial investment. This is computed as follows:

\[
\text{Present value of cash inflows computed based on minimum desired discount rate} \quad \$ \ xx \\
\text{Less: Present value of investment} \quad xx \\
\text{Net Present Value} \quad \$ \ xx
\]

**Decision Rule:**
Accept the investment proposal if NPV is positive or zero and reject if NPV is negative. If the NPV is positive, it means that the project will earn a return greater than the discount rate also known as the hurdle rate. If the projects do not meet the hurdle rate, they should be rejected because the funds that would be invested in them can earn a higher rate in some other investment. In short:
- If: \( \text{NPV} \geq 0 \); Accept
- If: \( \text{NPV} < 0 \); Reject

**Illustrative Problem 13.8 Net present Value Application, Uniform Cash Inflows**

ABC wants to invest in a machine costing $80,000 with a useful life of six years and no salvage value. The machine will be depreciated using the straight-line method and is expected to produce annual cash inflow from operations, net of income taxes, of $22,000. The present value of an ordinary annuity of $1 for six periods at 10% is 4.355. The present value of $1 for six periods at 10% is 0.564. Assuming that ABC wants a minimum rate of return of 10%, what is the net present value of this proposed investment? Is the proposal acceptable?

**Solution: ABC Company**

\[
\begin{align*}
\text{Present value of annual cash inflows} & \quad \$ \ 95,810 \\
\text{For six periods at 10\% ($22,000 \times 4.355)} & \\
\text{Less: Present value of net investment} & \quad 80,000 \\
\text{Net present value} & \quad \$ \ 15,810
\end{align*}
\]
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Yes. The ABC Company should invest in the new machine because it could earn more than the minimum return that they desire as indicated by the positive net present value in the above schedule.

Illustrative Problem 13.9 Net Present Value Application: Uneven Cash Inflow

Detdet Corp. plans to invest in a four-year project that will cost $75,000. Detdet's cost of capital is 8%. Additional information on the project is as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>$Cash Flow from Operations net of taxes</th>
<th>Present Value of P1 at 8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20,000</td>
<td>0.926</td>
</tr>
<tr>
<td>2</td>
<td>22,000</td>
<td>0.857</td>
</tr>
<tr>
<td>3</td>
<td>24,000</td>
<td>0.794</td>
</tr>
<tr>
<td>4</td>
<td>26,000</td>
<td>0.735</td>
</tr>
</tbody>
</table>

REQUIRED:

Using the net present value method, determine whether the project is acceptable or not.

Solution: **Detdet Corp.**

Present value of cash inflow after taxes at 8%:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
<th>PV factor</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20,000</td>
<td>0.926</td>
<td>$18,520</td>
</tr>
<tr>
<td>2</td>
<td>22,000</td>
<td>0.857</td>
<td>18,854</td>
</tr>
<tr>
<td>3</td>
<td>24,000</td>
<td>0.794</td>
<td>19,056</td>
</tr>
<tr>
<td>4</td>
<td>26,000</td>
<td>0.735</td>
<td>19,110</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$75,540</td>
</tr>
</tbody>
</table>

Less: Present value of net investment:

Excess or net present value:

Conclusion: The project is acceptable because it will yield a return exceeding the minimum desired rate of 8%.

Illustrative Problem 13.10 Application of Net Present Value Method

Under a special licensing arrangement, Santos Company has an opportunity to market a new product for a five-year period. The product
would be purchased from the manufacturer, with Santos Company responsible for all costs of promotion and distribution. The licensing arrangement could be renewed at the end of the five-year period at the option of the manufacturer. After careful study, Santos Company has estimated that the following costs and revenues would be associated with the new product:

Cost of equipment needed $60,000
Working capital needed 100,000
Overhaul of the equipment in four years 5,000
Salvage value of the equipment if five years 10,000
Annual revenues and costs:

Sales revenues 200,000
Cost of goods sold 125,000
Out-of-pocket operating costs (for salaries, advertising, and other direct costs) 35,000

At the end of the five-year period, the working capital would be released for investment elsewhere if the manufacturer decided not to renew the licensing arrangement. Santos Company’s cost of capital is 20%. Would you recommend that the new product be introduced? Ignore income taxes.

Solution: Santos Company

<table>
<thead>
<tr>
<th>Relevant</th>
<th>Year(s)</th>
<th>Amount of Cash Flows</th>
<th>20% Factor</th>
<th>PV of Cash Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase of equipment</td>
<td>Now</td>
<td>$(60,000)</td>
<td>1.000</td>
<td>$(60,000)</td>
</tr>
<tr>
<td>Working capital needed</td>
<td>Now</td>
<td>$(100,000)</td>
<td>1.000</td>
<td>$(100,000)</td>
</tr>
<tr>
<td>Overhaul of equipment</td>
<td>4</td>
<td>$(5,000)</td>
<td>0.482*</td>
<td>$(2,410)</td>
</tr>
<tr>
<td>Annual net cash inflows from</td>
<td>1 – 5</td>
<td>40,000</td>
<td>2.991</td>
<td>119,640</td>
</tr>
<tr>
<td>sales of the product line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salvage value of the</td>
<td></td>
<td>10,000</td>
<td>0.402*</td>
<td>4,020</td>
</tr>
<tr>
<td>Equipment</td>
<td>5</td>
<td>100,000</td>
<td>0.402*</td>
<td>40,200</td>
</tr>
<tr>
<td>Net present value</td>
<td></td>
<td></td>
<td></td>
<td>$1,450</td>
</tr>
</tbody>
</table>

* From Table for the Present Value of P1
From Table for the Present Value of an Annuity of $1 in arrears
Sales revenues $200,000
Less cost of goods sold 125,000
Gross margin 75,000
Less out-of-pocket costs for salaries, advertising, etc 35,000
Annual net cash inflows 40,000
Discounted Rate of Return

Discounted Rate of Return, also known as internal rate of return (IRR) and time adjusted rate of return, is the rate which equates the present value of the future cash inflows with the cost of the investment which produces them. It is also the equivalent maximum rate of interest that could be paid each year for the capital employed over the life of an investment without loss on the project.

Steps in the Computation of the Discounted Rate of Return

A. Cash inflows are evenly received:
   If the cast returns or inflows are evenly received during the life of the project, the computational procedures are as follows:
   1. Compute the Present Value Factor by dividing Net Investment by Annual Cash Returns.
   2. Trace the PV factor in the Table for Present Value of $1 received annually using the life of the project as point of reference.
   3. The column that gives the closest amount to the PV factor is the “Discounted rate of return”.
   4. To get the exact Discounted rate of return, interpolation is applied.

B. Cash inflows are evenly received:
   The steps in computing for the discounted rate of return are:
   1. Compute the Average Annual Cash Returns by dividing the sum of the returns to be received during the life of the project by the total economic life of the project.
   2. Divided Net Investment by the Average Annual Cash Returns to get the Present Value Factor.
   3. Refer to the Table for Present Value of $1 received annually to determine the rate that will give the closest factor to the computed present value factor.
   4. Using the rate obtained in Step No. 3, refer to the Table for Present Value of $1. If the returns are increasing, use a discount rate lower than the rate obtained in Step No. 3, if the returns are decreasing, use a higher rate. Compute the present value of the annual cash returns.
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5. Add the present value of the annual returns and compare with the Net Investment.
6. If the result in Step No. 5 does not give equality of present value of returns and net investment, try at another rate.
7. Interpolate to get the exact discounted rate of return.

Decision Rule:
Accept the proposed investment if DCR or IRR is equal to or greater than minimum desired rate of return of cost of capital. Reject the proposal if IRR is lower than the minimum desired rate of return. In short.
If: \( \text{NPV} \geq \text{Required rate of return} \); Accept
If: \( \text{NPV} < \text{Required rate of return} \); Reject

Illustrative Problem 13.11 Discounted or Internal Rate of Return Computation, Uniform Cash Returns
An investment of $50,000 will yield an average annual cash return of $7,500 a year for a period of 10 years. What is the discounted rate of return?

Solution:
Let \( x \) – PV factor

1. Investment \( = \) Annual Cash Returns (PV factor)
   \[
   50,000 = 7,500 \times x
   \]
   \[
   x = 6.6667
   \]

2. Referring to the Table for Present Value of $1 received annually for 10 years, the column that gives the nearest value to 6.6667 is the column for 8%

3. To get the exact rate of return, interpolate between 8% and 10%
   \[
   \begin{align*}
   8\% &= 6.710 \\
   x\% &= 6.667 & \text{0.043} \\
   10\% &= 6.145 & \text{0.565}
   \end{align*}
   \]
   Exact discounted rate of return = \( 8\% + ((0.043 / 0.565) \times 2\%) \)
   \[
   = 8\% + 0.15\%
   \]

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\[ = 8.15\% \]

Illustrative Problem 13.12 Discounted or Internal Rate of Returns Computation; Uneven Cash Returns

An investment amounting to P100,000 is expected to yield cash returns as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$40,000</td>
</tr>
<tr>
<td>2</td>
<td>50,000</td>
</tr>
<tr>
<td>3</td>
<td>60,000</td>
</tr>
</tbody>
</table>

**REQUIRED**: Compute the discounted rate of return.

**Solution**:

1. Average cash returns

\[ = \frac{150,000}{3} = $50,000 \]

2. PV Factor

\[ = \frac{100,000}{50,000} = 2 \]

3. Referring to the Table for Present Value of $1 received annually period 3, the column that will give the nearest value to 2 is the column for 22%

4. Using the Table for Present Value of $1, column 22%, the cash returns are discounted as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount of Cash Returns</th>
<th>PV Factor</th>
<th>PV of Cash Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$40,000</td>
<td>0.820</td>
<td>$32,800</td>
</tr>
<tr>
<td>2</td>
<td>50,000</td>
<td>0.672</td>
<td>33,600</td>
</tr>
<tr>
<td>3</td>
<td>60,000</td>
<td>0.551</td>
<td>33,060</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$99,460</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Trial at 22%</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$40,000</td>
<td>0.833</td>
<td>$33,320</td>
</tr>
<tr>
<td>2</td>
<td>50,000</td>
<td>0.694</td>
<td>34,700</td>
</tr>
<tr>
<td>3</td>
<td>60,000</td>
<td>0.579</td>
<td>34,740</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$102,760</td>
</tr>
</tbody>
</table>

Discounted rate of return is 22%. If the exact discount rate of return is required, interpolation may be necessary. Computation will be:

\[
\frac{22\%}{99,460} = \frac{540}{3,300} \times \frac{99,460}{100,000} = 0.30\%
\]

Discounted rate of return = 22% - ((540 / 3,300) x 2%) = 22% - 0.30% = 21.70%

**Payback Reciprocal**

Payback reciprocal is the rate of recovery of investment during the payback period. When the project is at least twice the payback period and the annual cash flows are approximately equal, the payback reciprocal may be used to estimate the discounted rate of return. A project with an infinite life would have a discounted rate of returns exactly equal to its payback reciprocal.

To compute for the payback reciprocal, the following may be used.

\[
\text{Payback reciprocal} = \frac{\text{Annual cash flow}}{\text{Net investment}}
\]

OR

\[
= \frac{1}{\text{Payback period}}
\]

**Profitability Index**

The *Profitability index*, (also known as present value index, benefit-cost rate, desirability index), is the ratio of the total present value of future cash
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inflow to the initial investment. The index expresses the present value of cash benefits as to an amount per dollar of investment in a project and is used as a measure of ranking projects in a descending order of desirability. This is computed as follows:

\[ PV \text{ index} = \frac{PV \text{ of Cash Inflow}}{PV \text{ of Net Investment}} \]

**Decision Rule:**

The higher the profitability index, the more desirable the project will be. Projects with index of less than 1 are rejected. Thus:

- If PV Index \( \geq 1 \), Accept
- If PV Index < 1, Reject

**Illustration Problem 13.13 Profitability Index**

Company XYZ has $200,000 funds available for investment. It is considering the following projects:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV of annual cash inflow</td>
<td>$244,000</td>
<td>$130,000</td>
<td>$130,000</td>
</tr>
<tr>
<td>Less: Investment required</td>
<td>200,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Net present value</td>
<td>$44,000</td>
<td>$30,000</td>
<td>$30,000</td>
</tr>
</tbody>
</table>

Required:

1. Compute the profitability index of each project.
2. Rank each project on the basis of the present value index.
3. Which project(s) should be undertaken?

**Solution: Company XYZ**

1. Computation of Profitability or PV Index

\[
\text{Project A: } \frac{244,000}{200,000} = 1.22
\]

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Project B: \[
\frac{130,000}{100,000} = 1.30
\]

Project C: \[
\frac{130,000}{100,000} = 1.30
\]

2. Ranking of projects

<table>
<thead>
<tr>
<th>Rank</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B and C</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
</tr>
</tbody>
</table>

3. The company should invest in Project B and C for the following reasons:
   a. The PV indexes of Project B and C are higher than Project A
   b. The combined net present value of Project B and C is higher than that of Project A
   c. The company can afford to invest both Project A and B.

Discounted Payback Period

A method that recognizes the time value of money in a payback context is the discount payback method. This is used to compute the payback in terms of discounted cash flow received in the future. That is, the periodic cash flows are discounted using an approximate cost of capital rate. The payback period is computed using the discounted cash flow value rather than the actual cash flows.

Illustrative Problem 13.14 Discounted Payback Period

A project required an investment if $70,000 is expected to generate the following cash inflows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60,000</td>
</tr>
<tr>
<td>2</td>
<td>60,000</td>
</tr>
<tr>
<td>3</td>
<td>60,000</td>
</tr>
<tr>
<td>4</td>
<td>60,000</td>
</tr>
<tr>
<td>5</td>
<td>60,000</td>
</tr>
</tbody>
</table>
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If the cost of capital is 15%, what is its discounted payback period?

Solution:
The discounted payback period is determined as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>Present value factor at 15%</th>
<th>Discounted cash flow</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(170,000)</td>
<td>1.000</td>
<td>$(170,000)</td>
<td>$(170,000)</td>
</tr>
<tr>
<td>1</td>
<td>60,000</td>
<td>0.870</td>
<td>52,000</td>
<td>(118,000)</td>
</tr>
<tr>
<td>2</td>
<td>60,000</td>
<td>0.756</td>
<td>45,000</td>
<td>73,000</td>
</tr>
<tr>
<td>3</td>
<td>60,000</td>
<td>0.658</td>
<td>39,000</td>
<td>(34,000)</td>
</tr>
<tr>
<td>4</td>
<td>60,000</td>
<td>0.572</td>
<td>34,000</td>
<td>-0-</td>
</tr>
</tbody>
</table>

The discounted payback period is 4 years.

Preference Decision – The Ranking of Investment Projects

Preference decisions come after screening decisions and attempt to resolve the question of “How do the investment proposals, all of which have been screened and provide an acceptable rate of return, rank in terms of preference?” The preference decisions are much more difficult to make than screening decisions because investment funds are usually limited and that some ir many other profitable investment opportunities may have to be foregone.

Basically, either the internal rate of return method or the net present value method can be used in making preference decisions.

Internal Rate of Return Method

The preference rule when using the internal rate of return method to rank competing investment projects is:

"The higher the internal rate of return, the more the desirable project will be"

This method is widely used for two main reasons, they are:
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1) No additional computations need to be made beyond those already performed in making the initial screening decisions.
2) The ranking data are easily understood by management.

Net Present Value Method

The net present value method can be used to rank competing investment projects if the projects are equal size, that is, investment funds required are the same. If the competing projects require different amounts of funding, it may be necessary to compute the profitability index. Profitability index is computed by dividing the present value of the cash inflow by the investment required.

The preference rule to rank competing investment projects using the profitability index is:

"The higher the profitability index, the more desirable the project will be"

Comparing the Preference Rules

If an independent project is being evaluated, then the NPV and IRR criteria always lead to the same accept/reject decision.

For mutually exclusive projects (choosing among acceptable alternative) especially those that differ in scale (project size) and/or timing of conflicts if ranking may arise. That is, the IRR method may favor one alternative over another while the NPV method may indicate otherwise. If conflict arises, the NPV method should be used. The NPV method assumes the cash flows will be reinvested at the firm’s cost of capital while the IRR method assumes reinvestment at the project’s IRR. Because the reinvestment at the cost of capital is generally a better (closer to reality) assumption, the NPV is superior to the IRR.

The profitability index is conceptually superior to the internal rate of return as method of making preference decisions. The reason is that the profitability index will always give the correct indication as to the relative desirability of alternatives, even if the alternatives have different lives and different patterns of earnings. On the other hand, if lives are unequal, the
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internal rate of return method can lead the manager to make incorrect decisions.

Inflation and Capital Budgeting

Does inflation affect a capital budgeting analysis? The answer is a qualified yes in that inflation affects the numbers that are used in the analysis. However, it does not affect the results of the analysis of certain condition are satisfied.

This is the best illustrated using the following data:

Marvex Corporation wants to purchase a new equipment that costs $300,000. The equipment would provide annual net cash flow from operation of $200,000 and it would have a three year-life with no salvage value. For each of the next three years, the company expects a 10% inflation rate in the cash flow associated with the new equipment. If the company’s real cost of capital is 12% or market based cost of capital of 23.2% should the equipment be purchased.

Analysis:

When performing a new present value analysis, the following should be observed:

1. If a “market-based cost of capital” is used to discount cash flows, then the cash flow should be adjusted upwards to reflect the effects of inflation in forthcoming period.
2. If the “real cost of capital” is used in the analysis, there is no need to adjust the cash flow upward since the inflationary effects have been taken out of the discount rate.

Computations under the two approaches are presented as follows:

Reconciliations of the Market-Based and Real Costs of Capital

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The real cost of capital</td>
<td>12.0%</td>
</tr>
<tr>
<td>The inflation factor</td>
<td>10.0</td>
</tr>
<tr>
<td>The combined effect (12% x 10% = 1.2%)</td>
<td>1.2</td>
</tr>
<tr>
<td>The market-based cost of capital</td>
<td>23.2%</td>
</tr>
</tbody>
</table>
Solution A: Inflation Net Combined

<table>
<thead>
<tr>
<th>Items</th>
<th>Year(s)</th>
<th>Amount of Cash Flow</th>
<th>12% Factor</th>
<th>Present value of Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>Now</td>
<td>$(360,000)</td>
<td>1.000</td>
<td>$(360,000)</td>
</tr>
<tr>
<td>Annual cost saving</td>
<td>1-3</td>
<td>200,000</td>
<td>2.402</td>
<td>480,000</td>
</tr>
<tr>
<td>Net present value</td>
<td></td>
<td></td>
<td></td>
<td>$120,400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items</th>
<th>Year</th>
<th>Amount of Cash Flow</th>
<th>Price index number*</th>
<th>Price-Adjusted Cash Flow</th>
<th>23.2% Factor*</th>
<th>PV of Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>Now</td>
<td>$(360,000)</td>
<td>1.000</td>
<td>$(360,000)</td>
<td>1.000</td>
<td>$(360,000)</td>
</tr>
<tr>
<td>Annual cost saving</td>
<td>1</td>
<td>200,000</td>
<td>1.100</td>
<td>220,000</td>
<td>0.812</td>
<td>178,640</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>200,000</td>
<td>1.210</td>
<td>242,000</td>
<td>0.659</td>
<td>159,480</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>200,000</td>
<td>1.331</td>
<td>262,200</td>
<td>0.535</td>
<td>142,420</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$120,540**</td>
</tr>
</tbody>
</table>

* Computation of the price-index numbers, assuming a 10% inflation rate each year: Year 1, (1.10)^1 = 1.10, year 2 (1.10)^2 = 1.21, year 3 (1.10)^3 = 1.331.

** These amounts are different only because of rounding error.

+ Discount formulas are computed using the formula 1/(1+r)^n, where r is the discount rate and n is the number of years. The computations are 1/((1.232)^2 = 0.659 for year 2, and 1/(1.232)^3 = 0.535 for year 3.

It will be noted that the net present value obtained in Solution B, where inflation is explicitly taken into account is the same within rounding error to the obtained in Solution A where the inflation effects were not considered. This result may seem surprising but it is logical because it has been adjusted both the cash flow and the discount rate so that they are consistent and these adjustments cancel each other out across the two solutions.
SHORT QUESTIONS

1. Define the term Cash flow. Explain the difference between cash inflow and revenue.

2. What are the similarities and differences between payback period and discounted payback period?

3. In your own opinion, which method is more useful in capital budgeting decision, net present value (NPV) and internal rate of return (IRR)?

4. What is/are the difference(s) between accounting rate of return (ARR) and internal rate of return (IRR)?

5. If the profitability index is applied for the capital budgeting decision, how the result be interpreted in order to accept or reject the project?

6. Define the term "Tax shield"? Explain the differences between tax saving and tax shield.

7. How will the inflation effect the decision on capital budgeting using the present value approach?

8. If a project provide the zero net present value and internal rate of return equals to the hurdle rate required, what will your decision be, accept or reject the project? Why or why not?

9. Management uses several capital budgeting methods in evaluating projects for possible investment. Identify those methods that are more desirable from a conceptual standpoint, and briefly explain what features these methods have that make them more desirable than other methods. Also identify the least desirable method and explain its major weaknesses.

10. Manny Perez is trying to understand the term "cost of capital." Define the term, and indicate its relevance to the decision rule under the annual rate of return technique.
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EXERCISES

Problem 1
Diamond Company is considering investing in new equipment that will cost $1,400,000 with a 10-year useful life. The new equipment is expected to produce annual net income of $90,000 over its useful life. Depreciation expense, using the straight-line rate, is $140,000 per year.

Required:
Compute the cash payback period.

Problem 2
Madeline Company is proposing to spend $200,000 to purchase a machine that will provide annual cash flows of $38,000. The appropriate present value factor for 10 periods is 5.65.

Required
Compute the proposed investment’s net present value and indicate whether the investment should be made by Madeline Company.

Problem 3
LakeFront Company is considering investing in a new dock that will cost $560,000. The company expects to use the dock for 5 years, after which it will be sold for $300,000. LakeFront anticipates annual cash flows of $110,000 resulting from the new dock. The company’s borrowing rate is 8%, while its cost of capital is 10%.

Required
Calculate the net present value of the dock and indicate whether LakeFront should make the investment.

Problem 4
Mobil Company has hired a consultant to propose a way to increase the company’s revenues. The consultant has evaluated two mutually exclusive projects with the following information provided for each project:

<table>
<thead>
<tr>
<th></th>
<th>Project Turtle</th>
<th>Project Snake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital investment</td>
<td>$1,105,000</td>
<td>$625,000</td>
</tr>
<tr>
<td>Annual cash flows</td>
<td>180,000</td>
<td>105,000</td>
</tr>
<tr>
<td>Estimated useful life</td>
<td>10 years</td>
<td>10 years</td>
</tr>
</tbody>
</table>

Mobil Company uses a discount rate of 9% to evaluate both projects.
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Required
1. Calculate the net present value of both projects.
2. Calculate the profitability index for each project.
3. Which project should Mobil accept?

Problem 5
Corn Doggy, Inc. produces and sells corn dogs. The corn dogs are dipped by hand. Austin Beagle, production manager, is considering purchasing a machine that will make the corn dogs. Austin has shopped for machines and found that the machine he wants will cost $215,000. In addition, Austin estimates that the new machine will increase the company’s annual net cash inflows by $33,000. The machine will have a 12-year useful life and no salvage value.

Required:
1. Calculate the cash payback period.
2. Calculate the machine’s internal rate of return.
3. Calculate the machine’s net present value using a discount rate of 10%.
4. Assuming Corn Doggy, Inc.’s cost of capital is 10%, is the investment acceptable? Why or why not?

Problem 6
Cepeda Manufacturing Company is considering three new projects, each requiring an equipment investment of $22,000. Each project will last for 3 years and produce the following cash inflows.

<table>
<thead>
<tr>
<th>Year</th>
<th>AA</th>
<th>BB</th>
<th>CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$ 7,000</td>
<td>$ 9,500</td>
<td>$11,000</td>
</tr>
<tr>
<td>2</td>
<td>9,000</td>
<td>9,500</td>
<td>10,000</td>
</tr>
<tr>
<td>3</td>
<td>15,000</td>
<td>9,500</td>
<td>9,000</td>
</tr>
<tr>
<td>Total</td>
<td>$31,000</td>
<td>$28,500</td>
<td>$30,000</td>
</tr>
</tbody>
</table>

The equipment’s salvage value is zero. Cepeda uses straight-line depreciation. Cepeda will not accept any project with a payback period over 2 years. Cepeda’s minimum required rate of return is 12%.

Required:
1. Compute each project’s payback period, indicating the most desirable project and the least desirable project using this method. (Round to two decimals.)
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2. Compute the net present value of each project. Does your evaluation change? (Round to nearest dollar.)

Problem 7
Tom Bat became a baseball enthusiast at a very early age. All of his baseball experience has provided him valuable knowledge of the sport, and he is thinking about going into the batting cage business. He estimates the construction of a state-of-the-art building and the purchase of necessary equipment will cost $840,000. Both the facility and the equipment will be depreciated over 12 years using the straight-line method and are expected to have zero salvage values. His required rate of return is 9% (present value factor of 7.1807). Estimated annual net income and cash flows are as follows:

<table>
<thead>
<tr>
<th>Revenue</th>
<th>$350,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Utility cost</td>
<td>40,000</td>
</tr>
<tr>
<td>Supplies</td>
<td>8,000</td>
</tr>
<tr>
<td>Labor</td>
<td>141,000</td>
</tr>
<tr>
<td>Depreciation</td>
<td>70,000</td>
</tr>
<tr>
<td>Other</td>
<td>38,500</td>
</tr>
<tr>
<td>Net income</td>
<td>297,500</td>
</tr>
</tbody>
</table>

Required:
For this investment, calculate:
1. The net present value.
2. The internal rate of return.
3. The cash payback period.

Problem 8
Yappy Company is considering a capital investment of $320,000 in additional equipment. The new equipment is expected to have a useful life of 8 years with no salvage value. Depreciation is computed by the straight-line method. During the life of the investment, annual net income and cash inflows are expected to be $22,000 and $62,000, respectively. Yappy requires a 10% return on all new investments.

<table>
<thead>
<tr>
<th>Present Value of an Annuity of 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>
Chapter 13 Capital Budgeting Decisions

Required

1. Compute each of the following:
   a) Cash payback period.
   b) Net present value.
   c) Profitability index.
   d) Internal rate of return.
   e) Annual rate of return.

2. Indicate whether the investment should be accepted or rejected.

Problem 9

Shilling Corp. is thinking about opening a baseball camp in Florida. In order to start the camp, the company would need to purchase land, build five baseball fields, and a dormitory-type sleeping and dining facility to house 100 players. Each year the camp would be run for 10 sessions of 1 week each. The company would hire college baseball players as coaches. The camp attendees would be baseball players age 12-18. Property values in Florida have enjoyed a steady increase in value. It is expected that after using the facility for 20 years, Shilling can sell the property for more than it was originally purchased for. The following amounts have been estimated:

- Cost of land $630,000
- Cost to build dorm and dining facility $2,100,000
- Annual cash inflows assuming 100 players and 10 weeks $2,520,000
- Annual cash outflows $2,260,000
- Estimated useful life 20 years
- Salvage value $4,400,000
- Discount rate 10%
- Present value of an annuity of $18,514
- Present value of 1 $149

Required:

1. Calculate the net present value of the project.
2. To gauge the sensitivity of the project to these estimates, assume that if only 80 campers attend each week, revenues will be $2,085,000 and expenses will be $1,865,000. What is the net
present value using these alternative estimates? Discuss your findings.

3. Assuming the original facts, what is the net present value if the project is actually riskier than first assumed, and a 12% discount rate is more appropriate? The present value of 1 at 12% is .104 and the present value of an annuity of 1 is 7.469.

Problem 10
Wornell Industries is currently purchasing part no. 456 from an outside supplier for $90 per unit. Because of supplier reliability problems, the company is considering producing the part internally in a currently idle manufacturing plant. Annual volume over the next five years is expected to total 400,000 units at variable manufacturing costs of $88 per unit. Wornell must acquire $200,000 of new equipment if it reopens the plant. The equipment has a five-year service life, a $20,000 salvage value, and will be depreciated by the straight-line method. Normal equipment maintenance is expected to total $12,000 in year 4, and the equipment will be sold at the end of its life for $20,000, which represents $20,000 gain.

Required:
Rounding to the nearest dollar, use the net-present-value method (total-cost approach) and a 12% after-tax hurdle rate to determine whether Wornell should make or buy part no. 456. The company is subject to a 30% income tax rate.

Problem 11
Ivory Corporation is reviewing an investment proposal that has an initial cost of $52,500. An estimate of the investment's end-of-year book value, the yearly after-tax net cash inflows, and the yearly net income are presented in the schedule below. Yearly after-tax net cash inflows include savings from the depreciation tax shield. The investment's salvage value at the end of each year is equal to book value, and there will be no salvage value at the end of the investment's life.
Chapter 13 Capital Budgeting Decisions

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial Cost and Book Value</th>
<th>Yearly After-Tax Net Cash Inflows</th>
<th>Yearly Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$35,000</td>
<td>$20,000</td>
<td>$2,500</td>
</tr>
<tr>
<td>2</td>
<td>21,000</td>
<td>17,500</td>
<td>3,500</td>
</tr>
<tr>
<td>3</td>
<td>10,500</td>
<td>15,000</td>
<td>4,500</td>
</tr>
<tr>
<td>4</td>
<td>3,500</td>
<td>12,500</td>
<td>5,500</td>
</tr>
<tr>
<td>5</td>
<td>----</td>
<td>10,000</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>$75,000</td>
<td></td>
<td>$22,500</td>
</tr>
</tbody>
</table>

Ivory uses a 14% after-tax target rate of return for new investment proposals.

**Required**

1. Calculate the project's payback period.
2. Calculate the accounting rate of return on the initial investment.
3. Calculate the proposal's net present value. Round to the nearest dollar.

**Problem 12**

Cones & Moore sells frozen custard and sandwiches. It is considering a new site that will require a $2 million investment for land acquisition and construction costs. The following operating results are expected:

Sales revenue .......................................................... $980,000
Less operating expenses:
  Food & supplies .............................................. $320,000
  Wages & salaries ............................................. 180,000
  Insurance & taxes ............................................ 40,000
  Utilities ......................................................... 10,000
  Depreciation .................................................... 70,000
Operating income ................................................... $360,000

Disregard income taxes.
Chapter 13 Capital Budgeting Decisions

Required
1. If management requires a payback period of four years or less, should the new site be opened? Why?
2. Compute the accounting rate of return on the initial investment.
3. What significant limitation of payback and the accounting rate of return are overcome by the net-present-value method?
CHAPTER 14
DECENTRALIZED OPERATIONS AND SEGMENT REPORTING

After studying this Chapter, you should be able to:

1. Describe a decentralized type of organization.
2. Explain the importance of decentralization in a responsibility accounting system.
3. Enumerate the advantages of decentralization.
4. Prepare a segmented income statement using the contribution margin format.
5. Explain the difference between traceable and common fixed costs.
6. Understand the problems related to proper cost assignment.
Management must accomplish its objectives by working through people. Presidents of companies could not possibly execute all of their company's strategies alone and therefore must rely on other. The process of delegating the decision-making authority throughout an organization is called decentralization.

Before designing strategic performance measurement systems, top managers determine when delegation of responsibility (called decentralization) is desirable.

The strategic benefit of the centralized approach is that top management retains control over key business functions, ensuring a desired level of performance. Additionally, with top management involvement in most decisions, the expertise of top management can be effectively coordinated. For many firms, however, a decentralized approach is preferable. The main reason is that top management cannot effectively manage the operations at a very detailed level; it lacks the necessary local knowledge. Decisions at lower levels in the firm must be made on a timely basis using the information at hand to make the firm more responsive to the customer. For example, the retail store manager must often make quick changes in inventory, pricing and advertising to respond to local competition and changing customer buying habits and tastes.

In a decentralized organization, managers are allowed at various operating levels the authority to make decisions relating to their area of responsibilities. This usually presented in an organization chart which shows not only the formal lines of reporting and communicating or chain of command but also how responsibility has been divided among managers. It is also possible that informal relationships and channels of communication can develop outside the formal reporting relationships on the organization chart as a result of personal contact among managers. The informal structure does not appear on the organization chart, but is often vital to effective operations.
Advantages of Decentralization

1. Creates greater responsiveness to local needs. Information is the key to wise decisions. Subunit managers compared with top managers are better informed about their customers, competitors, suppliers, and employees, as well as about local factors that affect the performance of their jobs such as ways to decrease costs and improve quality. Sony Company reports that two advantages of decentralization are an “increase in the company’s knowledge of the marketplace and improved service to customers.”

2. Leads to gains from quicker decision making. Decentralization speeds decision making, creating a competitive advantage over centralized organizations. Centralization slows decision making as responsibility for decisions creeps upward through layer after layer of management.

3. Increases motivation of subunit managers. Subunit managers are usually more highly motivated when they can exercise greater individual enterprise.

4. Aids management development and learning. Giving managers more responsibility promotes the development of an experienced pool of management talent - a pool to draw from for higher-level management positions. The organization also learns which people is not management material. An electronics instruments company, expressed this benefit as follows: “Decentralized units provide a training ground for general managers, and a visible of combat where product champions fight their ideas.”

5. Sharpens the focus of subunit managers. In a decentralized setting, the manager of a small subunit has a concentrated focus. A small subunit is more flexible and nimble than a larger subunit is better able to adapt itself quickly to a fast-opening market opportunity. Also, top management, relieved of the burden of day-to-day operating decisions, can spend more time and energy on strategic planning for the entire organization.

6. Decisions are best made at that level in an organization where problems and opportunities arise.

7. Management is relieved of much day-to-day problem solving and is left free to concentrate on long-range planning and on coordination of efforts.
8. Segment managers obtain more job satisfaction and are encouraged to put forth their best efforts by giving them added responsibility and decision-making authority.

9. It provides excellent training to managers by giving them greater decision-making control over their segments.

10. Better and faster performance evaluation. Performance of managers are better measured and evaluated because through decentralization he has more latitude for employing his or her skills and efforts.

Limitations of Decentralization

1. Dysfunctional decision making may result to suboptimal or incongruent decision making. This will arise when a decision’s benefit to one subunit is more than offset by the costs or loss of benefits to the organization as a whole. This cost arises because top management has given up control over decision making.

Suboptimal decision making may occur (1) when there is a lack of harmony or congruence among the overall organization goals, the subunit goals, and the individual goals of decision makers, or (2) when no guidance is given to subunit managers concerning the effects of their decision on other parts of the organization.

Suboptimal decision making is most likely to occur when the end product of one subunit is used or sold by another subunit.

2. Manager's attention may be focused only on the subunit rather than the organization as a whole. Individual subunit managers may regard themselves as competing with managers of other subunits in the same organization as if they were external rivals. Consequently, managers may be unwilling to share information or to assist when another subunit faces an emergency. Also, subunit managers may use information they have about local conditions to further their own self-interest rather than the organization’s goals.

3. Cost to gather information is increased. Managers may spend too much time obtaining information about different subunits of the organization in order to coordinate their actions.
4. Activities may be duplicated. Several individual subunits of the organization may undertake the same activity separately. For example, there may be a duplication of staff functions (accounting, human resources, and legal) if an organization is highly decentralized. Centralizing these functions helps to consolidate, streamline, and downsize these activities.

SEGMENT REPORTING

To operate effectively, managers need more information at their disposal than is available in a single companywide income statement.

Statement of income designed to focus on various segments of the company is known as segment reporting. A segment is any part or activity of an organization about which manager seeks costs, revenue or profit data. This can be classified by regional, branches, product type or product line. They are formally called business unit or BU.

The purpose of segment reporting is to provide information needed by the manager to determine profitability of product lines, divisions, sales territories and other segments of a company. It emphasizes performance of a profit or investment center rather than the performance of the company as a whole.

Illustrative Problem 14.1 Preparation of Segmental Income Statement

From the following data, prepare a segmental income statement for the X'OR Company for year 20x1 and evaluate the results.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Phama</th>
<th>Agricultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$1,000,000</td>
<td>$600,000</td>
<td>$400,000</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controllable by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>division manager</td>
<td>250,000</td>
<td>130,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Controllable by others</td>
<td>120,000</td>
<td>70,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>420,000</td>
<td>220,000</td>
<td>200,000</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>140,000</td>
<td>70,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Unallocated fixed costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>20,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Solution: X’OR Company

<table>
<thead>
<tr>
<th>X’OR COMPANY</th>
<th>Income Statement by Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Sales</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Less: Variable costs:</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>420,000</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>140,000</td>
</tr>
<tr>
<td>Total variable costs</td>
<td>560,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>440,000</td>
</tr>
<tr>
<td>Less: Fixed costs controllable by division manager</td>
<td>250,000</td>
</tr>
<tr>
<td>Contribution control by division manager</td>
<td>190,000</td>
</tr>
<tr>
<td>Less: Fixed costs controllable by others</td>
<td>120,000</td>
</tr>
<tr>
<td>Divisional segment margin</td>
<td>$70,000</td>
</tr>
<tr>
<td>Less: Unallocated common costs</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>40,000</td>
</tr>
<tr>
<td>Selling and administrative</td>
<td>20,000</td>
</tr>
<tr>
<td>Total</td>
<td>60,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

Both divisions showed positive results as far as the Contribution Controllable by Division Managers are concerned. However, the Agricultural Division showed a much smaller contribution so that it was not able to fully absorb the other fixed costs allocated to it. The manager of this division should strive to have a bigger contribution margin either by adjusting the selling price of his products or controlling the variable costs to enable it to absorb fixed costs and still have profit.

Levels of Segmented Statement

Segmented income statement can be prepared for activities at many levels in a company. To provide more information to the company’s divisional manager, the report could further segment the divisions according to their major product lines, and the product lines could be segmented as to how they are sold—in retail computer stores or by catalog sales. As one goes from one segmented statement to another, he/she
looks at smaller and smaller pieces of the company. This is illustrated in Figure 14.1.

Significant benefits are received from a series of statements such as those presented in Figure 14.1. A manager is able to gain considerable knowledge into the company's operations viewed from many different angles by examining trends and results in each segment. Through advanced computer information systems, such a statement can easily be constructed and be kept continuously current.

Figure 14.1

**Lucky Products Inc.**

**Segmented Income Statement in the Contribution Format**

### Segments Defined as Divisions

<table>
<thead>
<tr>
<th>Divisions</th>
<th>Total Company</th>
<th>Business Products Division</th>
<th>Consumer Products Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$500,000</td>
<td>$330,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Less variable expenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable cost of goods sold</td>
<td>180,000</td>
<td>120,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Other variable expenses</td>
<td>50,000</td>
<td>30,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Total variable expenses</td>
<td>$230,000</td>
<td>$150,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>$270,000</td>
<td>$150,000</td>
<td>$120,000</td>
</tr>
<tr>
<td>Less traceable fixed expenses</td>
<td>$170,000</td>
<td>$90,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>Divisional segment margin</td>
<td>$100,000</td>
<td>$60,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Less common fixed expenses not traceable to the individual divisions</td>
<td>$85,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net operating income</td>
<td>$15,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Segments Defined as Product Lines

**Of the Consumer Products Division**

<table>
<thead>
<tr>
<th>Product Line</th>
<th>Consumer Products division</th>
<th>Clip Art</th>
<th>Computer Games</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$200,000</td>
<td>$75,000</td>
<td>$125,000</td>
</tr>
<tr>
<td>Less variable expense:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable cost of goods sold</td>
<td>60,000</td>
<td>20,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Other variable expenses</td>
<td>20,000</td>
<td>5,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Total variable expenses</td>
<td>$80,000</td>
<td>$25,000</td>
<td>$55,000</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>$120,000</td>
<td>$50,000</td>
<td>$70,000</td>
</tr>
<tr>
<td>Less traceable fixed expenses</td>
<td>$70,000</td>
<td>$30,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>Product-line segment margin</td>
<td>$50,000</td>
<td>$20,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Less common fixed expenses not traceable to the individual product lines</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divisional segment margin</td>
<td>$40,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Segments Defined as Sales Channels for One Product Line, Computer Games, of the Consumer Products Division

<table>
<thead>
<tr>
<th>Sales</th>
<th>Computer Games</th>
<th>Sales Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Retail Stores</td>
<td>Catalog Sales</td>
</tr>
<tr>
<td>$1250,000</td>
<td>$100,000</td>
<td>$25,000</td>
</tr>
</tbody>
</table>

Less variable expenses:
- Variable cost of goods sold...
  - 40,000
- Other variable expenses...
  - 15,000

Total variable expenses...
  - 55,000

Contribution margin...
  - 70,000

Less traceable fixed expenses...
  - 25,000

Sales-channel segment margin...
  - 45,000 $48,000 $(3,000)

Less common fixed expenses not traceable to the individual sales channels...
  - 15,000

Product-line segment margin...
  - 30,000

- Notice that this $80,000 in traceable fixed expense is divided into two parts when the Consumer Products Division is broken down into product lines—$70,000 traceable and $10,000 common.

Sales and Contribution Margin

In the preparation of an income statement for a particular segment, variable expenses are deducted from sales to yield the contribution margin for the segment. The contribution margin is particularly useful in determining what happens to profit as volume changes, assuming that the segment’s capacity and fixed costs are constant. Decisions concerning the most effective, temporary or short-run uses of existing capacity such as special orders can be made using the contribution margin information.

Traceable and Common Fixed Costs

The report in Figure 14.1 shows two kinds of fixed costs—traceable and common.

Only the traceable or direct fixed costs are charged to the segments in the report. Traceable fixed costs of a segment is a fixed cost that is incurred as a consequence of the existence of the segment and could be easily identified or traced to the particular segment. Examples are:

- Salary of the division manager
- Insurance and maintenance cost of the division building
Deducting traceable fixed costs from the segment contribution margin would yield the segment margin or contribution to indirect or common costs.

Segment margin represents the margin available after a segment has covered all of its own costs and the best gauge of the long-run profitability of a segment. It is also most useful in major decisions that affect capacity such as dropping a segment.

Finally, deducting the allocated common fixed expense not traceable to the individual segment from the segment margin would result to the net operating income or loss of the segment.

Problems Related to Proper Cost Assignment

For segment reporting to accomplish its objectives, costs must be properly assigned to segments. If the purpose is to determine the profits being generated by a particular division, then all of the costs attributable to that division and only those costs—should be assigned to it. The problem however is there are certain practices that hinder proper cost assignment. These are

a. Omission of some costs in the assignment process,
b. The use of inappropriate methods for allocating costs among segments of a company, and
c. The assignment of costs to segments when they are really common costs.

Omission of Costs

For financial reporting purposes, only manufacturing costs are included in product costs. The costs assigned to a segment should include all costs attributable to that segment from the company’s entire value chain. Value chain consists of all the major business functions that add value to a company’s products and services. These business functions include research and development, product design, manufacturing, marketing, distribution and customer service, are required to bring a product or service to the customer and generate revenues. If companies omit from their profitability analysis part or all of the “upstream costs” (research and development and product design) and the “downstream costs” (marketing, distribution and customer service), then the product is undercosted and management may unintentionally develop and maintain
products that in the long run result in losses rather than profits for the company.

**Inappropriate Methods for Allocating Costs among Segments**

Cost distortion or cross-subsidization occurs when costs are improperly assigned among the company’s segments. This can occur in two ways:

1. When the company fails to track costs directly to segments in those situations where it is feasible to do so.
2. When the company uses inappropriate bases to allocate costs.

**Arbitrarily Dividing Common Costs among Segments**

The practice of assigning nontraceable or common costs to segments is another business practice that leads to distorted segment costs. For example, some companies allocate or divide the costs of the corporate headquarters building equally to products on segment reports. While it is true that common costs must be covered, arbitrarily allocating common costs to segment may produce results that could be used in making erroneous decisions. For example, adding a share of common costs to the real costs of a segment may make an otherwise profitable segment appear to be unprofitable. If a manager erroneously eliminates the segment, the revenues will be lost, the real costs of the segment will be avoided, but the common costs will still be there. This will result to a reduction in the profits of the company as a whole and make it even more difficult to “cover the common costs.”
**SHORT QUESTIONS**

1. What is segmented accounting and segmented income statement?
2. If you are appointed as the management accountant of a company, will you allocate the common costs in your segmented reports? Why or why not?
3. What are the differences between common costs and traceable costs?
4. Should the common costs of one segment be the traceable costs of other segment? Why or why not?
5. What are the differences or similarities between segmented report and profit center report? Explain with example(s).

**EXERCISES**

**Problem 1**

County Cable Services Inc. is organized in three segments: Metro, Suburban, and Outlying. Data for the company and for these segments follow.

<table>
<thead>
<tr>
<th></th>
<th>Cable Services</th>
<th>Segments of Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service revenue</td>
<td></td>
<td>$500 $400 $200</td>
</tr>
<tr>
<td>Less: Variable costs</td>
<td>$225</td>
<td>$ $ $</td>
</tr>
<tr>
<td>Segment contribution margin</td>
<td>$440</td>
<td>$200 $160 $75</td>
</tr>
<tr>
<td>Less: Controllable fixed costs</td>
<td>200</td>
<td>160 $75</td>
</tr>
<tr>
<td>Controllable profit margin</td>
<td>$180</td>
<td>$85 $100 $30</td>
</tr>
<tr>
<td>Less: Noncontrollable fixed costs</td>
<td>$850</td>
<td>$55</td>
</tr>
<tr>
<td>Segment profit margin</td>
<td>$180</td>
<td>$85 $100 $30</td>
</tr>
<tr>
<td>Less: Common fixed costs</td>
<td>$75</td>
<td>$55</td>
</tr>
<tr>
<td>Income before taxes</td>
<td>$</td>
<td>$55</td>
</tr>
<tr>
<td>Less: Income tax expense</td>
<td>75</td>
<td>$55</td>
</tr>
<tr>
<td>Net income</td>
<td>$</td>
<td>$55</td>
</tr>
</tbody>
</table>
Variable costs as a percentage of service revenue are: Metro, 20%; Suburban, 18.75%; and Outlying, 25%.

**Required:**
1. Complete the segmented income statement for County Cable.
2. Evaluate the three segment managers for consideration of a pay raise. Base the managers' performance on (1) absolute dollars of the appropriate profit measure, and (2) the appropriate profit measure as a percentage of service revenue. What causes any difference in rankings between the two approaches?

**Problem 2**

Fog City Retail operates a retail store in Phoenix, Las Vegas, and Portland. The following information relates to the Phoenix facility:

- The store sold 65,000 units at $18.00 each, after having purchased the units from various suppliers for $12.50. Phoenix salespeople are paid a 5% commission based on gross sales dollars.
- Phoenix's sales manager oversees the placement of local advertising contracts, which totaled $54,000 for the year. Local property taxes amounted to $14,500.
- The sales manager's $65,000 salary is set by Phoenix's store manager. In contrast, the store manager's $134,000 salary is determined by Fog City's vice president.
- Phoenix incurred $6,800 of other noncontrollable costs.
- Nontraceable (common) corporate overhead totaled $68,000. Fog City's corporate headquarters is located in Portland, and the company uses responsibility accounting to evaluate performance.

**Required:**
Prepare a segmented income statement for the Phoenix store, being sure to disclose the segment contribution margin, the segment controllable profit margin, and segment profit margin.

**Problem 3**
Chapter 14 Decentralized Operation and Segment Reporting

The following selected data relate to the Idaho Division of Far West Enterprises (FWE):

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales revenue</td>
<td>$4,580,000</td>
</tr>
<tr>
<td>Uncontrollable fixed costs traceable to the division</td>
<td>1,360,000</td>
</tr>
<tr>
<td>Allocated corporate overhead</td>
<td>590,000</td>
</tr>
<tr>
<td>Controllable fixed costs traceable to the division</td>
<td>1,120,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td>40% of revenue</td>
</tr>
</tbody>
</table>

Required:

1. Compute the following for the Idaho Division:
   - a) Segment contribution margin.
   - b) Controllable profit margin.
   - c) Segment profit margin.

2. Which of the three preceding measures should be used when evaluating the Idaho Division as an investment of FWE's resources? Why?

3. Assume that management made the decision to prepare a segmented income statement that reflected Idaho's five operating departments. Would all $1,120,000 of the controllable fixed costs be easily traced to the departments? Briefly explain.

4. Which of the five-dollar amounts presented in the body of the problem would be used in computing the income before taxes of Far West Enterprises?

Problem 4

Kirsten, Inc. operates a chain of 80 retail stores throughout the Northwest that specializes in the sale of sports equipment. The following costs relate to store no. 19 in Seattle, Washington:

- Salary of store manager: $58,000
- Allocated corporate overhead: $55,000
- Cost of goods sold: $2,560,000
- Landscaping and grounds costs (yearly contract): $6,800
- Hourly wages of sales clerks: $343,000
- Local advertising (negotiated by store manager): $76,000
- Property taxes: $25,800
- Sales commissions: $221,000
Chapter 14 Decentralized Operation and Segment Reporting

**Required:**
Which of the preceding costs would be used in computing:

1. Store no. 19's segment contribution margin?
2. Store no. 19’s controllable profit margin?
3. Store no. 19’s segment profit margin?
4. The net income of Kasten, Inc.?

**Problem 5**

Bluegrass, Inc., which is headquartered in Atlanta, operates a chain of 225 clothing stores throughout the United States. Consider the costs that appear in the following table, many of which pertain to the company’s sole operation in Jacksonville, Florida:

<table>
<thead>
<tr>
<th>Cost</th>
<th>Performance Measure</th>
<th>Jacksonville's Segment Contribution Margin</th>
<th>Jacksonville's Controllable Profit Margin</th>
<th>Jacksonville's Segment Profit Margin</th>
<th>Bluegrass Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacksonville's property taxes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales commissions paid to Jacksonville employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allocated corporate overhead to individual store sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wages of Jacksonville hourly employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary of Jacksonville’s manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jacksonville’s cost of goods sold</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local advertising handled by Jacksonville’s manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bluegrass income tax expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jacksonville’s store maintenance costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specify store maintenance as a fixed costs. Adopt the following language. "Jacksonville’s store maintenance costs as agreed upon in yearly maintenance contract negotiated by Jacksonville’s manager."

**Required:**
Analyze each of the costs and determine whether the cost affects Jacksonville’s segment contribution margin, controllable profit margin, and
segment profit margin, and/or the net income of Bluegrass, Inc. Place an "X" in the appropriate cell(s).

Problem 6

Segmented income statements are used to show revenues, expenses, and income for major parts of an organization.

Required:
1. Consider a regional chain of department stores that has two or three stores in each of several cities. One way to segment this business is geographically. Describe another way of segmenting the firm.
2. Segmented income statements often distinguish between "fixed expenses controllable by the segment manager" and "fixed expenses traceable to the segment, but controllable by others." Assume that the Cleveland district has three retail stores. Give two examples of each type of fixed cost.
3. Common costs create difficulties when preparing segmented income statements. Define "common costs," give an example for the regional chain of department stores, and explain in general terms why such costs create a problem.
Reference


### Appendix: Table for Present Value and Future Value

#### Table 1: Future Value of $1.00 (1 + r)^t

<table>
<thead>
<tr>
<th>Period</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>1.020</td>
</tr>
<tr>
<td>3</td>
<td>1.040</td>
</tr>
<tr>
<td>4</td>
<td>1.060</td>
</tr>
<tr>
<td>5</td>
<td>1.080</td>
</tr>
<tr>
<td>10</td>
<td>1.160</td>
</tr>
<tr>
<td>20</td>
<td>1.610</td>
</tr>
<tr>
<td>30</td>
<td>2.488</td>
</tr>
<tr>
<td>40</td>
<td>3.431</td>
</tr>
<tr>
<td>50</td>
<td>4.172</td>
</tr>
</tbody>
</table>

#### Table 2: Future Value of an annuity of $99.00 ((1 + r)⁻¹) / s

<table>
<thead>
<tr>
<th>Period</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.990</td>
</tr>
<tr>
<td>2</td>
<td>1.980</td>
</tr>
<tr>
<td>3</td>
<td>2.970</td>
</tr>
<tr>
<td>4</td>
<td>3.960</td>
</tr>
<tr>
<td>5</td>
<td>4.950</td>
</tr>
<tr>
<td>10</td>
<td>9.900</td>
</tr>
<tr>
<td>20</td>
<td>19.800</td>
</tr>
<tr>
<td>30</td>
<td>29.700</td>
</tr>
<tr>
<td>40</td>
<td>39.600</td>
</tr>
<tr>
<td>50</td>
<td>49.500</td>
</tr>
</tbody>
</table>

#### Table 3: Present Value of $1.00 1/(1 + r)^t

<table>
<thead>
<tr>
<th>Period</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.990</td>
</tr>
<tr>
<td>2</td>
<td>0.980</td>
</tr>
<tr>
<td>3</td>
<td>0.961</td>
</tr>
<tr>
<td>4</td>
<td>0.942</td>
</tr>
<tr>
<td>5</td>
<td>0.925</td>
</tr>
<tr>
<td>10</td>
<td>0.614</td>
</tr>
<tr>
<td>20</td>
<td>0.376</td>
</tr>
<tr>
<td>30</td>
<td>0.231</td>
</tr>
<tr>
<td>40</td>
<td>0.148</td>
</tr>
<tr>
<td>50</td>
<td>0.091</td>
</tr>
</tbody>
</table>

#### Table 4: Present Value of an annuity of $1.00 (1 / (1 + r) * (1 - (1 + r)^t))

<table>
<thead>
<tr>
<th>Period</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.990</td>
</tr>
<tr>
<td>2</td>
<td>0.980</td>
</tr>
<tr>
<td>3</td>
<td>0.961</td>
</tr>
<tr>
<td>4</td>
<td>0.942</td>
</tr>
<tr>
<td>5</td>
<td>0.925</td>
</tr>
<tr>
<td>10</td>
<td>0.614</td>
</tr>
<tr>
<td>20</td>
<td>0.376</td>
</tr>
<tr>
<td>30</td>
<td>0.231</td>
</tr>
<tr>
<td>40</td>
<td>0.148</td>
</tr>
<tr>
<td>50</td>
<td>0.091</td>
</tr>
</tbody>
</table>

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The last page.