Management Accounting Summary (Lectures + Literature)

Lecture 1 - Introduction to Accounting

Chapter 1 - Cost Management and Strategy

What a company aims for is written in its **mission statement**. The **strategy** is a roadmap on how to accomplish the mission statement.

Strategy = Plan to achieve competitive advantage.

The **agency problem** is a common problem in the business world.
The agency relationship exists whenever one partner in a transaction (**principal**) delegates authority to another, better informed party (**agent**) and the welfare is affected by the choices of the agent.
Usually, the principal and the agent act self-interested, but the interests may not be aligned. Principals cannot perfectly and costless acquire agent's information or monitor their actions.
Even well designed incentives don't always work perfectly.

Essentially, the agency problem is a management control problem. Managers suffer from:

- Lack of direction
- Lack of motivation
- Personal limitations, e.g. lack of information, resources, skills

Management control

Incentives, controls and information systems that organizations implement to motivate and enable managers to work in the best interest of the organization.

Management accounting and cost accounting

- Foundation of management control
- Formal techniques that provide information for
  - Planning
  - Decision making
  - Performance evaluation

Management accounting and the role of cost management

Cost management information is developed and used to implement the organization's strategy.

- Consists of financial information about costs and revenues and nonfinancial information about customer, retention, productivity, quality, other success factors

Cost management is the development and use of cost management information.

Management accounting is a profession that involves partnering in management decision making, devising planning and performance management systems, and providing expertise in financial reporting and control to assist management in the formulation and implementation of an organization's strategy.

Using accounting information for:

- Planning (what are the costs of our products and how much should we produce in the next year?)
- Decision making (which product should we produce if we have capacity constraints? Which price?)
- Performance evaluation (did our production managers control costs in a good manner?)

Accountants:

- Understand costs
- Decisions such as production quantity, production mix, outsource, invest
- Measure performance

Financial accounting (FA) vs Managerial Accounting (MAC)

	Financial Accounting	**Management accounting**
Target audience	External (reports are audited) e.g. investors, government regulators	Internal
Customization	No, standardized	Yes, tailored
Level of detail	Summarized	Detailed, cost-benefit tradeoff
Time focus	Mostly historical, quarter or year	Historical & projections, real-time to 10-15 years
Type of information	Financial	Financial and nonfinancial
Focus	Accuracy and compliance	Timeliness and usefulness

Cost accounting information provides a basis for both MA and FA

Cost management information is developed through 5 stages (up the value chain):

1) Business events
2) Data
3) Information
4) Knowledge
5) Decisions

Usually, management accountants report to the **controller**.

The four functions of management

The management accountant develops cost management information for the CFO, other managers and employee teams. Cost management information is provided for each of the four management functions:

1. **Strategic management:** Development and implementation of sustainable competitive position
2. **Planning and decision making**: Budgeting, profit planning, cash flow management
3. **Management and operational control**: Provide a fair and effective basis for identifying inefficient operations and to reward and motivate the most effective managers (mid-management level)
4. **Preparation of financial statements**: Provide accurate accounting for assets for the preparation of financial reports

<u>Strategic management and the strategic emphasis in cost management</u>

It is important to drive the company and stay competitive. The firm's attention is focused on satisfying the customers' needs; all of the firm's resources, from *all functions*.

<u>Types of organizations</u>

- Wholesalers: merchandisers that sell to other merchandisers
- Retailers: merchandisers selling direct to customers
- Manufacturing firms: use raw materials
- Service firms
- Governmental firms
- Non-profit firms

Cost management information is important to all firms. Cost incurred after the product is completed, such as service costs or warranty costs are often called **downstream costs**.

The contemporary business environment

Changes recently in the business world are:

- Increased global competition
- Lean manufacturing
- Advances in information technologies (Internet, Enterprise Resource Management)
- Greater focus on the customer
- New forms of management organization
- Changes in the social, political and cultural environment of the business

The current challenges (public debt, unemployment rates, economic growth) have an effect on these changes.

The global business environment

Driver of the changes is mainly the **growth of international markets** and **trade** due to the rise of economies throughout the world. Different trade associations (NAFTA; CAFTA; WTO; EU), multinational firms add to that. Therefore, firms need financial and nonfinancial information about competing effectively in other countries.
Consequences:

- Increased competitiveness
- Increased opportunities for investment in foreign firms

Lean manufacturing

New manufacturing technologies, such as **just-in-time** inventory methods, lean methods applied in Japanese manufacturing;

Key competitive edge: **Speed-to-market**

Use of IT, Internet, ERM

Most fundamental change: New technologies, Internet, performance management systems.
= **New economy**

Focus on the customer

Increased **consumer expectation** is a key change in the business environment. Businesses now focus more on customer satisfaction by producing value for the customer by focusing more on quality, service, timeliness of delivery, ability to response to the customer's desire for specific features (and not only on low costs and quantity).

Management Organization

Emphasis has shifted from financial and profit-based measures of performance to customer-related, nonfinancial performance measures such as **quality**, **time to delivery** and **service**.

Organizations shift towards a more flexible form encouraging **teamwork**, coordination among business functions. Therefore, cost management practices are also changing to include reports that are useful to **cross-functional teams**: variety of operating and financial information: product quality, unit cost, customer satisfaction, production bottleneck etc.

Social, Political, and cultural considerations

They differ from country to country but often have an **ethnically** and **racially diverse workforce**. Firms need to be flexible and adaptable.
Firms also need to focus **outside** the organization.

The strategic focus of cost management

The management accountant focuses on the factors that make the company successful (and not only relying on financial measures and costs); these factors are the **critical success factors (CSFs)**.

CFS are measures of those aspects of the firm's performance that are essential to its competitive advantage and therefore to its success.

Contemporary management techniques: the management accountant's response to the contemporary business environment

There are different methods of how to response to the six changes in the contemporary business environment.

- **The balanced scorecard/strategy map**
  - **Balanced scorecard:** Captures all aspects that contribute to firm's success;
    Four perspectives:
    - Financial performance
    - Customer satisfaction,
    - Internal processes,
    - Learning and growth
  - **Strategy Map**: links the various perspectives in a cause-and-effect diagram
- **Value chain**

    - Identifies the specific steps required to provide a product or service to the customer (can determine where costs can be reduced or which activities should be outsourced
- **Activity-based costing and management**
    - **Activity analysis:** Develops a detailed description of the specific activities performed in the firm's operations
    - **Activity-based costing:** improves the accuracy of cost analysis by improving the tracing of costs to products or to individual customers
    - **Activity-based management**: uses the previous two and helps managers to improve the value of products and services and increases overall competitiveness
- **Business intelligence**
    - Usage of data to understand and analyze business performance in order to implement strategy
- **Target costing**
    - Determines desired cost for a product on the basis of a given competitive price
- **Life-cycle costing**
    - Identifies and monitors the costs of a product throughout its life cycle
        - R&D
        - Product design
        - Manufacturing, inspecting, packaging, warehousing
        - Marketing, promotion, distribution
        - Sales & service
- **Benchmarking**
    - Identifies CSF and compares it to other firms within the industry
- **Business process improvement**
    - Program of continuous improvement in quality and other CFSs
    - **Business process reengineering** (more radical than BPI)
- **Total quality management**
    - Policies and practices are developed that ensure that the firm's products exceed customers' expectations
- **Lean accounting**
    - Uses value streams to measure the financial benefits of a firm's progress in implementing **lean manufacturing**
- **Theory of constraints**
    - Helps firms to effectively improve the rate at which raw materials are converted to finished products (**cycle time**); TOC helps identify bottlenecks in order to be faster
- **Sustainability**
    - Balancing the company's short- and long-term goals in all three dimensions (**social, environmental, financial**)
- **Enterprise of risk management**
    - Framework and process for firms to manage the risks that could negatively or positively affect competitiveness and success (risks such as hazards, financial risks, operating risks, strategic risks)

How a firm succeeds: Competitive strategy

Strategy: plan for using resources to achieve sustainable foals within a competitive environment.
Cost management focus shifted towards a tool for development and implementation of business strategy; accountant as business partner;

Developing a competitive strategy

1. **Cost leadership**
    a. Reducing price and undermining competitor's profitability
    b. Large market share
    c. Serves broad market
    d. Productivity in manufacturing process, distribution
    e. Limited selection of products
    f. Low price marketing
2. **Differentiation**

   a. Product leadership (innovation and features in the product): unique product/service
   b. Customer-focused / customer-solution (success on customer dimension)
   c. Products have wide-variety, differentiating features
   d. Innovation in differentiating products
   e. Premium price and innovative marketing

The five steps of strategic decision making

1. Determine the strategic issues surrounding the problem
2. Identify the alternative actions
3. Obtain information and conduct analyses of the alternatives
4. Based on strategy and analysis, choose and implement the desired alternative
5. Provide an ongoing evaluation of the effectiveness of implementation in Step 4

The professional environment of cost management

The professional environment is influenced by two types of organizations:

1) Organization that sets guidelines and regulations regarding management accounting practices
   a. Federal agencies (Internal Revenue Service)
   b. Federal Trade Commission (FTC)
   c. Securities and Exchange Commission (SEC); role has been strengthened by the Sarbanes-Oxley Act of 2002
2) Organization that promotes the professionalization and competence of accountants
   a. Institute of Management Accountants (IMA)
   b. Financial Executives International (FEI)

Professional certifications

Provide a distinct measure of experiences, training, and performance capability for the management accountant.
Certifications:

1. Certified Management Accountant (CMA)
2. Certified Public Accountant (CPA)

Professional ethics

= commitment of the management accountant to provide a useful service for management.
The ethical behavior is guided by the code of ethics of the Institute of Management Accountants (IMA). There are four main standards:

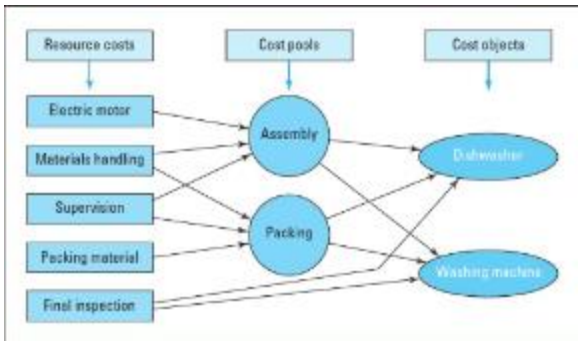
1. Competence
2. Confidentiality
3. Integrity
4. Credibility

Chapter 3 - Basic Cost Management Concepts

Cost terminology

To achieve competitive advantage, firms need to identify key costs and cost drivers within the organization

- **Cost:** Resource used to achieve a specific objective (e.g. production)
  - **Actual cost**: cost that has been incurred
  - **Budgeted cost:** anticipated, predicted cost
- **Cost pools:** meaningful groups into which costs are often collected
  - By type of cost (product design cost, distribution cost, material costs)
  - By source of costs (cost of labor, costs of material)
- **Cost object:** any product, service, customer, activity, organizational unit to which costs are assigned
  - Broad concept; includes products, groups of products (called **value streams**), services, projects, departments;
- **Cost driver**: variable that causes a change in total costs



Direct and indirect costs

Cost assignment is the process of assigning resource costs to cost pools and then from cost pools to cost objects. The two types of assignment are **direct tracing** and **allocation**.

- Direct tracing: assigning **direct costs**
- Cost allocation: assigning **indirect costs**
  - Cost drivers used to allocate costs are often called the **allocation bases**

- **Direct costs:** Costs can be directly traced to a specific cost object (e.g. cost of materials required for a particular product)
  - E.g. direct labor, direct materials, commissions, piece rate wages, manufacturing supplies
  - Tend to be variable costs
- **Indirect costs:** Costs can't be (conveniently or economically) traced to a cost object; they are assigned to a cost object according to an allocation schedule
  - E.g. production supervision salaries, depreciation, insurance, quality control costs
  - Tend to be fixed costs

Costs may be direct for some cost objects but indirect to other costs objects

- Two cost objects: Car vs. production plant
- Costs for salary of a manager overseeing the production plant is indirect for an individual car but direct for the production plant

Direct and indirect material costs

- **Direct material costs** are the costs of material in the product or other cost object
- **Indirect material costs** are the costs of materials used in manufacturing that are not part of the finished product

Direct and indirect labor costs

- **Direct labor costs** are the costs used in labor to manufacture the product or to provide the service
- **Indirect labor costs** include supervision, quality control, inspection, purchasing, receiving, materials handling, downtime, training, cleanup;

An element of labor can be both direct and indirect, depending on cost object.

	Studios as the Cost Object	Direct Cost or Indirect Cost	Variable Cost or Fixed Cost
1.	Each dancing instructor's salary	Indirect cost ✗	Fixed cost ✗
2.	Manager's salary	Indirect cost ✗	Fixed cost ✗
3.	Music tapes used in instruction	Direct cost ✓	Variable cost ✓
4.	Utilities for the studio	Direct cost ✓	Variable cost ✓
5.	Part-time studio receptionist	Direct cost ✓	Fixed cost ✗
6.	Planning and development materials sent from the home office	Indirect cost ✓	Variable cost ✓
7.	Free lessons given by each studio as a promotion	Direct cost ✓	Fixed cost ✗
8.	Regional TV and radio advertisements placed several times a year	Indirect cost ✗	Fixed cost ✓

	Lessons as the Cost Object	Direct Cost or Indirect Cost	Variable Cost or Fixed Cost
1.	Each dancing instructor's salary	Direct cost ✓	Fixed cost ✓
2.	Manager's salary	Indirect cost ✓	Fixed cost ✓
3.	Music tapes used in instruction	Direct cost ✗	Variable cost ✗
4.	Utilities for the studio	Indirect cost ✓	Variable cost ✗
5.	Part-time studio receptionist	Indirect cost ✓	Fixed cost ✓
6.	Planning and development materials sent from the home office	Indirect cost ✓	Variable cost ✗
7.	Free lessons given by each studio as a promotion	Indirect cost ✓	Fixed cost ✓
8.	Regional TV and radio advertisements placed several times a year	Indirect cost ✓	Fixed cost ✓

Other indirect costs

Other indirect costs are the costs of facilities, equipment used to manufacture the product / provide the service, other support equipment.
All indirect costs are combined into a single cost pool called **overhead**. In a manufacturing firm, it is called **factory overhead**.

The three costs (direct materials, direct labor and factory overhead) are sometimes combined.

- **Prime costs** = direct materials + direct labor
- **Conversion cost** = direct labor + overhead

Cost drivers and cost behavior

Cost drivers provide two important roles for the management accountant:

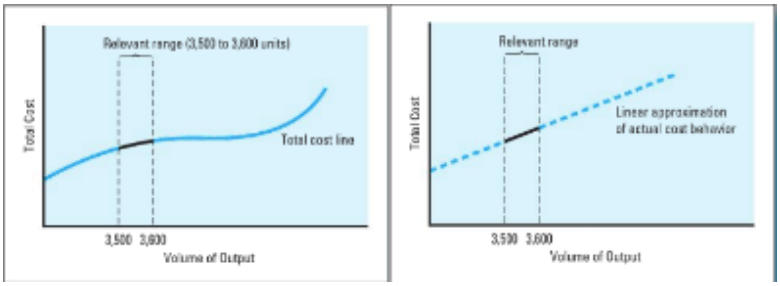
1. Enabling the assignment of cost objects
2. Explaining the cost behavior (how total costs change as the cost driver changes)

Cost management enables an understanding of how total cost of a cost object changes as cost driver changes. Cost drivers are categorized in four types:

1. **Activity-based cost drivers**
    a. Identified using activity-analysis
    b. Associated with given manufacturing activity (e.g. machine setup, product inspection, materials handling)
2. **Volume-based cost drivers**
    a. Developed at aggregated level, e.g. number of units produced, quantity of direct materials, hours of direct labor
    b. At low values for cost driver, costs increase at a decreasing rate (effect of learning: higher productivity at lower costs) = **increasing marginal productivity**
    c. Eventually, costs increase at a faster rate than productivity: **Law of diminishing marginal productivity** (at higher levels of the cost driver, costs begin to increase at an increasing rate)

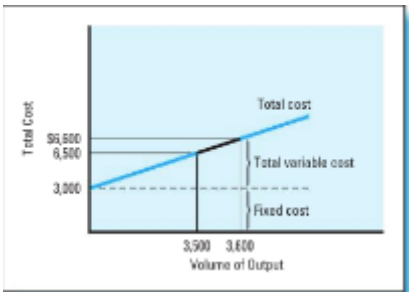
→ nonlinear cost relationship in general; however, we are mostly interested in only a small part (e.g. costs between 2500 and 2600 products)

The **relevant range** is the range of the cost driver in which the actual value of the cost driver is expected to fall and for which the relationship to total cost is assumed to be approx. linear.



3. **Structural and executional cost driver**
    a. Involve strategic and operational decisions.
    b. **Structural cost drivers** are strategic in nature because they involve decisions that have long-term effects on the firm's total costs.
        i. Scale decisions (Larger firms have lower overall costs due to economies of scale)
        ii. Experience decisions (Firms with employees with greater manufacturing or sales experience will likely to have lower development, manufacturing and distribution costs)
        iii. Technology decisions (New technologies can reduce design, manufacturing, distribution, customer service costs)
        iv. Complexity decisions (Firms with many products have higher costs of scheduling and managing production process)
    c. **Executional cost drivers** are factors that the firm can manage in the short-term operational decision making to reduce costs.
        i. Workforce empowerment
        ii. Design of the production process
        iii. Supplier relationship

Fixed and variable costs



Costs are not only classified whether they are direct or indirect but also whether they are **fixed** or **variable.**

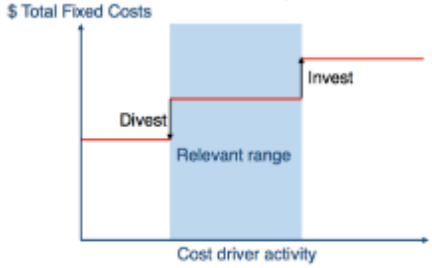
- **Fixed costs:** Don't change in proportion with volume of a cost driver, at least not within a relevant range (many indirect costs such as facility costs, depreciation, tax etc.)
- **Variable costs:** Change in proportion with volume of a cost driver, such as production or sales quantity (e.g. direct materials, direct labor)

Total fixed costs and unit variable costs are expected to remain approx. constant within the relevant range.

Mixed costs are total costs that include both fixed and variable costs.

	Fixed or variable	**If variable, which cost driver?**
Raw materials	Variable	Production volume
Depreciation	Fixed	
CEO compensation	Fixed (base salary) Variable (bonus system)	Sales volume
Assembly line labor	Fixed (in Europe) Variable (in China)	
Plant electricity	Fixed	
Salesforce commissions	Variable	Sales volume

Fixed costs over the long term



Relevant range = range in which the relationship between activity/volume level and the respective cost is constant

- When business activity declines, firms divest to eliminate excess capacity
- When business activity inclines, firms invest to increase capacity

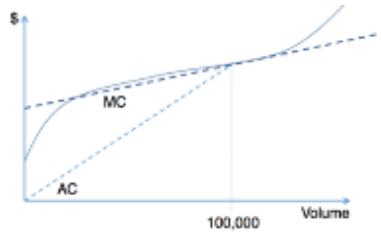
→ over the long term, fixed costs behave like **step-functions**

A **step cost** is a cost when it varies with the cost driver but does so in steps. E.g. clerical tasks are step costs, e.g. order filling or claims processing.

Total cost (TC) = FC + VC
The **Average cost (AC)** (also called unit cost) = TC/X.

- Unit fixed costs change as output changes
- Unit variable costs do not change as output changes

Marginal cost (MC): additional cost incurred in producing an additional unit of output
Slope of total cost function at output level of interest, i.e. first derivative = dTC/dX



Capacity vs. usage of costs

Costs that provide capacity *for* operations (e.g. plant building and equipment) = fixed costs vs. costs that are consumed *during* operations (e.g. direct materials and labor) = variable costs.

Different cost classifications for different purposes

Purpose	Cost classification
Understand cost behavior	Fixed vs. variable
Estimating costs of products, customers, divisions, processes	Direct vs. indirect
External financial reporting	Product/service vs period/operating
Internal decision making	Relevant vs irrelevant

Cost concepts for product and service costing

Product costs and period costs

Cost of goods sold is the cost of the product transferred to the income statement when inventory is sold.
Product costs for manufacturing firm include *only* the costs necessary to complete the product and the manufacturing step in the value chain:

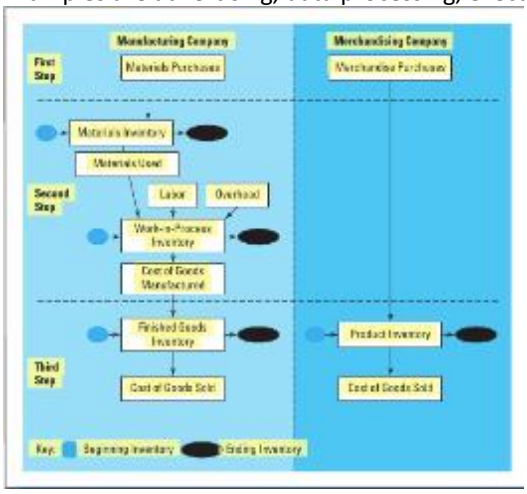
1. Direct materials (materials used to manufacture the product)
2. Direct labor
3. Factory overhead

The value chain of a manufacturer begins with the upstream activities of design, product development, and new product testing, and then moves to manufacturing, followed by downstream activities of distribution, sales, and customer service. Upstream and downstream costs are *not* included in the product costs.

Product costs for a merchandising firm include the cost to purchase the product plus the transportation costs paid by the retailer/wholesaler to get the product to the location from which it will be sold or distributed.

All other costs for managing the firm and selling the product are not product costs. They are expenses in the period in which they are incurred (= **period costs**). Period costs include general, selling, and administrative costs that are necessary for the management of the company but are *not* involved directly or indirectly in the manufacturing process.

Period costs = advertising + interest + office expense
Examples are advertising, data processing, executive, staff costs.



The **manufacturing firm** use three inventory accounts:

1) Materials inventory (contains the cost of the supply of the materials to be used in the manufacturing process)
2) Work-in-process inventory (contains all costs put into the manufacture of products that are started but not complete at the financial statement date)
3) Finished Goods inventory (costs of goods that are ready for sale)

Each account has its own beginning and ending inventory balance.

Inventory formula:
Beginning inventory + Cost added = Cost transferred out + Ending inventory

Inventory Accounting	Cost Added	Cost Transferred Out
Materials Inventory	Purchase of materials	Cost of materials used in production
Work-in-Process inventory	1. Cost of materials used 2. Labor cost 3. Overhead cost	Cost of goods manufactured
Finished goods inventory	Cost of goods manufactured	Cost of goods sold

Total manufacturing costs are the sum of materials used, labor and overhead.
Cost of goods manufactured is the cost of goods finished and transferred out of the Work-in-Process Inventory account this period.

Attributes of cost information

- **Accuracy**
  - Internal accounting controls is a set of policies and procedures that restrict and guide activities in the processing of financial data
- **Timeliness**
- **Cost and value of cost management information**

Periodic and perpetual inventory systems

- **Perpetual inventory system**
  - Updates Finished Goods Inventory account for each sales transaction
  - Most manufacturers and large retailers use this
- **Periodic inventory system**
  - Inventory is counted at the end of each accounting period
  - Keeps track of stolen, missing items

Companies often use both methods

TC = FC + VC

- AC: (also called unit cost) = TC / X
- Marginal cost (MC) = additional cost incurred in producing an additional unit of output
  - Slope of total cost function at output level, i.e. first derivative dTC / dX

Example: Rotterdam plant of SanDisk produces a USB stick

- Current volume is 100,000 USBs per month:
  - Price: €5.00 → revenue: €500,000
  - €3.00 variable cost per unit = €300,000 total variable cost
  - €150,000 fixed costs

Suppose, Media Markt buys 10,000 sticks at a price of 5€ every month. MM proposes to buy a one-time extra quantity of 2,000 sticks at a price of €4 each.

- Average costs of producing all 102,000 units?
  - 3€ variable costs per unit, 150,000€ fixed
  - (102,000 * 3 + 150,000) / 102,000 = €4,47 (looks like a bad deal)

→ however, the fixed costs have already been incurred in the first 100,000 units. Decision relevant are only the costs that are incurred to produce the additional 2,000 units

- total cost without extra units: 450,000
- total cost with extra order: 450,000 + 3*102,000 = 456,000
- change in total cost / change in volume = (456,000-450,000) / 2,000 = 3€ per stick
- the 3€ are the variable costs per extra stick → order is profitable, so accept it

→ as volume increases, total fixed costs are spread over more cost driver units

- marginal cost of producing one more unit doesn't change
- fixed cost 'per unit' is an artificial number

Additional factors to be considered:

- Will these additional units affect the €5 price of the 10,000 units?
- What is the alternative use of the excess capacity consumed by the 2000 USB?
- Would refusing the order hurt the business relationship with Media Markt?
- The plant has two divisions:
  - Production: rewards based on average cost per unit
  - Marketing: reward based on sales revenues
- Suppose that incremental cost of producing the 2000 extra sticks was €4.08 per unit (instead of 3€)
  - Average unit cost = €4.4918 (4.50€ * 100 000 + 4,08€ * 2000) / 102,000
  - 4.4918 < 4.50 so the performance of production increases by accepting the order
  - Marketing will also accept the order since the total revenues increase
  - However, the firm as a whole is worse off by accepting the order because the contribution margin decreases by €160 = 2,000 * (4,80-4.00)

Lecture 2 - CVP Analysis and Learning Curves

Recap

In 2015, turmoil in the oil market. Oil prices plummeted.
Why?

1. Iran as one contributor; Iran came on the market so that there was an increase in supply there
2. USA **frecking**: you can extract the oil faster; kicked of really in 2015

Why is **cost behavior** important?
In case of the oil market, accelerating production was the key cause in decreasing prices (increasing supply decreases prices)

- Especially US and Saudi Arabia, Iraq increased their production between 2008 and 2014
- Extracting oil in the middle east is very cheap (onshore)
- Extracting oil in USA is more expensive (oil extracted by frecking) variable costs of -$25 per barrel

What happens to shale production when oil price is between $25 and $65?
As fixed costs have already incurred, at a price of $50, they would still produce something but if this goes longer, then they would go out business
Newspaper: Half of US frecking industry could go bankrupt;
Why is US Shale not capitulating yet;

- Even though Saudi Arabia's strategy was to keep the prices down so that US would capitulate, this didn't work: Oil production remained profitable in 5 states in the US (even when price is below 30$)

Fixed costs and startups

When founding a start-up, fixed costs tend to be very high although sales level is very low. This is why start-ups go out of business really soon.
Solution: Make fixed costs more variable (e.g. commissions, employees get shares of the company)

Chapter 8 – Cost Estimation

Cost management information is critical in cost planning and decision making. For that, it is essential to have *accurate cost estimates*.

Strategic Role of Cost Estimation

Cost estimation = development of a well-defined relationship between a cost object and its cost drivers in order to be able to predict the cost.
It facilitates strategic management in:

1) Helps predicting future costs
2) Helps identifying key cost drivers for a cost object
3) Cost drivers and cost-estimating relationships are useful in planning and decision making

Using cost estimation to predict future costs

1. Facilitates strategy development and implementation
2. Facilitates planning and decision making
3. Facilitates target costing and pricing
4. Facilitates effective performance measurement, evaluation, and compensation

The cost estimation can be used for any of the four types of cost drivers:

1 Activity-based → Linear cost estimation methods
2 Volume-based → Linear cost estimation methods
3 Structural
   a. Decisions are long-term and have strategic impact on the firm;
   b. Technology and complexity: Activity-based costing: Linear methods
   c. Experience: Non-linear cost methods (e.g. experience effect when cost decrease with increased manufacturing experience = Learning curve)
   d. Scale (manufacturing similar products differing in size): Total manufacturing costs often increase more rapidly than increase in size of product → Non-linear cost estimation
4 Executional
   a. Decisions are long-term and have strategic impact on the firm;
   b. Technology and complexity: Activity-based costing: Linear methods
   c. Experience: Non-linear cost methods (e.g. experience effect when cost decrease with increased manufacturing experience = Learning curve)
   d. Scale (manufacturing similar products differing in size): Total manufacturing costs often increase more rapidly than increase in size of product → Non-linear cost estimation

Cost estimation is also being used to identify appropriate cost drivers.

Six steps of cost estimation

1. **Define cost object** (e.g. products manufactured in plant, individual manufacturing departments etc.)
   = Dependent variable (e.g. production costs)
2. **Determine cost drivers** (= causal factors in the estimation of the cost)
   = Independent variable (e.g. production quantity)
   a. **Cost to be estimated → Cost driver**
      Fuel expense for a delivery truck → Miles driven
      Heating expense for a building → Temperature outside the building
   b. Sometimes, there is not only one driver (e.g. fuel expense also depends on the weight, function of miles travelled, nature of delivery data)
3. **Collect consistent and accurate data on both variables**
   a. *Consistent*: Each period of data is calculated using the same accounting basis and all transactions are properly recorded in the period in which they occurred;
   b. *Accurate*: Depends on length of period (longer period reduces the number of data points available); depends on source (internal vs. external)
4. **Graph the data**
   a. By graphing, you can identify unusual patterns
5. Select and employ **estimation method**

a. Choose option with the best accuracy/cost trade-off
b. **High-low method** vs **regression method**

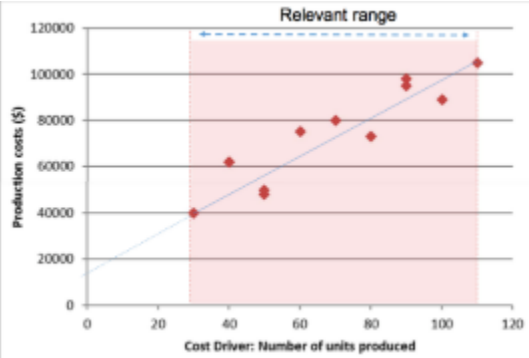
6. **Assess accuracy of cost estimate**
   a. Compare actual results over time
   b. Measure the errors (MAPE: Mean absolute percentage error)

Cost estimation methods

Example:
Following data on maintenance costs are available:

	January	February	March	April	May	June	July
Maintenance cost ($)	22,843	22,510	22,706	23,032	22,413	22,935	23,175

- **High-Low Method**
  - Based on a unique cost line (and not a rough estimate based on a view on the graph)
  - Permits to add information that might be useful in predicting maintenance costs: e.g. total operating hours



- $Y = a + (b * X)$

Y = value of estimated
a = **Intercept** = Fixed costs
b = **slope** of the line = Variable costs
X = **cost driver**

x-axis: Cost driver
y-axis: cost object (dependent variable)

$$\text{Slope} = \frac{\text{Cost}_{(\text{highest observation cost driver})} - \text{Cost}_{(\text{lowest observation cost driver})}}{\text{Highest observation cost driver} - \text{Lowest observation cost driver}}$$

$$\text{Intercept} = \text{Cost}_{(\text{highest observation cost driver})} - \text{slope} * \text{highest observation cost driver}$$

Afterwards: Plug in into $Y = a + (b * X)$

Advantage of high-low method:

- Requires management accountant to prepare and study a graph of the data (ensures that outliers and non-linearity are present in the data)
- Simplest method to calculate
- Provides a first overview between cost and cost driver

Disadvantage:

- sensitive to outliers
- Inefficient use of cost information

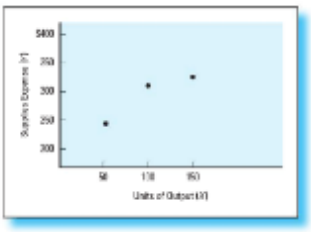
- **Regression analysis**
  - Measures the **average change in the dependent variable** (cost object) associated with a **unit change** in one or more **independent variable** (cost driver)
  - Fits data by minimizing the sum of the squares of the **estimation errors**: each error is the distance measured from the regression line to one of the data points) / minimizing the squared deviation from the regression line, called ordinary least squares (OLS)
  - Simple (multiple) linear regression uses only one (at least two) independent variables
  - Also called **least squares regression**
  - Two types of variables:

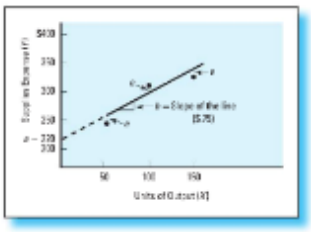
- Dependent variable = cost to be estimated
- Independent variable = cost driver used to estimate the value of the dependent variable
  - With 1 independent variable: Simple regression
  - With two or more independent variables: Multiple regression

- Y = a + bX + e

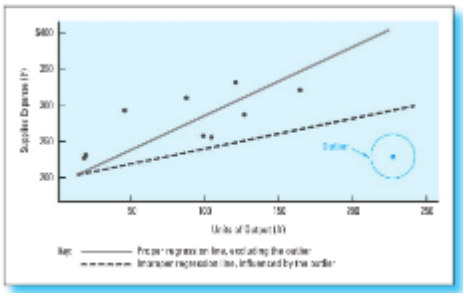
  Y = amount of the *dependent variable* (cost to be estimated)
  a = fixed quantity (intercept or constant term); Y when X is zero
  b = unit variable cost; *coefficient* of the independent variable (increase in Y, cost, for each unit increase in X, cost driver)
  X = value for the *independent variable*, cost driver for the cost to be estimated
  e = estimation error, the amount by which the regression prediction (Y = a + bX) differs from the data point

Month	Supplies Expense (Y)	Production Level (X)
1	$250	50 units
2	310	100
3	325	150
4	?	125





- Y = $220 + 0.75X
  For month 4: $220 + ($0.75+125) = $313.75



Advantage of regression analysis:

- Estimate that produces the least estimation error for the data
- Uses information from all available observations

Disadvantage of regression analysis:

- Strongly influenced by **outliers** (unusual data points)
- To prevent this: prepare a graph of the data prior using regression and determine whether any outliers are present

Choosing the dependent variable in regression analysis
Dependent variable = cost object

- At aggregate level, such as total maintenance costs for entire firm
- At detailed level, such as maintenance costs for each plant

Choosing the independent variable

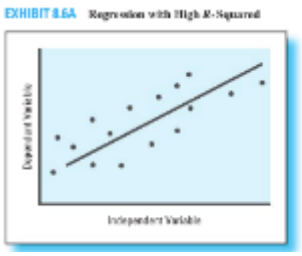
- Choose all financial, operational, other economic data that might be relevant for estimating the dependent variable
- Variables should 1) change when dependent variable changes, 2) not duplicate other independent variables
- **Dummy variable** = used to represent the presence or absence of a condition

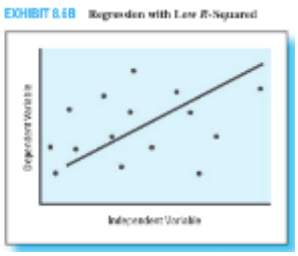
Selected Dependent Variables	Independent Variables	
	Financial Data	Operating Data
• Labor expense	• Wage rates • Sales	• Hours worked • Number of employees
• Utilities expense	• Sales	• Average daily temperature • Number of hours store is open
• General expenses: office supplies, cleaning, security, and repairs	• Sales • Total expense • Net fixed assets	• Number of employees

Evaluating a regression analysis
Regression analysis also provides quantitative measure of its precision and reliability.

- **Precision** = accuracy of the estimates from the regression
- **Reliability** = does regression reflect actual relationships among variables

<u>Key measures for regression analysis</u>

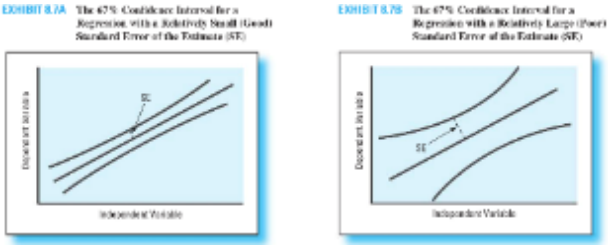




1. **R-Squared (coefficient of determination)**
    a. Goodness of fit
    b. Measures reliability of the regression
    c. Number between 0 and 1
    d. Indicates the explanatory power of the regression model, i.e. degree to which changes in the dependent variable can be explained by changes in the independent variable
    e. The *higher* R-squared, the *more reliable* the regression model
        i. On the graph: regression with high R-squared show data points lying near the regression line
        ii. Regression with low R-squared, data points are scattered

2. **The t-value**
    a. Measures reliability of each independent variable (measures validity of independent variable in predicting dependent variable)
    b. **Reliability** = degree to which an independent variable has a valid, stable, long-term relationship with the dependent variable
    c. **Calculation:** Divide coefficient (slope) by standard error
    d. Small t-value: little, no relationship between independent and dependent variables (in multiple regression model, remove variable with low t-value)
    The higher, the better predictor
        i. With two or more independent variables, low t-value as possible signal for **multicollinearity** (= two or more independent variables are highly correlated with each other), however, independent variables *should not be* correlated with each other, but rather independent from each other!
        ii. **Correlation** = Given variable tends to change predictably in the same (or opposite) direction for a given change in the other, correlated variable
        iii. With multicollinearity, regression estimates are unreliable (cost estimates of regression is reliable but the amount of the coefficient cannot be reliably interpreted as the per-unit cost driver)

3. **The standard error of the estimate (SE)**
    a. Measures precision, or accuracy, of the regression (measures dispersion of the actual observations)
    b. Can be used to determine a **range** (dispersion) around the regression estimate in which the unknown actual value for the estimate can be expected to fall in
    Range = **confidence interval** (range around the regression line within which the management accountant can be confident the actual value of the predicted cost will fall)
        i. 67% confidence interval: take regression line and identify a range that is 1 standard-error distance on either side of line
        ii. 95% confidence interval: take regression line and identify range that is 2 SE distance on either side of the line
        iii. e.g. if regression prediction is 4,500$ and the SE is 500$, then the 67% confidence interval is 4,500$ +/- 500$ → one can be 67% confident that the unknown value lies between 4,000$ and 5,000$.
    c. SE must be interpreted by its relationship to the average size of the dependent variable;
    If SE is small relative to dependent variable, precision is relatively good; threshold of approx. 5-10% of the average dependent variable



4. **The p-value**
    a. Measures reliability of the regression: measures risk that a particular independent variable has only a change relationship to the dependent variable or that there is no significant relationship
    b. Translation of t-value into probability that observed relationship is due to chance
    c. Desirable: Small p-value (small risk), often p-value of 0.05 or less

Economic plausibility requires subjective assessment of cause-effect relationship.

Examples for demonstrating the four measures

Analyzing maintenance costs (example continued)

1. Cost object: Maintenance costs
2. Cost driver: Operating hours
3. Collect data (see above)
4. Graph the data (see above)
5. Solve regression using regression software, such as Excel
    a. Y = $15,843 + ($2.02 * X)
    b. For August, 3,600 hours are expected, so that
    Y = $15,843 + ($2.02 * 3,600) = $23,115
    c. Statistical measures:
    R-squared: 0.461 → <0.5
    t-value: 2.07 (p= 0.09) → t>2.0, p>0.05
    SE = $221.71 → approx. 1% of dependent variable
    d. Although SE is very good, the rest is rather poor
    e. Analysis of the costs:
        i. In may: maintenance costs dropped significantly; operating hours experienced modest drop (drop was due to unusually poor economic conditions, therefore output was reduced and operating hours and maintenance costs fell accordingly)
        ii. Dummy variables introduced for 1 May **D**, value of 0
        Y = $16,467 + ($1.856 * X) – ($408.638 * D),
        for X = 3,600; Y = §23,149
        iii. Statistical measures:
        R-squared: 0.0772
        t-values: Hours: 2.60 (p=0.07)
        Dummy variable: -2.33 (p=0.07)
        SE = $161.27
        → Variables are improved, so this analysis will be taken

Times-series and cross-sectional regression

The preceding examples are time-series regression.

Time-series regression is the application of regression analysis to predict future amounts, using a prior period's data.

Cross-sectional regression estimates costs for a particular cost object based on information on other cost objects and variables, where the information for all variables is taken from the same period of time.

Implementation problems: Nonlinearity

So far, we assumed linear relationships between the variables. If data relationships are nonlinear, the linear regression estimates are unreliable.

Nonlinearity most often happens because of certain time-series patterns to the data such as trend/seasonality, outlier of the data, data shift.

Whereas the high-low method cannot be adapted to non-linearity, the regression analysis can.

Trend and/or seasonality

Use a method to deseasonalize or to detrend a variable. Common methods:

- Use of a price change index to adjust the values of each variable to some common time period
- Use of a trend variable (takes on values of 1, 2, 3… for each period in sequence
- Replacement of the original variables with the first differences (first difference for each variable Is the difference between each value and the succeeding value in the time series)

Outliers

Outliers should be corrected or adjusted (e.g. by using a dummy variable)

Data shift

If unusual business condition is long lasting (e.g. introduction of new product technology), average direction of the data has a distinct shift that should be included in the estimate.
Possible by using a dummy variable to indicate the periods before and after the shift.

Correlation ≠ Causation
Sometimes, there are spurious relationships but not really realistic.

Chapter 9 – Short-term profit planning: Cost-Volume-Profit (CVP) Analysis

CVP analysis is a method for analyzing how various operating and marketing decisions affect short-term profit based.
→ How does changes in cost and volume affect profitability?
It has many applications:

- Setting prices for products and services
- Deciding whether to introduce a new product or service
- Determine desirability of replacing a piece of equipment
- Determine break-even point
- Deciding whether to make or buy a given product or service
- Determining the best product mix
- Performing strategic 'what-if' analysis

Five factors important:

1. Variable cost per unit
2. Total fixed costs
3. Sales volume
4. Selling price per unit
5. Sales mix

The CVP model is: **Operating profit = Sales – Total costs**

- Operating profit is profit exclusive of unusual or nonrecurring items and is *before* tax (when there are no unusual or nonrecurring items, operating profit is simply before tax income, π_B

Operating profit = Sales – Variable costs – Fixed costs

- Replacing sales with the number of units sold times selling price per unit
- Replacing variable costs with number of items sold times variable cost per unit

Operating profit = (Units sold * Selling price per unit) – (Units sold * Variable cost per unit) – Fixed costs

For convenience, CVP Model:
π_P = (p * Q) – (v * Q) – F

Three additional concepts required:

1. **Contribution margin per unit:** difference between selling price per unit (p) and the variable cost per unit (v)
   Contribution margin per unit = p – v
   Measures the increase in operating profit for each unit increase in sales (if sales are expected to increase by 100 units, the operating profit should increase by 100 times the contribution margin per unit)
   represents the portion of sales revenue that contributes to the coverage of fixed costs, either per unit or total

2. **Total contribution margin**: contribution margin per unit multiplied by the number of units sold, Q
   Total contribution margin = (p – v) * Q

3. **Contribution margin ratio:** ratio of the contribution margin per unit to the selling price per unit
   Contribution margin ratio = (p – v) / p
   Identifies the projected increase (or decrease) in operating profit caused by a given increase (or decrease) in sales dollars
   CM ratio is the CM per euro of revenue

A useful way to show the information developed in CVP analysis is to use the **contribution income statement**.

	2016		2017			
	Amount	Percent	Amount	Percent	Change	Notes
Sales	$180,000	100.00%	$195,000	100.00%	$15,000	
Variable costs	84,000	46.67	91,000	46.67	7,000	
Total contribution margin	$ 96,000	53.33%	$104,000	53.33%	$ 8,000	53.33% is the contribution margin ratio
Fixed costs	60,000		60,000		0	
Operating profit	$ 36,000		$ 44,000		$ 8,000	$8,000 = 0.5333 × $15,000

- Puts focus on cost behaviour (separates fixed costs from variable costs), whereas the conventional income statement puts focus on cost type (product cost and non-product cost)
    - CVP income statement: subtract variable costs from sales to get to total contribution margin; fixed costs then subtracted to yield amount of operating profit for the period
    - Conventional income statement: product costs are subtracted from sales to get gross margin; total operating expenses are then subtracted to yield amount of operating profit

Strategic Role of the CVP analysis

CVP analysis can help the firm to execute its strategy by providing an understanding of how changes in its volume of sales affect costs and profits. Many firms (especially low cost leadership firms) compete by increasing volume (often through lower prices) to achieve lower total costs per unit. Reduction occurs by spreading fixed costs over more units of output.
CVP provides a means to predict the effect of sales growth on operating profit.

CVP analysis also has a role in strategic positioning.

- Firm's strategy: cost leadership
  CVP at manufacturing stage of cost life cycle; CVP should identify the most cost-effective manufacturing methods (automation, outsourcing, TQM)
- Firm's strategy: differentiation
  CVP analysis in early phases to assess the profitability of new products and desirability of new features for existing products

CVP Analysis for breakeven planning

The **breakeven point** is the point at which total revenues equal total costs, so that operating profit is zero.

Breakeven in Units, Q

$\pi_B = (p * Q) – (v * Q) – F$

Using the example from before and setting operating profit = 0:
0 = (75$ * Q) – (35$ * Q) – 5000$/month
0 = [(75-35) * Q] – 5000$/month
for Q = 125 units/month

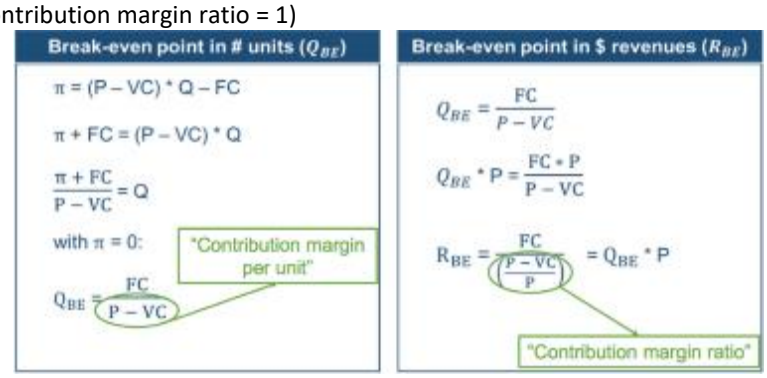
Here, the contribution margin was 40$ (75-35). Therefore, at sales of 125 units, the operating profit is zero, at 126 units, the operating profit is 40$. Using the contribution margin per unit gives us a quick way to estimate the change in operating profit for a change in the number of units sold.

Breakeven in Dollars, Y

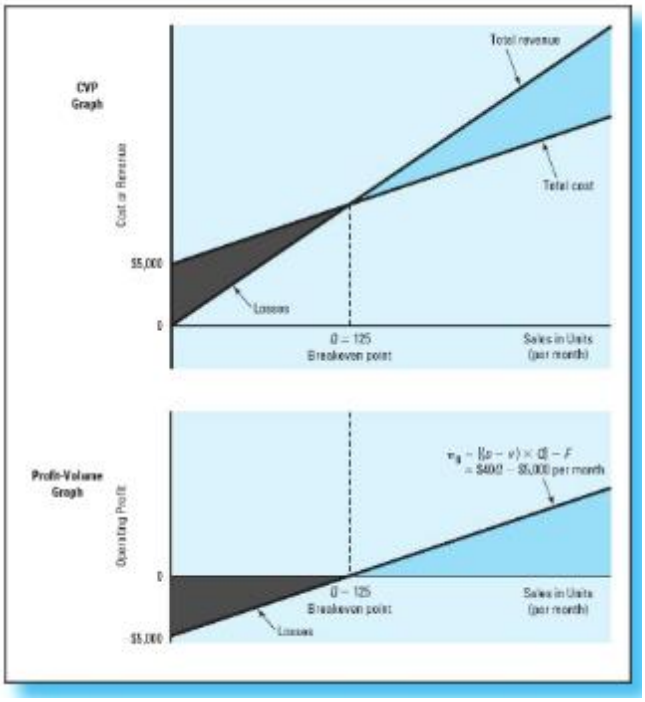
Solving for the breakeven point expressed in sales dollars:

- Indirectly (multiplying breakeven units by the selling price, p)
- Directly (use equation method in a revised form; Y = breakeven point in sales dollars)
    - Replace Q by Y/p (i.e. sales in dollars divided by selling price per unit = Q)
    - Operating profit = Sales – TVC – FC
      0 = (p * Q) – (v * Q) – F
      0 = [p * (Y/p)] – [v * (Y/p)] – F
      p * (Y/p) = [v * (Y/p)] + F
      Y = [(v/p) * Y] + F

- v/p: **variable cost ratio** (complement of the contribution margin ratio → variable cost ratio + contribution margin ratio = 1)



CVP Graph and the Profit-Volume Graph



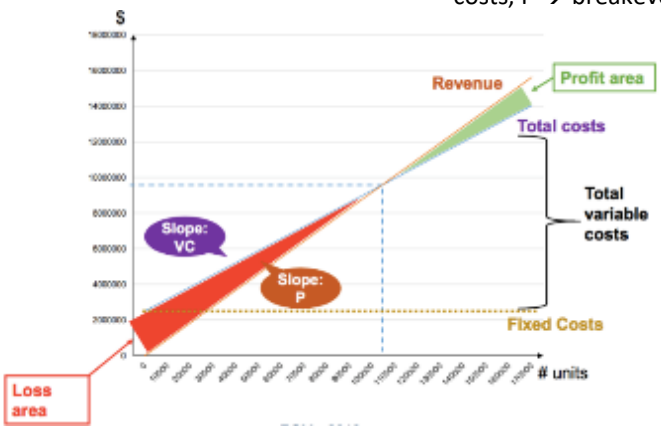
CVP graph illustrates how the levels of revenues and total costs change over different levels of sales volume expressed in units.

Slope of total revenue = selling price per unit, p
Slope of total costs = variable cost per unit, v

Profit-volume graph illustrates how the level of the operating profit changes over different levels of the sales volume, Q (at q=125, profit is 0)

Slope of the profit-volume line = contribution margin per unit, p-v

Breakeven point can be expressed as the volume level that produces just enough contribution margin to cover fixed costs, F → breakeven, when **Q * (p – v) = F**



CVP Analysis for Profit Planning

CVP analysis can be used to determine the level of sales needed to achieve a desired level of profit (either pre-tax or after-tax).

Net profit = Operating profit * (1 – tax rate)
Operating profit can be substituted by net profit in the CVP analysis by the following formula:

Operating profit = net profit / (1 – tax rate)

Revenue planning

Determine the revenue required to achieve a desired profit level.

$$\pi = (P - VC) * Q - FC$$

$$\pi + FC = (P - VC) * Q$$

$$\frac{\pi + FC}{P - VC} = Q$$

with $\pi = 0$:

$$Q_{BE} = \frac{FC}{P - VC}$$

with $\pi \neq 0$:

$$Q = \frac{FC + Profit}{P - VC}$$

Example: what is the sales volume required to achieve a pre-tax profit of 48,000$?

$\pi_B = (p * Q) – (v * Q) – F$

$Q = (F + \pi_B) / (p – v)$

Substitute $48,000 for profit and $60,000 for fixed costs

$Q = (60,000 + 48,000) / (75 – 35)/unit = 2,700$ units per year

In sales dollars, Y:

$Y = p * Q = \$75/unit * 2,700$ units/year = $202,500 per year

Cost planning

Here, the manager assumes that the sales volume and the desired profit are known. He wants to find the value of the required variable cost per unit, v, of the total fixed costs, F.

- Trade-offs between fixed and variable costs (Ex. 1)

See book p.306

CVP for determining the most cost-effective trade-off between different types of costs.

Assume HFI example: sales of 2,700 units per year.

Management considers purchasing a new machine that reduces variable cost per unit but increases total fixed costs by $7,250 per month.

How much must the variable cost per month fall to maintain current level of operating profit?

Q = 2,700 units

F = $5,000 + $2,250 per month = ($7,250 per month and $87,000 per year)

P = $75/unit

π_B = $48,000 per year

v = unknown (prev. $35)

$\pi_B = (p * Q) – (v * Q) – F$

$v = p – (F + \pi_B) / Q$

Solving for v gives $25.

In order to maintain operating profit, variable cost per unit must fall from $35 to $25.

- Trade-offs between fixed and variable costs (Ex. 2)

See book p.307

Breakeven analysis helps to identify **indifference point** (management would be indifferent between these two points)

Assume HFI example: company can choose between two machines:

Machine A: F = $5,000, v = $10/unit

Machine B: F = $15,000, v = $5/unit

Cost of machine A = Cost of machine B

$5,000 + ($10 * Q) = $15,000 + ($5 * Q)

Q = 2,000 units per year

→ if company produces more than 2,000 units per year, choose machine B; otherwise machine A

- Sales commissions and salaries (Ex. 3)

See book p. 308
Determine the most cost-effective means to manage selling costs (e.g. salary costs adding to the fixed costs and variable costs)

CVP analysis for activity-based costing (ABC)

The ABC approach is an alternative approach for constructing the CVP model. It identifies cost drivers for indirect cost activities (e.g. machine setup, materials handling, inspection, engineering)
In the CVP approach, on the other hand, the volume-based approach combines the costs of these activities and treats them as fixed costs.

- CVP approach differs from traditional volume based approach
- Activities can be classified into 4 levels:
  - **Unit** (volume-based, therefore treated same under volume-based and ABC-based CVP approach)
  - **Batch** (traditional CVP classifies as costs that do not vary with volume: fixed costs; Changes with number of batches → ABC based takes it into account)
  - **Product** (traditional CVP classifies as costs that do not vary with volume: fixed costs; Changes with number of products→ ABC based takes it into account)
  - **Facility** (traditional CVP classifies as costs that do not vary with volume: fixed costs in ABC-based and conventional CVP analysis)

Therefore, ABC-based CVP analysis alters the **batch** and **product** activities.

- Product-level cost (e.g. change in product design or features) is a cost that has a shorter planning period because these changes can be incorporated into the manufacturing process in a shorter period of time (often a year or less)
  - Planning period < several months, 1 year: product-level costs will not be considered as a cost that can change in either ABC-based or volume-based CVP
  - Planning period > several months, years: product-level changes may be included in the ABC-based CVP
- Batch-level costs can be altered in the short term, therefore, they have a short-term planning horizon

Check book p.311,312

Dealing with risk and uncertainty

The basic CVP model is said to be *deterministic* in nature. However, inputs for the CVP analysis are estimates of future values.

- **Uncertainty** means that a number of different values can exist for one or more of the variables in a decision model.
- **Risk** means the possibility of a loss or gain as a result of this uncertainty.

There are two models when dealing with risk and uncertainty: Sensitivity analysis and measures of operating risk.

Sensitivity analysis

This is a variety of methods that examine how an amount (e.g. operating profit) changes if factors involved in predicting the amount (e.g. sales volume) change.

- **"Basic" What-If analysis: Contribution margin and contribution margin ratio**

What-if analysis is the calculation of an amount given different levels of a factor that influences that amount.

Units Sold	Variable Cost per Unit	Fixed Cost	Selling Price per Unit	Operating Profit
1,500	$30	$60,000	$75	$ 7,500
1,500	35	60,000	75	—
1,500	40	60,000	75	−7,500
1,500	45	60,000	75	−15,000

Example: sensitivity of operating profit (variable of interest) to changes in v (variable cost per unit), holding all other variables constant.

- **Construction of decision tables and decision trees**

Include the following set of elements: set of managerial actions or decisions (e.g. choice of cost structure), set of events (e.g. level of demand for the company's product), set of outcomes (i.e. financial consequence of various combinations of actions and events).
After collecting all the information in a decision table or tree, we can calculate the *expected value* of each action (decision alternative).

- **Monte Carlo simulation** (p.314

Method of resampling values of factors (e.g. sales volume) in a model (e.g. CVP), according to some probability distribution, in order to generate a probability distribution of outcomes (e.g. operating profit).

1) Specify the form of probability distribution representing each factor in the CVO model
2) Choose the number of iterations in the simulations (number of independent draws from each probability distribution; normally at least 1000)

Margin of safety

The margin of safety (MOS) is the amount of planned (or actual) sales above the breakeven point.
MOS = Planned (or actual) sales – Breakeven sales

MOS in quantity, Q = Planned sales in units – breakeven quantity
MOS in sales dollars = breakeven quantity * price of unit

The margin of safety can also be expressed in ratio form (percentage of sales):
MOS ratio = MOS / Planned sales
1,500 / 3,000 = 0.5 (When everything is held constant, sales volume could fall from the planned level by 50% before losses start occurring)

MOS is a useful measure for comparing the risk of two or more alternative products (or decision alternatives). Product with a rel. low MOS is the riskier of the two products and therefore requires more management attention.

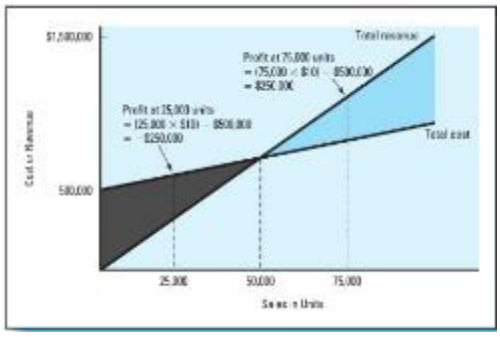
Operating leverage

Operating leverage is the extent to which the cost structure of an organization has fixed versus variable costs (the higher the amount of fixed costs, the higher the operating leverage, and the greater the sensitivity of operating income to sales volume).

Example: Two firms

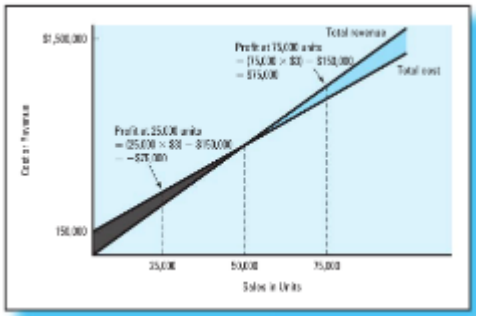
- Firm A: relatively low fixed costs, high variable costs (labor intensive firm)
  - Fixed costs/year = $500,000
  - Variable cost/unit = $2
  - Selling price/unit = $12
  - Contribution margin/unit = $10
- Firm B: high fixed costs, low variable firm (automated firm)
  - Fixed costs/year = $150,000
  - Variable cost/unit = $9
  - Selling price/unit = $12
  - Contribution margin/unit = $3

1) Graph for firm with high fixed costs:



Breakeven point: 50,000 units

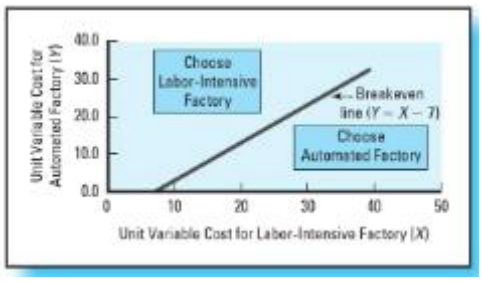
2) Graph for low fixed costs



Breakeven point: 50,000 units

→ although both have a breakeven point of 50,000 units, very different graph
e.g. at 25,000 units, the loss for firm with high fixed costs is high whereas the loss for the firm with low fixed costs is low;

Indifference points
Total cost of automated factory = Total cost of labor-intensive factory
$500,000 + (Y * 50,000) = $150,000 + (X * 50,000)
Y = X – 7



Firms with high fixed costs
are riskier;

Measuring the sensitivity of operating income can be done by the **degree of operating leverage (DOL)**.
At each volume level, Q: Contribution margin / Operating profit

For HFI example: At Q = 2,4000: DOL = $96,000 / $36,000 = 2.667
From this volume level (i.e. Q = 2,400), operating profit would increase by 2.667% for each percentage change in sales volume.

The five steps of strategic decision making for CVP Analysis

Book p.318

1. Determine the strategic issues surrounding the problem
2. Identify the alternative actions
3. Obtain the information and conduct an analysis of the decision alternatives
4. Based on strategy and analysis, choose and implement the desired alternative
5. Provide an ongoing evaluation of the effectiveness of implementation

CVP Analysis with two or more products/services

If fixed costs can be allocated to each product, company can construct a series of CVP models (one for each service).
If the products are sold in a particular **sales mix** (and the mix stays constant as total volume changes), then we can build a single CVP analysis model.

For these scenarios, we use the **average contribution margins** for bundles of products.

- **Weighted-average contribution margin per unit** (basis of sales volume)

Take the contribution margin per unit for a given product weighted by the sales mix percentage on relative *physical units* (not sales dollars) for the individual products.

Example: company sells two products, A and B, with corresponding per-unit contribution margin of $1 and $4. Sales mix is 50:50.
Weighted average contribution margin per unit = ($1 * 50%) + ($4 * 50%) = $2.50

- **Weighted-average contribution margin ratio** (basis of sales dollar)

Basis of relative *sales dollars;* basis of contribution margin ratio of the individual products weighted by sales mix (determined by relative sales dollars and not physical units).

Example: company sells two products, A and B; sales mix of 50:50; per-unit contribution margin of $1 and $4 and the unit selling prices are $4 and $6.
Weighted average contribution margin ratio = (25% * 0.4) + (66.667% * 0.6) = 50%

Multiproduct profit planning using the weighted-average contribution margin ratio (CMR)

Example:
Exp. Fixed costs = $168,000

	Calm	Windy	Gale	Total
Last period's sales	$750,000	$600,000	$150,000	$1,500,000
Percent of sales dollars	50%	40%	10%	100%
Last period's sales volume (units)	25,000	18,750	3,750	47,500
Percent of sales volume	52.63%	39.47%	7.90%	100%
Selling price per unit	$ 30	$ 32	$ 40	
Variable cost per unit	24	24	36	
Contribution margin per unit	$ 6	$ 8	$ 4	
Contribution margin ratio	0.20	0.25	0.10	

(percent of sales dollars and percent of sales volume = **sales mix**)

CMR = 0.5(0.2) + 0.4(0.25) + 0.1(0.1) = 0.21

The breakeven point in *dollars* for all three products can be calculated as:
Y = $168,000 / 0.21 = $800,000
(Company must have total sales of $800,000 to break even with its 3 products)

The sales for each product at the overall breakeven point are:
Calm: 0.5* $800,000 = $400,000 (13,334 jackets at $30)
Windy: 0.4* $800,000 = $320,000 (10,000 jackets at $20)
Gale: 0.1* $800,000 = $80,000 (2,000 jackets at $40)

The sale fo jackets in the assumed sales mix produces exactly the breakeven contribution margin of $168,000:
$6(13,334) + $8(2,000) + $4(2,000) = $168,000

Multiproduct profit planning using the weighted-average contribution margin per unit

Weighted-average contribution margin per unit:
0.5263($6.00) + 0.3947($8.00) + 0.790($4.00) = $6.63 (rounded)

Total breakeven units of 25,334 units:

For Calm	0.5263(25,334) = 13,334 jackets
For Windy	0.3947(25,334) = 10,000 jackets
For Gale	0.0790(25,334) = 2,000 jackets
Total	= 25,334 jackets

Multiproduct profit planning using the 'sales basket' approach

Construct a hypothetical 'basket' of products, in which each based consists of so many units of product #1, so many units of product #2, and so on. Then, we calculate either a weighted-average contribution margin per unit or a weighted-average contribution ratio.
Two step process:

1¶ Determine number of sales baskets needed to achieve profit target
2¶ Convert number of baskets to units of individual product based on the composition of each hypothetical sales basket

p. 321

Value stream accounting and CVP analysis

CVP Analysis for Not-for-profit (NFP) organizations

Learning curves

Example: Learning curves at Siemens
Throughout the years, the time needed for production decreased

- With little experience and high production = high variable costs (employees still need to learn how to use the resources efficiently)

A **learning curve analysis** is a systematic method for estimating costs when learning is present.

Learning curves show that resource consumption (direct labor, direct material) is <u>not</u> a linear function of output per time.

- Production efficiency increases as production quantity increases

The **cumulative average time learning model (CATLM)** shows that the *average time per unit declines* by a constant percentage each time the quantity of product *doubles.*

The **learning rate** is the percentage by which average time (or total time) falls from previous levels as output doubles.

$$Y_x = aX^b$$

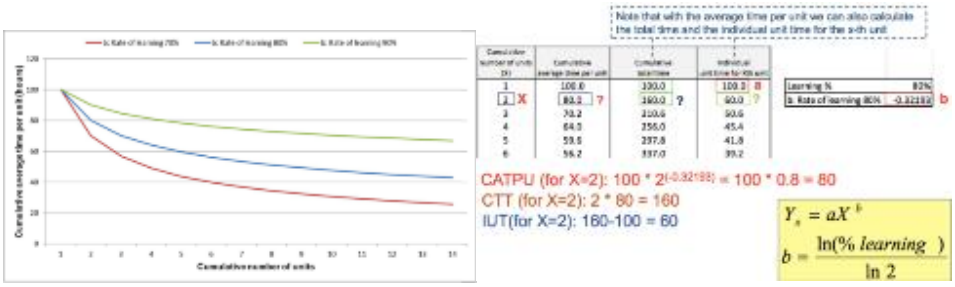
$$b = \frac{\ln(\%\ learning\ )}{\ln 2}$$

Y_x = Average time per unit
a = Time required to produce first unit
X = Number of units produced
b = Rate of learning

ln = Natural logarithm

Note 1: The smaller %learning, the faster the actual learning. 0 > %learning >= 1
Note 2: Because natural logarithm of number between 0 and 1 is always negative, and because ln(2) is a constant and positive, b will always negative (negative slope)

Learning rate = 1: No learning
Learning rate = 0.5: maximum learning rate possible



What decisions are influenced by learning?

- Cost-volume profit analysis
- Budgeting production levels and labor needs
- The make-or-buy decision
- Capital budgeting
- Preparation of bids for production contracts: target costing and life-cycle costing
- Development of standard product costs

Lecture 3 - Job-costing; Activity-based costing; allocation of support centers costs

Recap

Different cost classifications for different purposes

- Fixed vs. variable: Financial planning
- Direct vs. indirect: Estimating product/service costs
- Any non-diagonal combination is possible

- Variable & direct:
  - E.g. engine and tires (cost object: car)
  - Variable: making one more car requires one more part
  - Direct: we know how many of the parts a car needs
- Variable & indirect:
  - E.g. machine power of plant that makes several car types (cost object: car product line)
  - Variable: producing one car less leads to less power usage
  - Indirect: electricity costs are metered to plant, not product line
- Fixed & direct:
  - E.g. marketing for e-class (cost object: E-class product line)
  - Direct: advertisements for e-class only, not for other product lines
  - Fixed: spending is pre-committed, doesn't change with #cars
- Fixed & indirect:
  - E.g. tesla's battery R&D (cost object: car)
  - Fixed: R&D spending is pre-committed, doesn't change with #cars
  - Indirect: R&D benefits all Tesla models

Introduction to cost allocation

- Multi-product firms have to estimate the costs of each product
  - Total cost of a product = Sum(direct costs, indirect costs)
- **Direct costs** are easily traced to products, e.g.
  - Assembly line labor traced using employee time sheets
  - Components and material traced using bill of material
- **Indirect costs** are difficult to trace to products, e.g.
  - Costs of corporate support functions (HR, Finance)
  - Production overhead (maintenance, setting up machines, depreciation)
- Cost allocation is the process of assigning *indirect costs* to products
  - Indirect costs are allocated to products using cost drivers
  - Cost centers → cost drivers → products

The importance of cost allocation

- Product portfolio decisions
  - Allocate indirect costs to products to estimate product profitability
- Performance evaluation of business unit (BU) managers
  - Allocate support function costs to Bus to estimate BU performance
- Execute cost reduction programs
  - Deloitte (2016): 88% of firms pursue cost reduction over next 24 hours
  - Identifying activities causing indirect costs vital for successful cost reduction

Example: Harry Potter
Revenue: 938$ million
Production costs: 150$
Net profit: -167$ million
WB allocated dubious costs it would pay to itself, e.g. distribution, advertising and interest to the movie because screenwriter and actors often have a contract clause that they receive bonus based on movie's profit.

Chapter 4 – Job Costing

Costing systems

Costing is the process of accumulating, classifying, and assigning direct materials, direct labor, and factory overhead costs to cost objects, which most commonly are products, services, or projects.

What is the problem?
E.g. a home appliance manufacturer produces two products:
Washing machine and Dishwasher

- Direct costs are assembly labor and material
- Indirect cost include
    - Machine depreciation
    - Maintenance
    - Labor costs for setting up the machine
    - Labor costs involved in scheduling production and purchasing material
    - Packing and shipping
    - Engineering

When developing a particular costing system, the management accountant has to make three choices:

1. Costing accumulation method (job costing, process costing, joint costing)
    a. *At which level of detail do we want to accumulate production costs?*
2. Cost measurement method (actual, normal, standard costing)
    a. *How do we measure costs? At actual, normal or standard rates?*
3. Overhead application method (volume-based, activity-based)
    a. *How to we apply overhead costs to products?*

The choice depends on the nature of the industry and the product or service, the firm's strategy and management information needs costs and benefits of acquiring, designing, modifying, and operating a particular system.

Cost accumulation: Job or process costing?

Costs can be accumulated by tracing costs to a specific product or service or by accumulating the costs at the department level and then allocating them from department to the products or services.

- **Job costing system**
    - Cost object is a unit or multiple units (batch) of a distinct product, service or project called *job*
    - Traces costs to jobs
    - Different jobs with different amount of resource consumption
    - Appropriate when most costs can be readily identified with a specific product/batch of product, customer order, contract, or project
    - E.g. companies in manufacturing, construction, printing, special equipment manufacturing, shipbuilding, custom furniture manufacturing, professional services, medical services, advertising agencies, etc.
    - **Push method**: e.g. job consists of 20 units of a product planned for distribution to a warehouse for future sale
        - Fills the warehouse
    - **Pull method:** job consists of the quantity of products ordered by a customer
        - Based on direct customer demand

- **Process costing system**
    - Firms that produce one or a few homogenous products
    - Continuous mass production
    - Does not accumulate costs/job; instead, direct material, direct labor and overhead costs are accumulated at departmental level and then averaged to products
    - Industries such as chemical industry, bottling companies, plastics, food products, paper products (e.g. Coca-Cola)

Cost measurement: Actual, Normal, or Standard Costing?

- **Actual costing system**
  - Uses actual costs incurred for all product costs, including direct materials, direct labor and factory overhead
  - Actual costs = Actual direct costs rates * actual usage for the job
  - Overhead costs = actual overhead rate * actual usage for the job

- **Normal costing system**
  - Uses *actual costs* for direct materials and direct labor and *normal costs* (predetermined costs) for factory overhead
  - Normal costing estimates a portion of overhead to be assigned to each product as it is produced (provides a timely estimate of the cost of producing each product/job
  - Actual costs = actual direct cost rates * actual usage for the job
  - Overhead costs = budgeted overhead rate * actual usage for the job
  - Attention: Service firms usually use budgeted rates for direct labor costs and have no (significant) direct material costs

- **Standard costing system**
  - Uses standard costs and quantities for all three types of manufacturing costs
  - Standard costs are expected costs the firm should attain
  - Provides a basis for cost control, performance evaluation and process improvement.

	Types of Cost Used for		
Costing System	**Direct Materials**	**Direct Labor**	**Factory Overhead**
Actual costing	Actual cost	Actual cost	Actual cost
Normal costing	Actual cost	Actual cost	Estimated overhead cost (using predetermined rates)
Standard costing	Standard cost	Standard cost	Standard cost

Overhead application under normal costing

- **Volume-based product costing**
  - Use volume-based cost drivers to allocate overhead to products
  - Assumes each product uses same amounts of overhead
  - In a multiproduct firm, volume is better measured in terms of a common input factor, such as machine hours or direct labor hours
  - Overhead should be proportional to direct labor hours/machine hours needed to manufacture that good
- **Activity-based costing (ABC)**
  - Allocate overhead costs to products using cause-and-effect criteria with multiple cost drivers
  - Use both volume-based and non-volume-based cost drivers

- Shorter periods distort cost rates more due to fluctuations in nominator and denominator
- Longer period have bigger time lags before actual rate is known which makes them less useul for control purposes

→ **Budgeted** overhead rates are estimated at the beginning of the accounting period by estimating cost driver quantities and overhead costs

Rate = Estimated overhead costs / Estimated cost driver consumption

The strategic role of costing

Firms need accurate cost information, regardless of their competitive strategies. This is even more likely to be true for *cost leadership* firms as they rely heavily on manufacturing efficiency and quality to succeed.
Getting accurate and timely cost information requires that the firm chooses a cost system that is a good match for its competitive strategy.

E.g. a cost leadership firm that produces a commodity product is likely to be in a process industry (e.g. food or chemical processing); for that, *process costing* is a good fit; moreover, activity-based costing provides more accurate information than volume-based costing; it is also likely to choose more standard costing system to provide cost targets and regular reports.

Job costing: The cash flows

Job costing accumulates costs and assigns them to specific jobs, customers, projects, or contracts. The **job cost sheet** is the basic document supporting the costing method.

Direct and indirect materials costs

A **materials requisition** is an online data entry or a source document that the production department uses to request materials for the production.
In the example, the company used $1,500 in direct materials for the job. These costs are charged to work-in-progress inventory until the job is completed.

Work in progress: Debit
Materials inventory: Credit

The company also used some amount of indirect materials as part of the factory overhead cost.

Factory overhead: Debit
Materials inventory: Credit

Direct and indirect labor costs

Direct labor costs are recorded on the job cost sheet by means of a **time ticket** which shows the amount of time an employee worked on each job, the pay rate, and the total labor cost chargeable to each job.

Work-in-process inventory: Debit
Accrued Payroll: Credit

Indirect labor costs are treated as part of the total factory overhead. It includes items such as salaries for the supervisors, inspectors or warehouse clerks.

Factory overhead: Debit
Accrued Payroll: Credit

Factory overhead costs

Overhead application is a process of allocating factory overhead costs to jobs. We need allocation because overhead costs are not traceable to individual jobs.

Actual costing

An **actual costing system** uses actual costs incurred for direct materials and direct labor and records actual factory overhead for the jobs.
Actual factory overhead costs are incurred each month for indirect materials, indirect labor, and other indirect factory costs (including factory rent, insurance, property tax, depreciation, repairs, maintenance, power, light, heat, employer payroll taxes).

Factory overhead can also be called as manufacturing overhead, indirect manufacturing costs, production overhead, overhead.

The amount of actual overhead costs is not known until the end of the accounting period when total expenses are determined. Therefore, the actual costing system is often recorded for all of the company's jobs at the end of the accounting period. With actual costing, the company doesn't know the cost of the profitability of each job when it is completed during the period. If the company does require this when the job is completed, firms usually use normal rather than actual costing.

Normal costing

In a **normal costing system,** firms use actual costs for direct materials and direct labor and normal costs for factory overhead. The firm applies factory overhead to jobs by adding to the job an estimated amount of overhead for each unit of product in the job using a predetermined rate.
Normal costing avoids the fluctuations in cost per unit under actual costing resulting from changes in the month-to-month volume of units produced and changes in overhead costs from month to month.
By using a predetermined annual factory overhead rate, it normalizes overhead cost fluctuations.

The application of factory overhead in normal costing

The **predetermined factory overhead rate** is an estimated rate used to apply factory overhead costs to a specific job. It is determined from estimates of overhead costs and cost drivers for the upcoming operating period, usually coming fiscal year.
Four steps to find the rate:

1. Estimate total factory overhead costs for the upcoming operating period (usually a year)
2. Select the most appropriate cost driver for applying the factory overhead costs
3. Estimate the total amount of the chosen cost driver for the upcoming operating period
4. Predetermined overhead rate = Estimated factory overhead costs / estimated amount of the chosen cost driver

The **factory overhead applied** is the amount of overhead applied to a job using a predetermined factory overhead rate.

Cost drivers for factory overhead application

The cost drivers can be either volume-based (CH 4) or activity-based (CH 5) cost driver.
Direct labor costs, direct labor hours, and machine hours are the most frequently used volume-based cost drivers for applying factory overhead.

Applying factory overhead costs

The predetermined overhead rate usually is calculated at the beginning of the year and is used throughout the year.

POR = Estimated total factory overhead amount for the year / Estimated total amount of cost driver for the year

Example p.103
The **plantwide method of normal costing** uses the total overhead for all departments to determine the overhead rate. Alternatively, you can determine the overhead rate for each production department.

Departmental overhead rates

Use the *plantwide* method, when production departments in the plant are very similar as to the amount of overhead in each department and the usage of cost drivers in the departments.
In many cases, however, the departments have different amounts of cost and cost drivers.

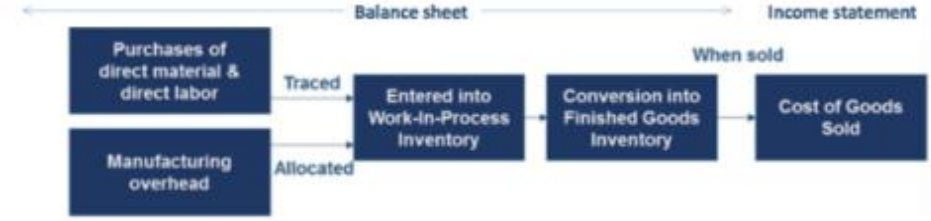
Disposition of under-applied and over-applied overhead

Using a predetermined overhead rate means that actual costs will rarely equal budgeted costs

- If allocated overhead < actual overhead, then overhead is **underallocated**
- If allocated overhead > actual overhead, then overhead is **overallocated**

Actual production costs should be reported in the period they were incurred. Total product costs at the end of the accounting period should be based on *actual* rather than *applied* overhead.
Under- and over-applied overhead can be disposed in two ways:

1. **Proration approach:** the difference is allocated between cost of goods sold, work-in-progress, and finished goods based on their relative sizes
2. **Write-off approach**: The difference is simply written off to cost of goods sold



End of period adjustment

Adjustment of Cost of Goods Sold

Imagine, company applied $200,000 overhead but found at the end of the year that the actual amount of overhead was $205,000. The difference of $5,000 is underapplied overhead.

Cost of goods sold: Debit $5,000
Factory overhead: Credit $5000
To record the disposition of underapplied overhead

At the time of adjusting entry, factory overhead account had a debit balance of $5,000 (incurred amount credited for 200,000 and factory overhead was debited by 205,000)

Potential errors in overhead application

Since application of overhead is based on estimates, it is subject to potential errors:

1) **Aggregation error**
    a. Arises when plantwide rate is used instead of departmental rates
    b. Always use departmental rates when departments differ significantly in the amount of cost or the amount of cost drivers
2) **Specification error**
    a. Arises when the wrong cost driver is used in the application rate
3) **Measurement error**
    a. Arises when the amounts used for estimated overhead or estimated cost drivers are incorrect
    b. Combination of estimation error and potential error in calculating the overhead and cost driver amounts

Job costing in service industries; project costing

Many service industries, such as advertising agencies, hospitals, repair shops, consulting, architecture, accounting and law firms use job costing.
Instead of talking about “jobs”, these companies talk about “clients”, “projects”, “cases”, “contract” etc. Therefore, many firms use the term *“project costing”*.
The methods for recording are similar to those earlier except for direct materials involved (there could be non or very little). The focus is on direct labor. The overhead costs are usually applied to jobs based on direct labor costs.

Example p106-107

Operation costing

Operation costing is a hybrid costing system that uses a job costing approach to assign direct material costs to jobs and a process costing approach to assign conversion costs to product or services.
For example, manufacturing firms use operation costing as their conversion activities are very similar across several product lines, but whose direct materials used in the various products differ significantly. After direct and factory overhead costs have been accumulated by operations or departments, the costs can then be assigned to products. On the other hand, direct materials costs are accumulated by jobs or batches, and job costing assigns these costs to products or services.

Industries for operation costing include food processing, textiles, shoes, furniture, metalworking, jewelry, and electronic equipment.

See example p108/109

Spoilage, rework, and scrap in job costing

Spoilage

Spoilage refers to unacceptable units that are discarded or sold for disposal value. There are two types of spoilage:

1. **Normal spoilage** occurs under normal operating conditions; it is uncontrollable in the short term and is considered as normal part of production and product costs
    a. **Specific normal spoilage**: particular to a given job; not due to factors related to other jobs
    b. **Common normal spoilage:** due to factors that affect two or more jobs (e.g. machine malfunction)
2. **Abnormal spoilage** is an excess over the amount of normal spoilage expected under normal operating conditions. It is charged as a loss to operations in the period detected.

Rework

Rework is the additional work performed to make non-conforming goods into good units that can be sold in regular channels.

1. Rework on normal defective units
2. Rework on normal defective units common with all jobs
3. Rework on abnormal defective units not falling within normal range

Scrap

Scrap is the material left over from the manufacturer of the product. It has little or no value. It can be classified to 1) a specific job, and 2) common to all jobs.

Chapter 5 – Activity-based costing and customer profitability analysis

You need to have accurate costs for
- Determining which of the products are most profitable
- Keep track of competitive bids for products and services

Accurate information helps a company to develop and execute its strategy.

The strategic role of activity-based costing

Activity-based costing (ABC) is a method for improving its accuracy of cost determination. It is used when the usage of activities is not proportional to the number of units produced.

Roles of volume-based costing

Volume-based costing is generally appropriate when common costs are relatively small or when activities supporting the production of the product or service are relatively homogenous across different product lines. For example, a firm that manufactures a limited range of paper products or a firm that produces a narrow range of agricultural products.

Activity-based costing

Resources are spent on activities. Products or services are the results of activities. Many resources can be traced to individual products and identified as **direct materials** or **direct labor** costs.
Most **overhead costs** relate only **indirectly** to final products or services.
In general, a costing system identifies costs with activities that consume resources and assigns resource costs to cost objects such as products, services, or intermediate cost pools based on activities performed for the cost object.

Activities → resource costs → cost objects

- Split up heterogeneous overhead into smaller pools of homogenous costs
- Identify activities that are carried out during manufacturing process and quantify use and costs
    - Business process analysis
    - E.g. materials acquisition, engineering, product inspection, setups, maintenance
- Allocate costs based on activity-based cost rates

Resources, activities, resource consumption cost drivers, and activity consumption cost drivers

An **activity** is a specific task, action, or unit of work done. It can be a single action or an aggregation of several actions. Examples are moving inventory or production setup. Activities are often listed in *activity dictionary*.

A **resource** is an economic element needed or consumed in performing activities. Examples are labor and supplies which are needed in performing manufacturing activities.

A **cost driver** is a factor that causes or relates to a change in the cost of an activity.
A cost driver is either *resource consumption cost driver* or *activity consumption cost driver*.

- **Resource consumption cost driver** is some measure of the demand for resources by an activity. It is the basis for assigning resource costs to a particular activity or to cost pool
    - E.g. number of items in a purchase or sales order, changes in product design, square feet to occupied space
- **Activity consumption cost driver** is a measure of the demand placed on the resources by products, services, or customers. It is used to assign activity cost pool costs to cost objects.
    - E.g. number of machine hours in the manufacturing of product X, number of batches used to manufacture product Y

What is activity-based costing?

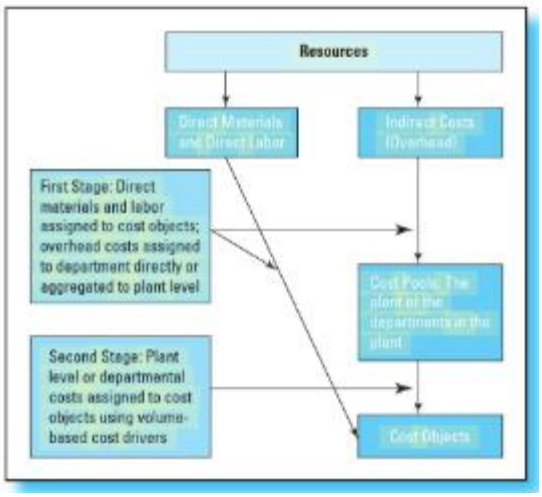
Activity-based costing (ABC) is a costing approach that assigns resource costs to cost objects such as products, services, or customer based on activities performed for cost objects.
Required is that a firm's products or services are the results of activities, and activities require resources, which have costs. ABC recognizes the causal or direct relationships between resource costs, cost drivers, activities, and cost objects in assigning costs to activities and then to cost objects.

ABC assigns factory overhead costs to cost objects such as products or services by identifying the resources and activities as well as their costs and amounts needed to produce output.

The two-stage cost assignment procedure

This procedure assigns resource costs (e.g. factory overhead) to activity cost pools and then to cost objects to determine the amount of resource costs for each of the cost objects.

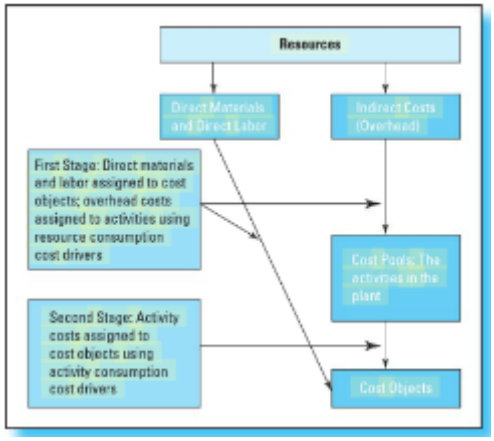
- Volume-based costing systems assign factory overhead costs first to plant or departmental cost pools and second to products or services



Stage 1 (volume-based costing):
Factory overhead costs are combined into a single plant cost pool or several departmental cost pools

Stage 2:
Volume-based rate (based on units produced or hours used in production) is used to apply overhead to each of the cost objects
However, volume-based costing is likely to distort product/service costs, especially in the second stage where a cost driver such as labor hours or output units is used to assign factory overhead costs. However not all products and services use equally portions of factory overhead resources, which leads to distortion.

ABC systems are different by linking uses of resources to activities and linking activity costs to products, services, customers.



Stage 1 (activity-based costing)
Assign factory overhead costs to activities by using appropriate resource consumption cost drivers

Stage 2:
Assign the costs of activities to cost objects using appropriate activity consumption cost drivers that measure the demands cost objects have for the activities.

By using cost drivers in the first and second stage, ABC provides more accurate measures.

Steps in developing ABC

1. Identify resource costs and activities
    a. Resource to perform an activity may come from different accounts or the resources are used by several operations
    b. Typical questions include “what work or activities do you do?”, “how much time do you spend performing these activities?”, “what resources are required?”
    c. **Levels of activities** (classify activities according to the way in which the activities consume resources)
        i. **Unit-level activity** is performed for each individual unit of product or service of the firm;
            1. Volume-based;
            2. Resource consumption driver and activity consumption driver are likely to be the same
        ii. **Batch-level activity** is performed for each batch, or group of products (e.g. setting up machines, placing purchase orders)

iii. **Product-level activity** supports the production of a specific type of product/service (e.g. designing products, purchasing parts required for the product)
iv. **Facility-level activity** supports operations in general and are not caused by products or customer service needs and cannot be traced to individual units, batches, or products (e.g. providing security for the plant, performing maintenance, factory property taxes, insurance)
    1. Referred to as business or infrastructure-sustaining activities
    2. E.g.

2. Assign resource costs to activities
    a. Choose resource consumption cost drivers based on cause-and-effect relationships
    b. Typical cost drivers:
        i. Labor hours for labor-intensive activities
        ii. Employees for payroll related activities
        iii. Setups for batch-related activities
        iv. Moves for materials-handling activities
        v. Machine hours for machine repair and maintenance
        vi. Square feet for general maintenance and cleaning activities
3. Assign activity costs to cost objects
    a. Cost objects are the outputs resulting from the firm's activities (typically products or services)

Benefits of activity-based costing

- Better profitability measure (ABC provides more accurate and informative product costs leading to more accurate customer and product profitability measures)
- Better decision making (with a more accurate measurement of activity-driving costs, management can make better decisions
- Process improvement (ABC provides guidance to identify areas where process improvement is required)
- Improved planning (better estimates of cost lead to better budgeting and planning)
- Cost of unused capacity (sometimes costs are incurred but not used, e.g. seasonal activities; with ABC one can identify unused capacity and maintain separate accounting for these costs)

Comparison between volume-based and activity based costing

Example p134

- **Volume-based costing**

It assigns factory overhead based on direct labor hours.
Factory overhead = $2,000,000
Direct labor hours = 100,000 hours
Overhead rate per direct labor hour = 2,000,000 / 100,000 = $20

The firm uses 25,000 direct labor hours to manufacture 5,000 units of AW:
Total overhead assigned to AW = $20 * 25,000 = $500,000
Number of units of AW = 5000
Factory overhead per unit of AW = $500,000 / 5000 = $100

Same for SZ
Total overhead assigned to SZ = $20 * 75,000 = $1,500,000
Number of units = 20
Factory overhead per unit of SZ = $1,500,000 / 20 = $75
Product profitability analysis:

	AW		SZ	
Unit selling price		$400		$200
Unit manufacturing cost:				
Direct materials and labor	$200		$80	
Factory overhead	100		75	
Cost per unit		300		155
Profit margin		$100		$ 45

- **Activity-based costing**

First, you have to assign activity costs to cost objects.

Activity	Budgeted Cost	Activity Consumption Cost Driver
Engineering	$ 125,000	Engineering hours
Setups	300,000	Number of setups
Machine operation	1,500,000	Machine hours
Packing	75,000	Number of packing orders
Total	$2,000,000	

Some operating data:

	AW	SZ	Total
Engineering hours	5,000	7,500	12,500
Number of setups	200	100	300
Machine hours	50,000	100,000	150,000
Number of packing orders	5,000	10,000	15,000

The cost driver rate for each consumption cost driver is calculated as:

(1) Activity Consumption Cost Driver	(2) Budgeted Cost	(3) Budgeted Activity Consumption	(4) = (2) ÷ (3) Activity Consumption Rate
Engineering hours	$ 125,000	12,500	$ 10 per hour
Number of setups	300,000	300	1,000 per setup
Machine hours	1,500,000	150,000	10 per hour
Number of packing orders	75,000	15,000	5 per order

Factory overhead for both products are:

AW (5,000 units)

(1) Activity Consumption Cost Driver	(2) Activity Consumption Rate	(3) Activity Consumption	(4) = (2) × (3) Total Overhead	(5) Overhead per Unit
Engineering hours	$ 10	5,000	$ 50,000	$ 10
Number of setups	1,000	200	200,000	40
Machine hours	10	50,000	500,000	100
Number of packing orders	5	5,000	25,000	5
Overhead cost per unit			$775,000	$155

SZ (20,000 units)

(1) Activity Consumption Cost Driver	(2) Activity Consumption Rate	(3) Activity Consumption	(4) = (2) × (3) Total Overhead	(5) Overhead per Unit
Engineering hours	$ 10	7,500	$ 75,000	$ 3.75
Number of setups	1,000	100	100,000	5.00
Machine hours	10	100,000	1,000,000	50.00
Number of packing orders	5	10,000	50,000	2.50
Overhead cost per unit			$1,225,000	$61.25

Product profitability analysis:

	AW		SZ	
Unit selling price		$400		$200.00
Unit manufacturing cost				
Direct materials and labor	$200		$80.00	
Factory overhead:				
Engineering	$ 10		$ 3.75	
Setups	40		5.00	
Machine running	100		50.00	
Packing	5	155	2.50	61.25
Cost per unit		355		141.25
Profit margin		$ 45		$ 58.75

Comparison of product costs and profit margin of volume-based and activity-based costing

→ Volume-based costing undercosts AW and overcosts SZ
(Over-/undercosting is also called **cross-subsidization**)

- Traditional volume based cost driver allocate too much overhead to high volume products
- Overcosting: A product consumes a low level of resources but is allocated high costs per unit
  - The overcosted (high volume) product absorbs too much costs, making it seem less profitable than it really is
- Undercosting: a product consumes a high level of resources but is allocated low costs per unit
  - Then undercosted (low volume) product is left with too little cost, making it seem more profitable than it really is

Calculating the cost of capacity in ABC

The ABC costs assigned to the cost objects are based on planned levels of spending and usage of capacity.

Practical capacity is the capacity available with the current resources of people, equipment and facilities – the reasonable level of output if the resource is fully utilized.

See example p138

Activity-based management

ABC costing can help management increase both the value customers receive and the profits to the firm through the use of activity-based management.
Activity-based management manages resources and activities to improve the value of products to customers and increase firm's competitiveness and profitability. Using ABC, management can identify ways to improve operations, reduce costs, and increase value to customers.

ABM can be categorized into 2 categories:

1. Operational ABM (enhances operational efficiency and asset utilization and lowers costs; focus on doing things right and performing efficiently)
2. Strategic ABM (choose appropriate activities for operation, eliminate non-essential activities, select most profitable customers)

Examples of activities required to sustain the organization are providing plant security and compliance with government regulations.

Value added analysis

A **process map** helps management to not miss any activities in the value-added analysis. It identifies each step that is currently involved in making a product or providing a service.
A **high-value-added activity** increases significantly the value of the product or service to the customers.
A **low-value-added activity** consumes time, resources, space but adds little in regard to satisfying customer needs.

Customer profitability analysis

ABC/M provides the basis for the customer profitability analysis. **Customer profitability analysis** identifies customer service activities and cost drivers and determines the profitability of each customer (group).
Customer service, here, includes all activities required to complete the sale and satisfy the customer (including advertising, sales calls, billing, collections, service calls, inquiries, etc.)
Customer profitability analysis allows managers to:

- Identify most profitable customers
- Manage each customer's cost-to-serve
- Introduce profitable new products, services
- Discontinue unprofitable products, services, customers
- Shift a customer's purchase mix toward higher-margin products and service lines
- Offer discounts to gain more volume with low costs-to-serve customers
- Choose types of after-sale services to provide

Customer cost analysis

Customer specific activities include order processing costs, billing, collection, payment processing costs, accounts receivable and carrying costs, customer service costs, selling and marketing costs.

Customer cost analysis identifies the activities and cost drivers related to servicing customers. Traditionally, these costs are hidden in the customer support, marketing, and sales function but with ABC/M, managers can understand these costs to serve customers.

Different activities have different cost drivers. Customer costs can be classified into the following:

- **Customer unit-level costs** (resources consumed for each unit sold to a customer, e.g. sales commissions, shipping costs, cost of restocking each sold unit)
- **Customer batch-level costs** (resources consumed for each sales transaction, e.g. order-processing costs, invoicing costs, recording of sales returns or allowances)
- **Customer-sustaining costs** (resources consumed to service a customer regardless of the number of products or batches sold, e.g. salespersons' travel costs to visit customers, monthly statement processing costs, collections costs for late payments)
- **Distribution-channel costs** (resources consumed in each distribution channel the firm uses to service customers, e.g. operating costs of regional warehouses, centralized distribution centers)

- **Sales-sustaining costs** (resources consumed to sustain sales and service activities that cannot be traced to an individual unit, batch, customer, or distribution channel, e.g. general corporate expenditures for sales activities, fringe benefits, bonuses)

Example:

Activity	**Cost Driver and Rate**	**Cost Category**
Order taking	$30 per order	Customer batch-level
Order Processing	$20 per order And $1 per item	Customer batch-level and Customer unit-level
Delivery	$100 per trip and $1 per mile	Customer batch-level Customer batch-level
Expedited order taking, processing and delivery	$800 per order	Customer batch-level
Customer visit	$200 per visit	Customer-sustaining

Customer profitability analysis

Customer profitability analysis combines customer revenues and customer costs analyses to assess the profitability of each customer and helps identify actions to increase it.
It provides valuable information for the assessment of customer value. Firms must weigh other relevant factors before determining the action appropriate for each customer. Relevant factors include:

- Growth potential of the customer, customer industry, and its cross-selling potential
- Possible reactions of the customer to changes in sales terms or services
- Importance of having the customer as future customer

Customer lifetime value

It is calculated as the net present value of the estimated future profits from the customer for a specified time (usually 3-5 years)

Implementation issues and extensions

Successful ABC/M implementation requires close cooperation among management accountants, engineers, manufacturing and operating managers.

Multistage activity-based costing

When some activities are intermediate cost objects for other activities, you need to calculate the **multistage activity-based costing.** Resource costs are assigned to certain activities which in turn are assigned to other activities before being assigned to the final cost objects.

Resource-consumption accounting (RCA)

Resource consumption accounting is generally new and uses an activity/process view but integrates marginal costs and a detailed resource consumption analysis to generate information for the decision support.
Its emphasis is on being able to attribute costs (fixed and proportional) to cost objects.
Three foundational concepts of RCA:

1. The view of resources (resources are the suppliers of capacity; capacity is a function of the resources available)
2. The quantity-based model (there is a causal relationship that can be expressed in terms of input and output)
3. Cost behavior (characteristics of the costs are inherent to the underlying resource and the consumption of those resources by value-creating operations)

RCA relies on attributable cost (attaching costs to a cost object only when causality exists).

Time-driven activity-based costing (TDABC)

It assigns resource costs directly to cost objects using the cost per time unit of supplying the resource (and not first assigning costs to activities and then from activities to cost objects).
It provides a direct way to measure unused capacity.

Chapter 7 – Cost allocation: Departments, joint products and by-products

With the growth of centralized services, new methods for allocating shared costs (costs that are shared among company's operating departments) are needed.
A **service department** is a unit of the organization that performs one or more support taska for production departments by supplying engineering services, information technology, quality control, HRM, etc.
The service department costs are allocated to the production departments, and then the costs of the production departments are allocated to the product.

Two types of joint costs:

1. Costs of production departments and service departments shared by two or more different products
2. Joint manufacturing costs for products that are not separately identifiable until some later point in the manufacturing process

Strategic role and objectives of cost allocation

There are four objectives:

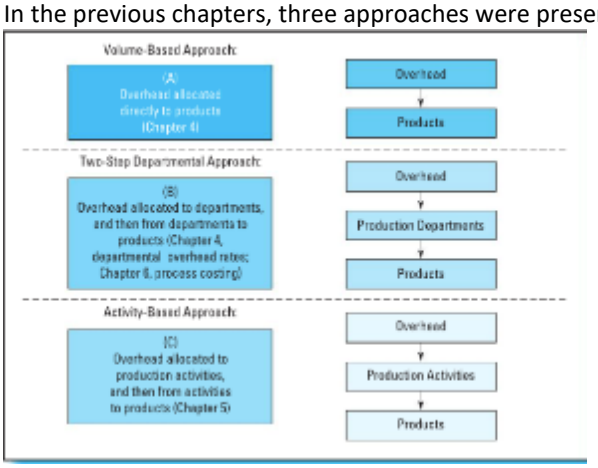
1 Determine accurate departmental and product costs (basis for evaluation of the cost efficiency of departments and profitability of different products)
   a. Must comply with financial reporting standards
2 Motivate managers to exert high level of effort to achieve goals of top management
3 Provide right incentive for managers to make decisions that are consistent with the goals of top management
4 Fairly determine the rewards earned by the managers for their effort and skill and for the effectiveness of their decision making
   a. Fairness when cost allocation is clear and consistently applied in determining manager's performance evaluation and compensation
   b. Most clear and unbiased basis is when cause-and-effect relationship exists
   c. When cause-and-effect is not possible, *ability-to-bear, benefit received*

Ethical issues of cost allocation

- Issues arise when costs are allocated to products or services that are produced for both a competitive market and a public agency or government department
- Equity or fair issue arises when a governmental unit reimburses the costs of a private institution or when it provides a good for the public
- Effect of chosen allocation method

Cost allocation to service and production departments

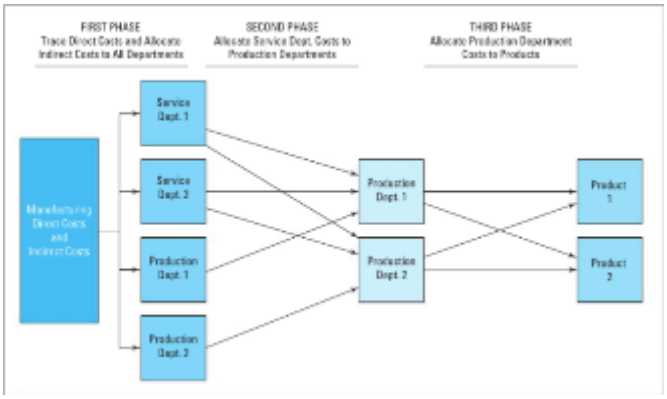
In the previous chapters, three approaches were presented:



Remember, the activity-based approach is much more accurate, however, it is uncommon to use when firm produces homogenous products

In the following, a more detailed method of the two-step departmental approach will be presented.
It distinguishes between production and service departments. Instead of 2 steps, the method has 3

1. Trace all direct manufacturing costs and allocate manufacturing overhead costs to both the service and production departments
2. Allocate service department costs to the production departments
3. Allocate the production department costs to the products



- Direct manufacturing costs = wages, materials that can be directly traced to a department
- Direct labor and materials used in a service department would be traced to that service department

Indirect costs (manufacturing, overhead) are indirect materials and indirect labor costs that are allocated by means of a predetermined cost driver to the departments that use those resources.
Cost drivers commonly used in departmental cost allocation are labor house, machine hours, head count, square feet of space in the department etc.

	Service Department 1	Service Department 2	Production Department 1	Production Department 2	Total Hours	Total Amount
Labor hours	1,800	1,200	3,600	5,400	12,000	
Machine hours	320	160	1,120	1,600	3,200	
Direct costs	$1,600	$5,500	$15,500	$13,400		$36,000
Indirect labor			Not traceable			25,000
Indirect materials			Not traceable			5,000
						$66,000

Phase 1: Trace direct costs and allocate indirect costs to all departments

Departmental Allocation Bases	All Departments: Service Department 1	Service Department 2	Production Department 1	Production Department 2	Total
Direct labor hours	1,800	1,200	3,600	5,400	12,000
Percent	15%	10%	30%	45%	100%
Machine hours	320	160	1,120	1,600	3,200
Percent	10%	5%	35%	50%	100%
First Phase: Trace Direct Costs and Allocate Indirect Costs to All Departments					
Direct costs	$1,600	$5,500	$15,500	$13,400	$36,000
Allocate indirect costs to departments:					
Indirect labor cost	3,750 = 15% × $25,000	2,500 = 10% × $25,000	7,500 = 30% × $25,000	11,250 = 45% × $25,000	25,000
Indirect materials cost	500 10% × $5,000	250 5% × $5,000	1,750 35% × $5,000	2,500 50% × $5,000	5,000
Totals for all departments	$5,850	$8,250	$24,750	$27,150	$66,000

- Total direct costs of $36,000 are traced to the four departments
- Overhead costs are allocating using labor hours (for indirect labor) and machine hours (for indirect materials)
- The $25,000 indirect labor is allocated using the labor hours allocation base

Phase 2: Allocate service department costs to the producing departments

Most complex because services can flow back and forth between the service departments (= **reciprocal flows**). The percentage of service relationships is commonly determined by reference to the labor hours, units processed or other methods that best reflects the service provided in the departments.

In the example, the service flow percentages for each service department are determined according to the labor hours used for services provided to the other service department and to the production departments.

	To			
From	Service Department 1	Service Department 2	Production Department 1	Production Department 2
Service Department 1	—	40%	30%	30%
Service Department 2	10%	—	30	60

There are three common methods to allocate costs in the second phase:

1) **The direct method**

By using the service flows only to production departments determining each production department's share of that service (ignore reciprocal flows).

For service department 1:
30% + 30% = 60%

Production department 1's share: 30% / 60% = 50%
Production department 2's share: 30% / 60% = 50%

For service department 2:
30% + 60% = 90%
Production department 1's share: 30% / 90% = 33.33%
Production department 2's share: 60% / 90% = 66.67%

These percentages are used to allocate the costs from service departments to production departments:

Second Phase: Allocate Service Department Costs to Production Departments

Direct Method		Production Department 1	Production Department 2	Total
Service Department 1	Service % to producing dept.	30%	30%	
	Allocation % per direct method	50% = 30 ÷ (30 + 30)	50% = 30 ÷ (30 + 30)	
	Allocation amount	$2,925 = 50% × $5,850	$2,925 = 50% × $5,850	$ 5,850
Service Department 2	Service % to producing dept.	30%	60%	
	Allocation % per direct method	33.3333% = 30 ÷ (30 + 60)	66.6667% = 60 ÷ (30 + 60)	
	Allocation amount	2,750 = 33.3333% × $8,250	5,500 = 66.6667% × $8,250	8,250
Plus: First-phase allocation		24,750	27,150	51,900
Totals for production departments		$30,425	$35,575	$66,000

2) **The step method**

Usage of sequence of steps in allocating service department costs to production departments.
Step 1: One service department is selected to be allocated fully (to the other service department and to each production department). The department to be allocated usually chosen because it provides the most service to other service departments.
In the example: service department 1 provides most service (40%); Service department 2 is then allocated to the production departments *same* as the *direct method*

Second Phase: Allocate Service Department Costs to Production Departments: Using the Step Method

	Service Department 2	Production Department 1	Production Department 2	Total
First Step				
Service Department 1				
Service percent	40%	30%	30%	
Amount	$2,340 = 40% × $5,850	$ 1,755 = 30% × $5,850	$ 1,755 = 30% × $5,850	$ 5,850
Second Step				
Service Department 2				
Service percent		30%	60%	
Allocation percent per direct method		33.3333	66.6667	
Amount	10,590 = $8,250 + $2,340	3,530 = 33.3333% × $10,590	7,060 = 66.6667% × $10,590	8,250 (= 3,530 + 7,060 − 2,340)
Plus: First-phase allocation		24,750	27,150	51,900
Totals for production departments		$30,035	$35,965	$66,000

3) **The reciprocal method**

As it considers all reciprocal flows, it is the most accurate method. It uses simultaneous equations:

Allocated S1 costs = Initial allocation + cost allocated from S2
$5,850 + (10% * S2)
Allocated S2 costs = Initial allocation + costs allocated from S1
$8,250 + (40% * S1)

Solve for S1 and S2:
S1 = $6,953.13 and S2 = $11,031.25
These values then are allocated to the producing departments using the percentage service amounts for each department

Second Phase: Allocate Service Department Costs to Production Departments Using the Reciprocal Method

First: Solve the simultaneous equations for Service Department 1 and Service Department 2 (see text):

Amount allocated from service department 1	$ 6,953.13
Amount allocated from service department 2	$11,031.25

	Production Department 1	Production Department 2	Total
Second: Allocate to producing departments			
Service Department 1			
Service %	30%	30%	
Allocated amount	$2,086 = 30% × $6,953	$2,086 = 30% × $6,953	$ 4,172
Service Department 2			
Service %	30%	60%	
Allocated amount	3,309 = 30% × $11,031	6,619 = 60% × $11,031	9,928
Plus: Costs allocated in first phase	24,750	27,150	51,900
Totals for production departments	$30,145	$35,855	$66,000

- allocation in the second phase is based on actual service percentages for each production department

Phase 3: Allocate production department costs to products

1) **The direct method**

Allocation from production departments to products is typically based on number of labor hours or machine hours used in the production department that produce the products.

Third Phase: Allocate Production Department Costs to Products

1. Allocation Base	Product 1	Product 2	
Base: labor hours			
Hours	1,800	1,800	3,600
Percent	50%	50%	
Machine hours			
Hours	400	1,200	1,600
Percent	25%	75%	
2. Cost Allocation to Products			
Production Department 1 (labor hours basis)	$15,212.50 = 50% × $30,425	$15,212.50 = 50% × $30,425	
Production Department 2 (machine hours basis)	8,893.75 = 25% × $35,575	26,681.25 = 75% × $35,575	
Totals for each product	$24,106.25	$41,893.75	$66,000

2) **The step method**

Same as the direct method:

Third Phase: Allocate Production Department Costs to Products

1. Allocation Base	Product 1	Product 2	
Labor hours			
Hours	1,800	1,800	3,600
Percentage	50%	50%	
Machine hours			
Hours	400	1,200	1,600
Percentage	25%	75%	
2. Cost Allocation to Products			
Production Department 1 (labor hours basis)	$ 15,017.50 = 50% × $30,035	$15,017.50 = 50% × $30,035	
Production Department 2 (machine hours basis)	8,991.25 = 25% × $35,965	26,973.75 = 75% × $35,965	
Totals for each product	$ 24,008.75	$41,991.25	$66,000

3) **The reciprocal method**

Second Phase: Allocate Service Department Costs to Production Departments Using the Reciprocal Method

First: Solve the simultaneous equations for Service Department 1 and Service Department 2 (see text):

Amount allocated from service department 1	$ 6,953.13
Amount allocated from service department 2	$11,031.25

	Production Department 1	Production Department 2	Total
Second: Allocate to producing departments			
Service Department 1			
Service %	30%	30%	
Allocated amount	$2,086 = 30% × $6,953	$2,086 = 30% × $6,953	$ 4,172
Service Department 2			
Service %	30%	60%	
Allocated amount	3,309 = 30% × $11,031	6,619 = 60% × $11,031	9,928
Plus: Costs allocated in first phase	24,750	27,150	51,900
Totals for production departments	$30,145	$35,855	$66,000

Implementation issues

Key issue is the choice of the method to be used. The reciprocal method is the most accurate and most complete.

Additional issues:

1) Distinctive effects when the allocation base is unrelated to usage

	Department A	Department B	Total Maintenance Cost
Panel 1: Basic information			
Square feet of floor space	5,000	5,000	
Average number of maintenance requests	50	50	
Total maintenance costs			$200,000
Panel 2: Maintenance cost allocation in an average month using square feet of floor space or number of requests:			
Allocated maintenance cost	$100,000	$100,000	$200,000
Panel 3: Here we consider maintenance cost allocation based on square feet for a month when department A increases usage of maintenance from 50 to 80 maintenance requests, while department B's usage remains the same at 50 requests. For simplicity, assume that maintenance costs are variable with the number of maintenance requests, or $2,000 per request ($200,000 ÷ (50 + 50)), so that total maintenance costs increase to $260,000 [$2,000 × (50 + 80)]. The allocation based on square feet and number of requests is compared below:			
Number of maintenance requests	80	50	
Allocation of maintenance costs based on square feet	$130,000	$130,000	$260,000
Allocated maintenance cost based on number of maintenance requests	$2,000 × 80 = $160,000	$2,000 × 50 = $100,000	$260,000

e.g. usage of square feet of floor space: department has no incentives to limit its use of maintenance expense

2) Disincentive effects when the allocation base is actual usage

When cost allocation base is determined from actual usage, disincentives can arise because the usage of resource by one department will affect the cost allocation to other departments

	Department A	Department B	Total Maintenance Cost
Panel 1: Basic information			
Actual number of maintenance requests	50	50	
Total maintenance costs			$200,000
Panel 2: Assume that maintenance costs are $100,000 fixed cost and $1,000 variable costs per request. The allocation base is $2,000 per request; $100,000 ÷ (50 + 50) × $1,000 = $200,000; $200,000 ÷ 100 = $2,000 per request.			
Allocated maintenance cost:	$100,000 − $2,000 × 50	$100,000 − $2,000 × 50	$200,000
Panel 3: Department A increases its usage to 80 requests, while department B continues to use 50 requests, for a total of 130 requests. Now total maintenance costs = $100,000 fixed cost plus $1,000 × 130 requests = $230,000; $230,000 ÷ 130 = $1,769.23 per request.			
Allocated maintenance cost based on requests:	$1,769.23 × 80 = $141,538	$1,769.23 × 50 = $88,462	$230,000
The outcome is that, while department B has not changed its usage of maintenance, its allocated costs have decreased; and department A's allocation has increased, but not at the rate of the increase in number of requests. Department B benefits from the fact that increased usage of maintenance reduces the per-request charge from $2,000 to $1,769.23 – variable costs are the same per request, but the $100,000 fixed cost is allocated over more requests. The result may not be satisfying to department A, which sees department B benefit from department A's increased usage.			
Panel 4: Similar to Panel 3, except that department A **reduces** its usage of maintenance to 30 requests, for a total of 80 requests for the two departments. Now total maintenance costs = $100,000 + $1,000 × (30 + 50) = $180,000; $180,000 ÷ 80 = $2,250 per request.			
Allocated maintenance costs based on requests:	$2,250 × 30 = $67,500	$2,250 × 50 = $112,500	$180,000
The outcome is that, while department B has not changed its usage of maintenance, its allocated costs have increased; and department A's allocation has decreased, but not at the rate of the decrease in number of requests. Department B suffers from the fact that decreased usage of maintenance in department A increases the per-request charge from $2,000 to $2,250. While department B has not changed its usage, its cost increases because of department A's decreased usage.			

in panel 3 and 4: cost allocation changes if usage of one of the department changes

Disincentives can be solved by **dual allocation** which separates fixed and variable costs and traces variable costs to the departments based on actual usage. Fixed costs are allocated based on either equal share among departments of a predetermined budgeted proportion

	Department A	Department B	Total Maintenance Cost
Panel 1: Basic information			
Actual number of maintenance requests	50	50	
Total maintenance costs			$200,000
Panel 2: Assume that maintenance costs are mixed; $100,000 fixed and $1,000 variable per request. The allocation base is $2,000 per request; $100,000 ÷ (50 + 50) × $1,000 = $200,000; $200,000 ÷ 100 = $2,000 per request.			
Allocated maintenance cost:	$100,000 − $2,000 × 50	$100,000 − $2,000 × 50	$200,000
Panel 3 (Dual allocation; fixed costs shared equally): Department A increases its usage to 80 requests, while department B continues to use 50 requests. Now total maintenance costs = $100,000 fixed cost plus $1,000 × 130 requests = $230,000. This method allocates fixed costs equally between the departments and variable cost based on usage.			
Allocated maintenance cost:	$50,000 + ($1,000 × 80) = $130,000	$50,000 + ($1,000 × 50) = $100,000	$230,000
The outcome is that department B's cost has not changed and department A's increase is in proportion to its increased usage. The result should be satisfying to both department A and department B.			
Panel 4 (Dual allocation; budget-based allocation of fixed costs): Assume, as in Panel 3 above, that department A increases its usage to 80 requests, while department B continues to use 50 requests. Now total maintenance costs = $100,000 fixed cost plus $1,000 × 130 requests = $230,000. Budget-based allocation uses a predetermined budgeted amount of usage to allocate the fixed costs; in this example we budget 60 requests for department A and 40 requests for department B. Thus, fixed costs are allocated $60,000 to department A and $40,000 to department B.			
Allocated maintenance cost:	$60,000 + ($1,000 × 80) = $140,000	$40,000 + ($1,000 × 50) = $90,000	$230,000
This outcome could be preferred to that of Panel 3 above, if the actual usage of the department were to fluctuate from period to period, but the long-term average usage of the resources by department A and department B is 60% and 40%, respectively.			

3) Disincentive effects when allocated costs exceed external purchase costs

Sometimes the methods allocate a higher cost for the service than the department would pay if it would get the service from outside supplier.
Allocation should be based on the cost obtaining the service outside the firm

(A) User Department	(B) Direct Labor Hours	(C) Direct Labor Hours Allocation Base	(D) Cost Allocation Based on Labor Hours	(E) Outside Price	(F) Allocation Base for Outside Price	(G) Allocation Based on Outside Price
A	3,000	30% (3,000 ÷ 10,000)	$ 300 (30% × $1,000)	$ 360	30% (360 ÷ 1,200)	$ 300 (30% × $1,000)
B	4,000	40% (4,000 ÷ 10,000)	400 (40% × $1,000)	600	50% (600 ÷ 1,200)	500 (50% × $1,000)
C	1,000	10% (1,000 ÷ 10,000)	100 (10% × $1,000)	120	10% (120 ÷ 1,200)	100 (10% × $1,000)
D	2,000	20% (2,000 ÷ 10,000)	200 (20% × $1,000)	120	10% (120 ÷ 1,200)	100 (10% × $1,000)
Total	10,000		$1,000	$1,200		$1,000

Cost allocation in service industries

The methods are equal in manufacturing, service or not-for-profit organizations that incur joint costs.
P229

Joint product costing

Many plants yield more than one product from a joint manufacturing process. A **joint production process** is one that yields multiple outputs from a common resource input. **Joint products** are products from a joint production process that have relatively substantial sales values. Products whose total sales are minor in comparison to the sales value of the joint products are **by-products**.
Both of these products start as part of the same raw material. In the first couple of phases, no distinction can be made until the **split-off point.** Afterwards, separate production processes can be applied to individual products. At the split-off point, joint products or by-products might be saleable or require further processing to be saleable.

Joint costs include all manufacturing costs incurred prior to the split-off point (direct materials, direct labor, factory overhead). These costs are allocated among the joint products. Additional costs incurred after the split-off point that can be identified directly with individual products are **separable processing costs**. Other outputs of joint production include scrap, waste, spoilage, defective units.

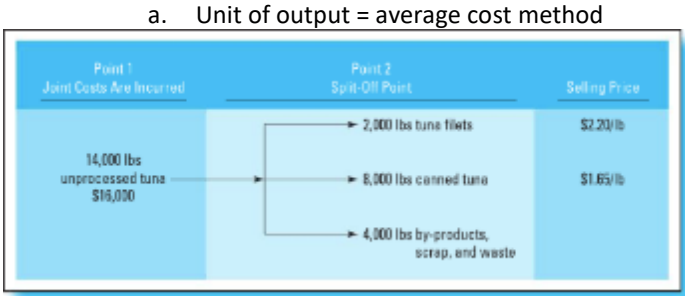
- Scrap = residue from production process with little or no value
- Waste = residue from production process with no value
- Spoiled units = won't be reworked for economic reasons
- Defective units = reworked to become saleable units

Methods for allocating joint costs to joint products

The physical measure method

It uses a physical measure (pounds, gallons, yards, unit of volume produced) at the split-off point to allocate joint costs to joint products.

1. Select proper physical measure (use units of input or output)
    a. Unit of output = average cost method



Point 2 = split-off point

Product	Physical Measure	Proportion	Allocation of Joint Cost	Cost per Pound
Tuna filets	2,000 lbs	0.20	$16,000 × 20% = $ 3,200	$1.60
Canned tuna	8,000 lbs	0.80	16,000 × 80% = 12,800	1.60
Total	10,000 lbs	1.00	$16,000	

- Physical measure used to determine relative weights for allocating the joint costs should be the measure of the products *at* the split-off point (and not when production is completed)

Production costs
Filets: $1.60 per pound = $3,200 / 2000 pounds
Canned tuna: $1.60 per pound = $12,800 / 8000 pounds

The physical measure is easy to use and the criterion for the allocation of the joint costs is objective. However, it ignored the revenue-producing capability of individual products that can vary widely among the joint products and have no relationship at all to any physical measure. Each product can also have a unique physical measure.

The sales value at split-off method

It allocated joint costs to joint products on the basis of their relative sales values at the split-off point. It can only be used when joint products can be sold at the split-off point.

Product	Units	Price per unit	Sales Value	Proportion	Joint Cost Allocated	Cost per Pound
Filets	2,000 lbs	$2.20	$ 4,400	0.25	$16,000 × 25% = $ 4,000	$2.00
Canned tuna	8,000 lbs	1.65	13,200	0.75	16,000 × 75% = 12,000	1.50
Total			$17,600	1.00	$16,000	

1. Compute total sales value of the joint products at the split-off point (sales price * number of production units)
2. Determine proportion of sales value at each joint product to the total sales value
3. Allocate joint costs among the joint products based on those proportions

In the example, filets have higher unit costs under sales value method than under physical measure method because they have higher sales value)

The method is easy to calculate and it is allocated according to the individual product's revenues. It is superior to the physical measure method because it allocated joint costs in proportion to the product's ability to absorb these costs.
However, market prices for some industries change constantly and the sales price at split-off might not be available because separable processing is necessary before the product can be sold.

The net realizable value method

Not all products can be sold at the split-off point as some require additional processing. Then we need the net realizable method. The **net realizable value (NRV)** of a product is the ultimate net sales value that is estimated at the split-off point. It is determined by subtracting the separable processing and selling costs beyond the split-off point from the estimated ultimate sales value for that product.

NRV = Estimated ultimate sales volume – Separable processing and selling costs

Product	Pounds	Price	Sales Value	Separable Processing	Net Realizable Value	Percent of NRV	Allocated Cost	Total Cost	Cost per Pound
Filets	2,000	$2.20	$ 4,400	—	$ 4,400	20%	$ 3,200	$ 3,200	$1.60
Canned tuna	8,000	1.65	13,200	—	13,200	60	9,600	9,600	1.20
Cat food	3,000	1.75	5,250	$850	4,400	20	3,200	4,050	1.35
Total	13,000		$22,850	$850	$22,000	100%	$16,000	$16,850	

In the example, assume firm also processes cat food from raw, unprocessed tuna. At the split-off point, 14 000 pounds of tuna yield 2000 pounds of filets and 8000 pounds of canned tuna and 3000 pounds of cat food. Remaining 1000 pounds is scrap, waste and by-products.

This method produces an allocation that yields a predictable, comparable level of profitability among the produces.

Decision to sell before or after additional processing

Important decision: Will the separable costs increase or decrease profits?

To make this decision, you have to ignore joint costs and focus instead on only separable costs and the increase in sales value.
Here, the cat food has no sales value as scrap or waste if not processed further, and additional processing costs of $850 provide increased reveue of 3000 * $1.75 = $5250. This exceeds processing costs and is therefore profitable.

The constant gross margin percentage method

If separable costs for the joint products are zero / negligible, then NRV method will produce a joint cost allocation that results in equal or nearly equal gross margin percentages (gross margin / total sales).
If separable costs are large, and a goal of allocation is to achieve an allocation that results in the same gross margin percentage for all joint products, then a variation of the NRV is used.
The constant gross margin percentage method determines an allocation of joint costs so that, after allocation, all joint produces have the same gross margin percentage.

Lecture 4 - Budgeting and Variance analysis

Overproduction in the automotive industry

Many car producers built up excess capacity: Production > Demand

- For external reporting firms they are required to assign all excess capacity costs, i.e. fixed manufacturing costs to either
  - COGS
  - Inventory (WIP Inventory → Finished goods inventory → COGS)

With cars in the inventory, smaller portion goes to **COGS** and larger portion goes to **inventory**

Chapter 10 – Strategy and the Master Budget

Budget = a detailed plan for the acquisition and use of financial and other resources over a specified period of time (year, quarter, month).
It includes both financial and nonfinancial aspects of planned operations and projects. It is a guideline for operations and a projection of the operating results for the budgeted period.

Budgeting = the process of preparing one or more budgets.

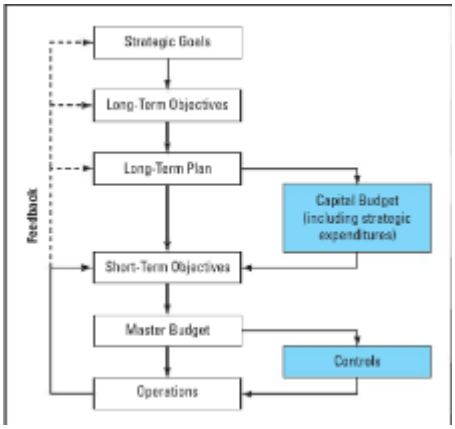
With budgets, management is able to anticipate and develop strategies for dealing with problems the organization might face in the coming periods.
It can help find current bottlenecks of the organization.
It is a mechanism by which management communicates expectations throughout the organization and it is also a motivating device.

Budgets also provide authority to acquire and use resources. This is especially important for government and not-for-profit organizations because budgeted amounts (**appropriations**) often serve as both approvals of activities and ceiling for expenditures.

With budgets, you can assess and evaluate the performance of the organization at the end of the period and interpret the variances → actual performance is compared to budgeted performance.

Strategy and the Master Budget

It is important to consider the firm's long term strategic goals when coming up with a budget.



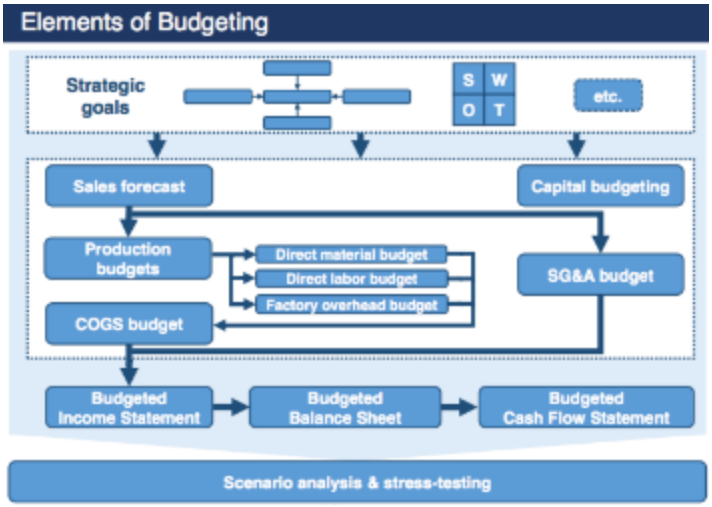
Long-range plans are over a **5- 10-year period** and aim to attain strategic goals of the organization. These plans often entail **capital budgeting** (a process for evaluating, selecting and financing major projects and programs, such as purchasing new equipment, new factory constructions, new products etc.).

Strategic budget expenditures are planned spending on initiatives and projects that lead to long-term value and competitive advantage for the organization. Relate to sustainability.

Short-term objectives (goals for the coming period; month - year) serve as a basis for the **master budget**, which is an aggregation of all subunit budgets into an integrated plan of action for the budget period.
It includes operating and financial budgets:

- **Operating budgets:** plans that identify resources needed to implement strategic projects and to carry out budgeted activities such as sales and customer service, purchasing, marketing and research development
  *Plans for all phases of **operations**, including production, purchasing, personnel, marketing budgets*

- **Financial budgets**: identify sources and uses of funds for planned capital expenditures and for the budgeted level of operations for the upcoming period
  - Include cash budget, budgeted statements of cash flows, budgeted balance sheets



The budgeting process

For large firms, the budgeting process can last several months until approval.

Budget committee

The committee oversees all budget matters and often is the highest authority in an organization for all matters related to the budget. It sets and approves overall budget goals for all major business units, coordinates budget preparation, resolves conflict and differences, approves final budget, monitors operations, reviews operating results.

Budget period

Usually, a budget is prepared for a set time (commonly for the **fiscal year** with sub-period budgets for each of the constituent **quarters** or **months**). In practice, firms rarely have budgets for only one year. The budgets for one year only contain essential operating data. Firms usually have budgets for 5 or 10 years.
→ long-term budget parallel with master budget allows for achievement of strategic goals and short-term operations.

Budget guidelines

The committee is responsible for providing guidelines after considering long-term goals, market economy, strategic projects etc. Each responsibility center (e.g. department, division) prepares initial budget proposal based on preparation guidelines of the organization.

Negotiation, review, approval

The executives of budget units examine initial budget proposals. When subunits complete their budgets, the budgets go through successively higher levels of the organization until they reach the top level.
→ combines unit budgets become the organization budget

Revision

This varies among organizations.

Example: General electric

- Understand how we think the business is going to perform
- Allocate capital accordingly
- Care about quality of thinking: Assuming the reasons behind the numbers is challenging
- Identify risks and come up with solutions
- Bottom-up process of proposing and challenging assumptions & targets

- Start with 5-10 year financial plan for all profit centers (Spring)
- Complete budgeted financial statements for entire company (July)

- Update spring forecasts using another few months of data (Fall)
- Updated forecasts and budgets represent outlook for next year; used for annual update with investors
    - Internal financing meets eternal capital markets

Why do we need budgeting?

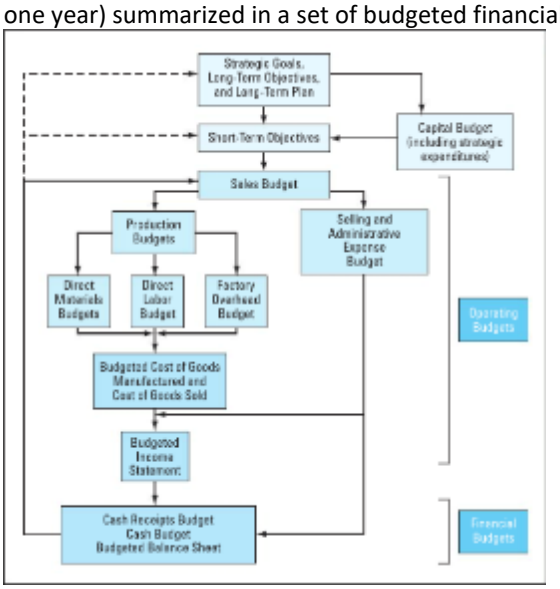
- Decision-making
    - Planning and resource allocation
    - Communication and coordination
    - Ex ante (before fiscal year)
- Decision-control
    - Monitoring
    - Performance evaluation and motivation
    - Ex post (during / after fiscal year)

Budgeting and control cycle

Providing a set of specific objectives (**budget goals**) against which **actual results** can be compared

Master budget

Master budget is a comprehensive expression of operating and financial plans for a future time period (usually one year) summarized in a set of budgeted financial statements.



Sales budget

The **sales budget** shows forecasted sales (in units and dollars) for an upcoming period. It is also referred to as the cornerstone of the entire master budget since it affects all other budgets.
You start with the **sales forecast**. Inaccurate sales forecast can render the entire budget and can impose costly expenses on the firm and suppliers.

To maintain objective, firms consider:

- Current sales levels and trend of last years
- General economic and industry conditions
- Competitors' actions and operating plans
- Pricing policies
- Credit policies
- Advertising and promotional activities
- Level of unfilled back orders

Manufacturing budgets

Production budget

A **production budget** shows planned production for a given period. Planned production depends on **budgeted sales, desired ending inventory** and units of **finished goods inventory** on hand at the beginning of the period.

Budgeted production (in units**) = Budgets sales (**in units**) + Desired ending inventory (**in units**) – Beginning inventory (**in units**)**

Step 1. Determine the desired ending inventory (April 30):	
Expected sales in May	25,000 units
× Desired percentage of next month's sales to be on hand on April 30	× 30%
Desired ending inventory (April 30)	7,500 units
Step 2. Calculate budgeted production for April:	
Budgeted sales for April (from Exhibit 10.3)	20,000 units
+ Desired ending inventory (April 30)	+ 7,500 units
Total number of units needed in April	27,500 units
− Beginning inventory (April 1)	− 5,000 units
Budgeted production for April	22,500 units

KERRY WINDOW SYSTEMS, INC.
Production Budget
For the Quarter Ended June 30, 2016

	April	May	June	Quarter
Budgeted sales (units)	20,000	25,000	35,000	80,000
Add: Desired ending inventory of finished units	7,500	10,500	**12,000***	**12,000**
Total units needed	27,500	35,500	47,000	92,000
Less: Beginning inventory of finished units	5,000†	7,500	10,500	5,000
Budgeted production (units)	**22,500**	**28,000**	**36,500**	**87,000**

Direct materials usage budget and direct materials purchases budget

- **Direct materials usage budget** shows the amount and budgeted costs of direct materials *required* for budgeted production.

DM needed = Budgeted production (in units) * Amount of DM needed to produce one unit

KERRY WINDOW SYSTEMS, INC.
Direct Materials Usage Budget
For the Quarter Ended June 30, 2016

Line	Item	April	May	June	Quarter	Calculation
A.	**Production Requirements**					
1.	Budgeted production	22,500	28,000	36,500	87,000	*
2.	Pounds of aluminum alloy for one unit of product	× 3	× 3	× 3	× 3	
3.	**Total pounds of aluminum alloy needed in production**	**67,500**	**84,000**	**109,500**	**261,000**	
B.	**Cost of Direct Materials**					
4.	Pounds of aluminum alloy from beginning inventory	7,000	8,400	10,950	7,000	
5.	Cost per pound (FIFO basis)	× $ 2.40	× $ 2.45	× $ 2.50	× $ 2.40	
6.	Total cost of aluminum alloy beginning inventory	$ 16,800	$ 20,580	$ 27,375	$ 16,800	(4) × (5)
7.	Total cost of aluminum alloy purchases	+ 168,805	+ 216,375	+ 284,310	+ 669,490	†
8.	Total cost of aluminum alloy available	$185,605	$236,955	$311,685	$686,290	(6) + (7)
9.	Desired ending inventory of aluminum alloy in units	8,400	10,950	10,800[F]	10,800	‡
10.	Cost per unit (FIFO basis)	× $ 2.45	× $ 2.50	× $ 2.60	× $ 2.60	‡
11.	Aluminum alloy ending inventory	− $ 20,580	− $ 27,375	− $ 28,080	− $ 28,080	(9) × (10)
12.	**Total cost of aluminum alloy used in production**	**$165,025**	**$209,580**	**$283,605**	**$658,210**	(8) − (11)

- The **direct materials purchases budget** shows the amount of direct materials (e.g. raw materials) to be *purchased* during the period (in units and costs) to meet the production and ending materials inventory requirements.

KERRY WINDOW SYSTEMS, INC.
Direct Materials Purchases Budget
For the Quarter Ended June 30, 2016

Line	Item	April	May	June	Quarter
1.	Total direct materials needed in production (from part A of Exhibit 10.5), in lbs.	67,500	84,000	109,500	261,000
2.	Add: Desired direct materials ending inventory	+ 8,400	+ 10,950	+ 10,800*	+ 10,800
3.	Total direct materials needed	75,900	94,950	120,300	271,800
4.	Less: Direct materials beginning inventory	− 7,000	− 8,400	− 10,950	− 7,000
5.	**Total direct materials purchases (in lbs.)**	**68,900**	**86,550**	**109,350**	**264,800**
6.	Purchase price per pound	× $ 2.45	× $ 2.50	× $ 2.60	
7.	**Total cost of direct materials purchases**	**$168,805**	**$216,375**	**$284,310**	**$669,490†**

Total amount of DM to be purchased = Total amount of DM needed in production + required ending inventory of DM – beginning inventory of DM

Direct labor budget

Budgeted production * Planned personnel

Depending on the anticipated production level, you need to plan how many employees you need.
Some firms have stable employment policies or labor contracts that prevent them from hiring or laying off workers in direct proportion to production needs.
Other organizations have **manufacturing cells** which are sets of machines laid out in the form of a semicircle. These organizations can use direct labor budget to plan for maintenance, minor repairs, installation, testing etc.

KERRY WINDOW SYSTEMS, INC.
Direct Labor Budget
For the Quarter Ended June 30, 2016

Line		April		May		June		Quarter
	Semiskilled Labor							
1.	Budgeted production (Exhibit 10.4)	22,500		28,000		36,500		87,000
2.	Semiskilled direct labor hours per unit	× 0.5		× 0.5		× 0.5		× 0.5
3.	Total semiskilled direct labor hours needed	11,250		14,000		18,250		43,500
4.	Hourly wage rate of semiskilled labor	× $8		× $8		× $8		× $8
5.	Total wages for semiskilled labor	$ 90,000		$112,000		$146,000		$348,000
	Skilled Labor							
6.	Budgeted production (Exhibit 10.4)	22,500		28,000		36,500		87,000
7.	Skilled direct labor hours per unit	× 0.2		× 0.2		× 0.2		× 0.2
8.	Total skilled direct labor hours needed	4,500		5,600		7,300		17,400
9.	Hourly wage for skilled labor	× $12		× $12		× $12		× $12
10.	Total wages for skilled labor	$ 54,000		$ 67,200		$ 87,600		$208,800
11.	**Total cost for direct manufacturing labor (5 + 10)**	**$144,000**		**$179,200**		**$233,600**		**$556,800**
12.	Total direct manufacturing labor hours (3 + 8)	15,750		19,600		25,550		60,900

Factory overhead budget

This budget includes all production costs other than direct labor and direct materials.

KERRY WINDOW SYSTEMS, INC.
Factory Overhead Budget
For the Quarter Ended June 30, 2016

	Rate per DLH*	April	May	June	Quarter
Total direct labor hours (Exhibit 10.7)		15,750	19,600	25,550	60,900
Variable factory overhead:					
Supplies	$0.12	$ 1,890	$ 2,352	$ 3,066	$ 7,308
Indirect labor	1.00	15,750	19,600	25,550	60,900
Fringe benefits	3.00	47,250	58,800	76,650	182,700
Power	0.20	3,150	3,920	5,110	12,180
Maintenance	0.08	1,260	1,568	2,044	4,872
Total variable factory overhead	**$4.40**	**$69,300**	**$86,240**	**$112,420**	**$267,960**
Fixed factory overhead:					
Depreciation		$ 30,000	$ 30,000	$ 40,000†	$100,000
Factory insurance		2,500	2,500	2,500	7,500
Property taxes		900	900	900	2,700
Supervision		8,900	8,900	8,900	26,700
Power		1,250	1,250	1,250	3,750
Maintenance		750	750	750	2,250
Total fixed factory overhead		**$ 44,300**	**$ 44,300**	**$ 54,300**	**$142,900**
Total factory overhead		**$113,600**	**$130,540**	**$166,720**	**$410,860**
Less: Depreciation		30,000	30,000	40,000	100,000
Cash disbursements for factory overhead		**$ 83,600**	**$100,540**	**$126,720**	**$310,860**

Cost of goods manufactured and costs of goods sold budget

The previous budgets help provide this budget.

KERRY WINDOW SYSTEMS, INC.
Cost of Goods Manufactured and Cost of Goods Sold Budget
For the Quarter Ended June 30, 2016

	April	May	June	Quarter
Direct materials (Line 12, Exhibit 10.5)	$165,025	$209,580	$283,605	$ 658,210
Direct labor (Line 11, Exhibit 10.7)	144,000	179,200	233,600	556,800
Total factory overhead (Exhibit 10.8)	113,600	130,540	166,720	410,860
Total cost of goods manufactured	$422,625	$519,320	$683,925	$1,625,870
Finished goods beginning inventory	90,000*	140,875	194,745	90,000
Total cost of goods available for sale	$512,625	$660,195	$878,670	$1,715,870
Finished goods ending inventory†	140,875	194,745	224,852	224,852
Cost of goods sold	**$371,750**	**$465,450**	**$653,818**	**$1,491,018**

The following includes financial budgets:

Merchandise purchases budget

This budget shows the amount and cost of merchandise it needs to purchase during the budget period. It has the basic format same as the production budget.

Instead of required production, the merchandise budget provides the number of units required for *purchases* for the budget period.

Selling and administrative expense budget

It can be broken down into **fixed** and **variable** components of total selling and administrative expenses.

Subdivide total selling and administrative expense budget into **total expenses** (income purposes) **and total cash expenses** (for preparing cash budget)

KERRY WINDOW SYSTEMS, INC.
Selling and Administrative Expense Budget
For the Quarter Ended June 30, 2016

	April	May	June	Quarter
Selling expenses				
Variable selling expenses:				
Sales commissions (given)	$ 30,000	$ 37,500	$ 52,500	$120,000
Delivery expenses (given)	2,000	2,500	3,500	8,000
Bad debts expense (allowance method)*	9,000	11,250	15,750	36,000
Total variable selling expenses	$ 41,000	$ 51,250	$ 71,750	$164,000
Fixed selling expenses:				
Sales salaries (given)	$ 8,000	$ 8,000	$ 8,000	$ 24,000
Advertising (given)	50,000	50,000	50,000	150,000
Delivery expenses (given)	6,000	6,000	6,000	18,000
Depreciation (given)	20,000	20,000	20,000	60,000
Total fixed selling expenses	$ 84,000	$ 84,000	$ 84,000	$252,000
Total selling expenses	$125,000	$135,250	$155,750	$416,000
Administrative expenses (all fixed)				
Administrative salaries	$ 25,000	$ 25,000	$ 25,000	$ 75,000
Accounting and data processing	12,000	12,000	12,000	36,000
Depreciation	7,000	7,000	7,000	21,000
Other administrative expenses	6,000	6,000	6,000	18,000
Total administrative expenses	$ 50,000	$ 50,000	$ 50,000	$150,000
Total selling and administrative expenses	**$175,000**	**$185,250**	**$205,750**	**$566,000**
Less: Noncash expenses (bad debts expense + depreciation)	$ 38,000	$ 38,250	$ 42,750	$117,000
Cash disbursements for selling and administrative expenses	**$139,000**	**$147,000**	**$163,000**	**$449,000**

Cash receipts (collections) budget

It provides details regarding anticipated collections of cash from operations for an upcoming period.

KERRY WINDOW SYSTEMS, INC.
Cash Receipts Budget—Operating Activities
For the Quarter Ended June 30, 2016

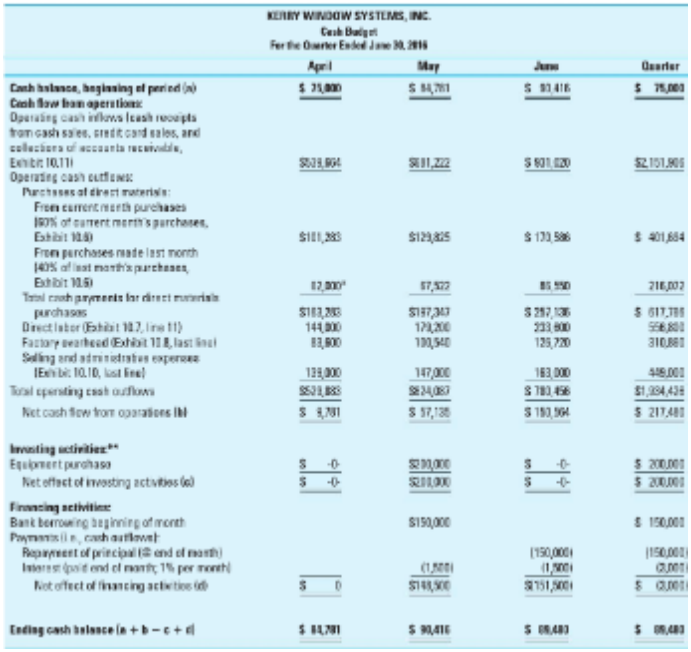
Sales Data	March	April	May	June	Quarter (April–June)
Cash and bank credit card sales (70% of total sales)	$315,000	$420,000	$525,000	$ 735,000	$1,680,000
Credit sales (30% of total sales)	135,000	180,000	225,000	315,000	720,000
Gross sales revenue (Exhibit 10.3)	$450,000	$600,000	$750,000	$1,050,000	$2,400,000
Cash received from cash sales					
(60% of cash and bank credit card sales)		$252,000	$315,000	$441,000	$1,008,000
Cash received from bank credit card sales					
(40% of cash and bank credit card sales × 97%)		162,960	203,700	285,180	651,840
Collections of accounts receivable:					
From credit sales the month before this month:					
Within cash discount period					
(Prior month's credit sales × 80% × 60% × 98%)		63,504	84,672	105,840	254,016
After the cash discount period					
(Prior month's credit sales × 80% × 40%)		43,200	57,600	72,000	172,800
From credit sales two months before this month					
(75% of 20% of credit sales two months prior)		18,000	20,250	27,000	65,250
Total cash receipts, net of bank service charge (3%) and discount (2%)		**$539,664**	**$681,222**	**$931,020**	**$2,151,906**

Cash budget

The **cash budget** brings together the cash effects of all budgeted activities. It pulls data from almost all parts of the master budget.

It includes three sections:

1. Net cash flows **from operating activities**
    a. Related to main operating activity
2. Net cash flows from **investing activities**
    a. Acquisitions and divestitures
3. Net cash flows from **financing activities**
    a. Issuances, payments, retirements of borrowings and equity



KERRY WINDOW SYSTEMS, INC.
Cash Budget
For the Quarter Ended June 30, 2016

	April	May	June	Quarter
Cash balance, beginning of period (a)	$ 35,000	$ 84,701	$ 93,416	$ 35,000
Cash flow from operations:				
Operating cash inflows (cash receipts from cash sales, credit card sales, and collections of accounts receivable, Exhibit 10.11)	$638,864	$681,222	$ 901,020	$2,151,900
Operating cash outflows:				
Purchases of direct materials:				
From current month purchases (60% of current month's purchases, Exhibit 10.6)	$101,383	$129,825	$ 170,586	$ 401,684
From purchases made last month (40% of last month's purchases, Exhibit 10.6)	82,000*	67,533	88,950	216,072
Total cash payments for direct materials purchases	$183,383	$197,347	$ 257,136	$ 617,756
Direct labor (Exhibit 10.7, line 11)	144,000	179,200	233,600	556,800
Factory overhead (Exhibit 10.8, last line)	83,600	100,540	129,720	313,860
Selling and administrative expenses (Exhibit 10.10, last line)	139,000	147,000	183,000	469,000
Total operating cash outflows	$553,883	$624,087	$ 783,456	$1,934,416
Net cash flow from operations (b)	$ 84,981	$ 57,135	$ 150,564	$ 217,484
Investing activities:**				
Equipment purchase	$ -0-	$200,000	$ -0-	$ 200,000
Net effect of investing activities (c)	$ -0-	$200,000	$ -0-	$ 200,000
Financing activities:				
Bank borrowing, beginning of month		$150,000		$ 150,000
Payments (i.e., cash outflows):				
Repayment of principal (@ end of month)			(150,000)	(150,000)
Interest (paid end of month; 1% per month)		(1,500)	(1,500)	(3,000)
Net effect of financing activities (d)	$ 0	$148,500	$151,500	$ (3,000)
Ending cash balance (a + b − c + d)	$ 84,701	$ 90,416	$ 88,480	$ 88,480

Budgeted income statement

It describes the expected net income for an upcoming period.

KERRY WINDOW SYSTEMS, INC.
Budgeted Income Statement
For the Quarter Ended June 30, 2016

	April	May	June	Quarter
Gross sales revenue (Exhibit 10.3)	$600,000	$750,000	$1,050,000	$2,400,000
Less: Cash discounts for early payment of credit sales (last month's credit sales × 80% × 60% × 2%)*	$ 1,296	$ 1,728	$ 2,160	$ 5,184
Bank service charge (3% of bank credit-card sales)*	$ 5,040	$ 6,300	$ 8,820	$ 20,160
Net sales	$593,664	$741,972	$1,039,020	$2,374,656
Less: Cost of goods sold (Exhibit 10.9)	371,750	465,450	653,818	1,491,018
Gross profit	$221,914	$276,522	$ 385,202	$ 883,638
Selling and administrative expenses (Exhibit 10.10)	175,000	185,250	205,750	566,000
Net operating income	$ 46,914	$ 91,272	$ 179,452	$ 317,638
Less: Interest expense (Exhibit 10.12)	0	1,500	1,500	3,000
Income before income taxes	$ 46,914	$ 89,772	$ 177,952	$ 314,638
Less: Income taxes (@30%)	14,074	26,932	53,386	94,391
Net income	**$ 32,840**	**$ 62,840**	**$ 124,566**	**$ 220,247****

Once being approved, the budgeted income statement can be used against the benchmark at which the performance for the period is being evaluated.

Budgeted balance sheet

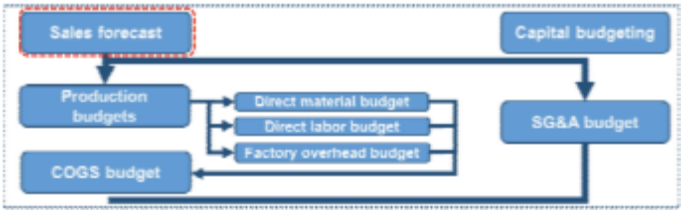
Last step to prepare a budgeted balance sheet.

KERRY WINDOW SYSTEMS, INC.
Balance Sheet
March 31, 2016

Assets			
Current assets:			
Cash (Exhibit 10.12)		$ 75,000	
Net accounts receivable*		146,250	
Direct materials inventory (Exhibit 10.5)		16,800	
Finished goods inventory (Exhibit 10.9)		90,000	
Total current assets			$328,050
Property, plant and equipment:			
Land (given)		$ 40,000	
Buildings and equipment, gross	$769,750		
Less: Accumulated depreciation	168,000	601,750	
Total property, plant, and equipment			641,750
Total assets			**$969,800**
Liabilities and Stockholders' Equity			
Current liabilities:			
Accounts payable (Exhibit 10.12)		$ 62,000	
Income taxes payable		0	
Total liabilities			$ 62,000
Stockholders' equity:			
Common stock (given)		$303,300	
Retained earnings (given)		604,500	
Total stockholders' equity			907,800
Total liabilities and stockholders' equity			**$969,800**

It incorporates the effects of all operations and cash flows during the budget period.

Incentive problems?



- Purchasing manager: Bonus based on **costs of direct materials**
- Production manager: Bonus based on **amount of spoilage/waste**

→ negative externalities due to inventive misalignment

- Sales manager: Bonus based on revenues minus target
- General manager: Bonus based on sales manager's target

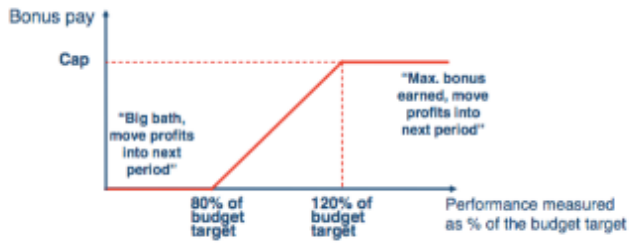
Budget slack: underestimating budgeted revenues, or over-estimating budgeted expenses, in an effort to make the resulting budgeted goals more easily attainable;

Negotiation and review of reported estimates necessary to reduce budget slack

Steps in budgeting process

1. Proposal
2. Negotiation
3. Review and approval
4. Revision

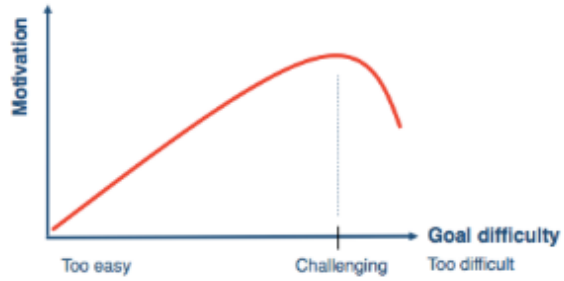
Problems due to non-linear compensation function (during the year):



Motivational aspects of budgetary target setting

- Does it matter for your own motivation whether you think a target is easy/difficult to achieve?
- Does it matter how difficult a target is for a manager's motivation?

→ Findings on goal-setting theory



Planning and **motivational** purposes are in conflict:
Realistic (= most likely outcome) for planning vs. challenging (= not most likely outcome) for motivation

Uncertainty and the budgeting process

The validity of the financial statements depends on the validity of the underlying budgeting model and the underlying data of the component budgets.

What-If Analysis

Decision Variable: Targeted Ending Inventory, Finished Goods				
		Budgeted Production (units) (Exhibit 10.4)		
		April	May	June
Original assumption	30%	22,500	28,000	36,500
Revised assumption	20%	20,000	27,000	36,000
Percentage change	(33%)	(11.1%)	(3.6%)	(1.4%)

Sensitivity analysis

Used as a tool to determine extent to which a change in the forecasted value of one or more budgetary inputs affects individual budgets and the set of pro forma financial statements.

Selling Price per Unit	Sales Volume (units)	Budgeted Net Operating Income	% Change from Master Budget Amount
$25.00	17,500	$(67,877)	(244.6)%
25.00	20,000	(50,746)	(208.2)
25.00	22,500	(33,249)	(170.9)
30.00	17,500	17,575	37.5
30.00	**20,000**	**46,914**	**N/A**
30.00	22,500	76,619	163.3
35.00	17,500	103,028	219.6
35.00	20,000	144,574	308.2
35.00	22,500	186,487	397.5

Advantages using sensitivity-analysis

- Ability to isolate risks associated with particular components of operations;
- Develop contingency plans for dealing with these risks

Scenario analysis

Create small and realistic scenarios, such as 'best-case', 'worst-case', and 'most-likely-scenario'. Provides range of scenarios (range of possible outcomes) and therefore a measure of risk.

1. It is possible to enhance the analysis by assigning subjective probabilities to each of the various scenarios
2. The process of identifying realistic scenarios is complicated in practice and therefore suggests the need for a cross-functional team

3. The most sophisticated way to handle uncertainty in the budgeting process is through Monte Carlo simulation

Budgeting in Service Companies

Budgets in service firms also consists of an integrated set of plans for an upcoming period. However, production and merchandise purchase budgets are missing. In service companies, the budgeting of **personnel planning** is crucial.
Example p.361

Alternative budgeting approaches

Zero-base budgeting (ZBB)

This requires managers to prepare budgets each period from a zero base starting with the current budget. It assumes that all current activities and functions are continued into the budget period.

Activity-based budgeting (ABB)

It starts with the budgeted output and segregates costs required for the budgeted output into homogenous activity cost pools such as unit, batch, product-sustaining, customer-sustaining, facility-sustaining activity pools. This leads to a more accurate budgets pertaining to support activities (including factory overhead).

- Begins by budgeting activities requirements based on estimated product (or service) demand for the upcoming period
- Then, budget the costs of resources needed to perform the activities

Example p-363

	Traditional Budgeting	**Activity-Based Budgeting (ABB)**
Budgeting unit	Expressed as the cost of functional area or spending categories	Expressed as the cost of activities and cost drivers
Focus on	Input resources	High-value-added activities
Orientation	Historical	Continuous improvement
Roles of suppliers and customers	Does not formally consider suppliers and customers in budgeting	Coordinates with suppliers and considers the needs of customers
Control objective	Maximize managers' performance	Synchronize activities with level of demand
Budget base	Descriptive accounts in departmental budgets	Value-added versus non-value-added activities

Time-driven activity-based budgeting

Time-driven activity-based costing (TDABC) is an alternative to ABC. Management only needs to provide two estimates:

1. Total cost and amount of resources supplied for a period
    a. Calculate cost rates
        i. E.g. packaging activity = cost of resources / amount of resources (in time)
2. Amount of resource capacity (measured in time) that is consumed by the cost objects (products, services)
    a. Allocate costs to cost objects
        i. Multiply cost rates by time requirements of cost objects

Stages:

1. Divide cost of resources for an activity (e.g. packaging) and divide it by the input (amount of resources measured in *time*)
2. Allocate costs to cost objects by multiplying estimated cost rates by the time requirements of the cost objects

Time-driven activity-based budgeting (TDABB) is connected to the TDACB. It also works backwards from forecasted sales volume (and mix) to calculate in a straightforward way resource spending needed to support production and sales plans.

In TDABC and TDABB we have to calculate cost-driver rates. These rates are best defined by dividing budgeted resource costs by the **practical capacity** of resources supplied for each activity or process.
The use of this level of capacity allows us to estimate the cost of unused capacity at the end of each period for each activity: estimate = difference between resources *supplied* and resources *used* during the period

Kaizen (continuous-improvement) budgeting

Kaizen budgeting is a budgeting approach that incorporates continuous-improvement expectations in the budget. It adjusts required resource demands based on target efficiency and productivity gains.

Behavioral issues in budgeting

Budgetary slack

Budgetary slack occurs when managers knowingly include a higher amount of expenditures (or lower amount of revenue) in the budget than they actually believe will occur.

Goal Congruence

Refers to the degree of consistency between goals of the firm, the subunits and its employees.
Three major factors that affect the level of goal congruence achieved:

1. Extent to which employees participate in the budgeting process
2. Level of difficulty embedded in the budget
3. Whether and how compensation is linked to the budgeted performance

Authoritative or participative budgeting

- **Authoritative approach:** Top-down approach:
  Management prepares budgets for the entire organization
- **Participative approach**: Bottom-up approach: Communication with employees

Effective budgeting process combines these two approaches into the **negotiated approach**.

Difficulty level of budget target

Budget too easy: not motivating
Budget too difficult: discourage managers from trying to attain.
Highly-achievable target is one that is achievable by most managers 80 – 90% of time.

- Increases manager's commitment
- Maintain confidence
- Decrease cost of organizational control
- Reduce risk that management will engage in harmful 'earning management' practices
- Allows effective and efficient managers greater operating flexibility
- Improves predictability of earning or operating results
- Enhances the usefulness of a budget as a planning and coordinating tool

Linkage of compensation and budgeted performance

Traditionally, budgets serve as tool for compensation. This type of compensation is referred to as **fixed-performance contract** (actual performance is compared to fixed/budgeted target). This reinforces managers to **game the performance measure**: take actions that make the performance indicator look better but to not increase the value of the firm.

Alternatives are:

1. Use of *linear compensation plans*
   a. Incentive compensation is based on linear compensation plan
   b. Managerial reward is independent of budgeted targets
   c. Managerial reward is a linear function of actual performance: the greater the performance, the greater the reward
2. Use of *rolling forecasts* and *relative performance contracts*

a. Reward managers for how their business units perform relative to some appropriate benchmark performance (and not a fixed budget target), e.g. ROI
b. In addition, **rolling financial forecasts** are updated regularly and they are separated from performance evaluation and control

Part 3: Operational-level control

Tools to evaluate performance of mid-level managers and operational personnel.

Chapter 14 – Operational performance measurement

Operational control = control system associated with the operational process.

This chapter is about the financial control. It starts at the end of the period (goes backwards). Actual performance is compared with the budgeted performance. The difference is the **variance**.

Management accounting and control systems

Control = set of procedures, tools, systems that organizations use to ensure that progress is being made toward accomplishing the goals and objectives of the organization.

Management accounting and control system = core performance measurement system (includes both planning and evaluation components).

- **Operational control:** subset of organization's overall management accounting and control system (focuses on short-term operational performance)
  - **Financial control system**
    - Compare actual to budgeted financial amounts
    - Differences in these amounts are **variances**
  - **Non-financial control system**
- **Management control system**

Building an effective operational control system

1. Determine the strategic issues surrounding the problem
2. Identify alternative actions
3. Obtain information and conduct analyses of the alternatives
4. Based on strategy and analysis, choose and implement desired alternative
5. Provide an ongoing evaluation of the effectiveness of implementation

Short-term financial control

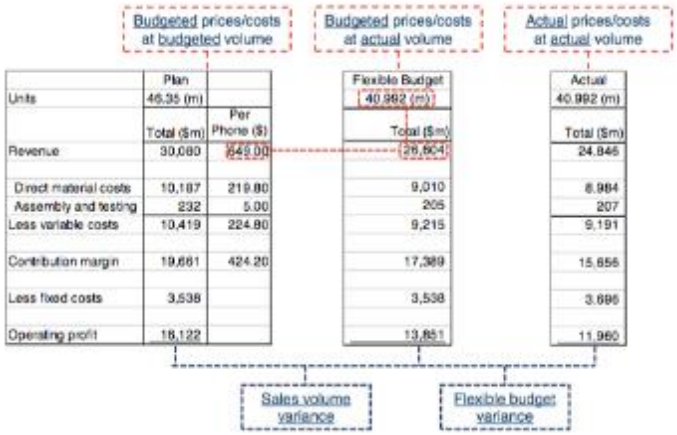
Important goal: achieve budgeted operating income for the period.
Difference between actual operating income and master budget operating income = **Total operating income variance** (or **master (static) budget variance.**

The master budget variance can be misleading. Total operating income variance only reveals whether the firm achieved budgeted operating income for the period.

The budget is prepared in the beginning of the period. It is also called **static budget** because it is developed for only a *single* output level.
Useful for initial planning and coordination of activities for a given period

Flexible budgets and profit-variance analysis

Variance Analysis Overview



Difference between plain profitability and actual profitability:

- **Sales volume variance:** Change in profitability due to changes in volume
  - Volume factors:
    - Market size variance
    - Market share variance
- **Flexible budget variance**: Change in profitability due to changes in prices/costs
  - Price/cost factors
    - Sales price variance
    - Direct material variance
    - Direct labor variance

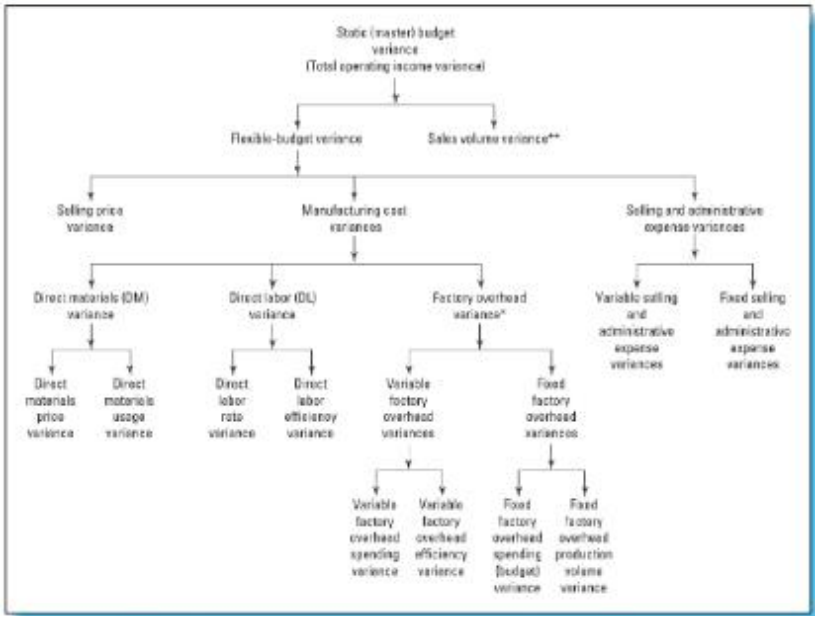
The flexible budget

Flexible budget is a budget that adjusts revenues and expenses to the **actual** output level and sales mix achieved

- Changes in output change firm's expected revenues and expenses
- Useful for assessing short-term financial performance

Prepared at the end of the period when the actual output is known.

EXHIBIT 14.2 **Operating-Income Variances (Single-Product Example: Product XY-1)**



By using a flexible budget and standard costs, one can subdivide the total operating income variance for the period into component variances related to each of the five factors that combine to determine short-term operating profit:

- Selling price
- Sales volume
- Sales mix
- Variable costs per unit
- Total fixed costs

Preparing a flexible budget

1. Determine the **output** for the period (actual output at the end of the period)
2. Use the selling price and variable cost per unit data from the **master budget**: calculate **budgeted** sales revenues and **budgeted** variable expenses to compute **flexible budget** contribution margin
3. Determine **budgeted** amount of fixed cost (= fixed costs in master budget)
4. Compute the flexible budget operating income

Formulas:

Total sales = **Actual** number of units sold * **Budgeted selling price** per unit
Total variable expenses = **Actual** number of units sold * **Budgeted variable** cost per unit
Total fixed expenses = **Amount of fixed expenses in the master budget**

→ *By setting the volume at actual levels and prices/costs at budgeted amounts, we strip out the volume effect.*

Pro forma: referring to budgets prepared for **multiple output levels**;
Flexible budget used in a more limited sense (budget based on the actual activity level achieved during the period)

Sales volume variance and flexible-budget variances

Total operating income variances

SCHMIDT MACHINERY COMPANY
Analysis of Financial Results
For October 2016

	(1) Actual	(2) Flexible-Budget Variances	(3) Flexible Budget	(4) Sales Volume Variances	(5) Master (Static) Budget
Units	780	0	780	220U	1,000
Sales	$639,600	$15,600F	$624,000	$176,000U	$800,000
Variable costs	350,950	50F	351,000	99,000F	450,000
Contribution margin	$288,650	$15,650F	$273,000	$ 77,000U	$350,000
Fixed costs	160,650	10,650U	150,000*	0	150,000*
Operating income	$128,000	**$ 5,000F**	$123,000	**$ 77,000U**	$200,000

Analysis of Total Operating Income Variance

Total operating income variance** = $128,000 − $200,000 = $72,000U

Flexible-budget variance = $128,000 − $123,000 = **$5,000F**

Sales volume variance = $123,000 − $200,000 = **$77,000U**

Sales volume variance

= Difference between flexible budget operation income and master budget operating income

Unfavorable: Flexible budget < master budget
Favorable: Flexible budget > master budget

Fixed costs = 0 since flexible budget FC = master budget FC;

Sales volume variance = (Actual units sold – budgeted units sold) * Master budget contribution margin per unit

Differences in operating profit only due to changes in **volume**
Reasons can be:

- Product market has changed (demand increased/decreased)
- Lost/gained market share
- Failure of setting proper goal for the period
- Inappropriate selling price
- Marketing and promotion programs were not effective

Flexible-Budget (FB) variances

The **flexible budget variance** for each income statement item refers to the difference between actual amount of that item and the flexible budget for that item

Flexible budget variance = Actual results – Flexible budget results

Therefore, there is a FB variance for sales, variable costs, fixed costs and for operating income. The sum equals the **total flexible budget variance** for the period.

Total FB variance = actual operating income – flexible budget operating income

Can be broken down into:

- Selling price variance
- Total variable cost flexible budget variance
- Total fixed cost flexible budget variance

Selling price variance

Reflects effect on operating income of a difference between actual and budgeted selling prices.

Selling price variance = Actual sales revenues – sales revenue in the flexible budget

Actual sales revenue = Units sold * Actual selling price per unit
Flexible budget sales revenue = Units sold * Budgeted selling price per unit

Total variable cost flexible-budget variance

Reflects deviation of actual variable cost incurred in the period from the total standard variable cost for the output of the period;

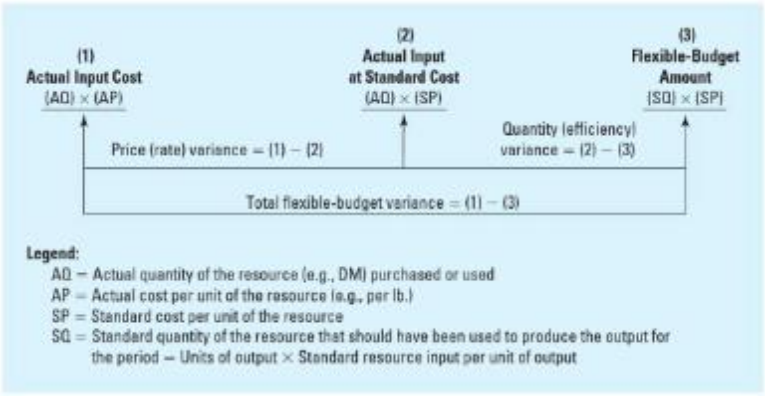
TVCFBV = Total variable cost incurred – total variable cost in the FB for period

The total variable cost flexible-budget variance = Total direct materials FB variance + Total direct labor FB variance + Total variable overhead FB variance + Total variable selling and administrative FB variance

SCHMIDT MACHINERY COMPANY October 2016			
Product XV-1 **Units Manufactured: 780**			
Actual Results			
Direct materials:			
Aluminum	3,630 pounds at $26 per pound	$94,380	
PVC	720 pounds at $41 per pound	29,520	$123,900
Direct labor	3,510 hours at $42 per hour		147,420
Variable factory overhead			40,630
Total variable cost of goods manufactured			$311,950
Variable selling and administrative expenses			39,000
Total variable costs for the period			$350,950
Flexible Budget			
Budgeted variable cost of goods manufactured:			
Standard variable manufacturing cost per unit (from Exhibit 14.5)		$400	
Number of units manufactured		× 780	$312,000
Budgeted variable selling and administrative expenses (780 × $50)			39,000
Total budgeted variable costs for 780 units			$351,000
Total variable cost flexible-budget variance for the period			$ 50F*

General model for the analysis of variable cost variances

Variable costs depend on price (P) and quantity (Q). Therefore, decompose any flexible budget variance for a given variable cost into **price variance** (rate) and **quantity variance** (efficiency).



Direct materials variances

Actual direct materials cost – total standard direct materials cost for period's output

The **direct materials flexible budget variance** = Total direct material cost incurred – flexible budget amount for period's output;

The **direct materials price variance (PV)** for each material = (Actual cost per unit – Standard cost per unit) * Total number of units of the direct material used in production;

PV = (AP – SP) * AQ

- Can result from failure to take purchase discounts, unexpected changes in the price of materials, changes in freight costs, variation in grades of materials
- A favourable direct materials price variance could lead to excessively high manufacturing costs if the low-cost materials are of poor quality

In addition to price variances, firms also use ratios when evaluating the performance;

- **Materials usage ratio** = ratio of quantity used over quantity purchased
  - Low ratio: Purchase for materials inventory and not usage
  - High ratio: Purchase for usage and not inventory

The **direct materials usage variance (UV)** refers to the efficiency with which each raw material was used during the period;

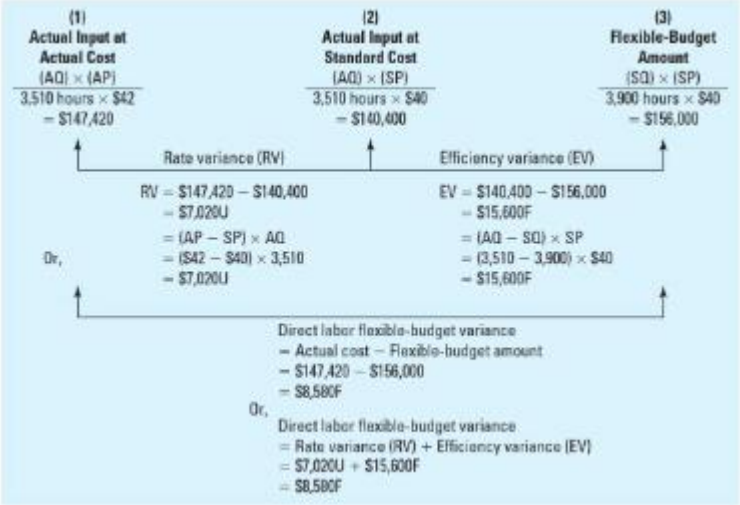
UV = (Total quantity of direct materials used – total standard quantity of direct material manufactured) * Standard cost per unit of DM

= **Efficiency** or **quantity variance**

- High ratio: operations consumed significant different amount of direct materials than the amount specified for the output of the period

Direct labor variances

Direct labor flexible-budget variances results of the total direct labor cost of a period being different from total standard labor cost for the output of the period



It can also be decomposed into two components: 1) Rate (price) and 2) Efficiency (quantity) variance

Direct labor rate variance = (Actual hourly wage paid – Standard hourly wage rate) * Total direct labor hours worked

Direct labor efficiency variance occurs when the total direct labor hours worked deviates from the total standard direct labor hours allowed for actual output;

DL efficiency variance = (Total direct labor hours worked – Total standard direct labor hours allowed) * Standard direct labor hourly rate

Factors contributing towards direct labor efficiency variance:

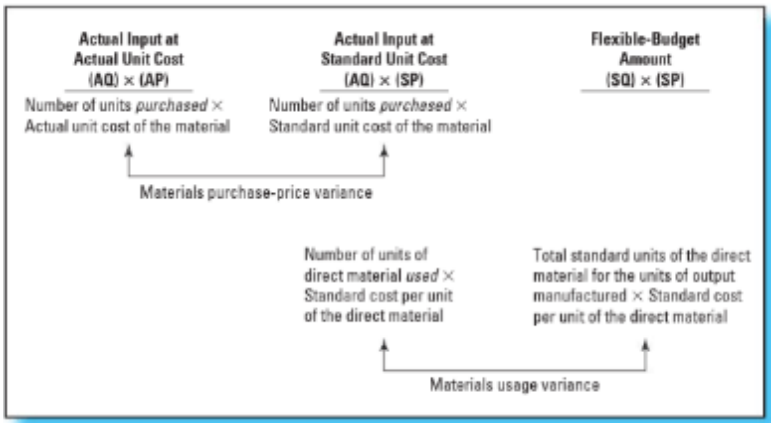
- Employees or supervisors are new on the job / inadequately trained
- Employees' skill levels are different from those specified in the standard cost sheet
- Batch sizes are different from the standard size
- Materials are different from those specified
- Machines or equipment are not in proper working conditions
- Supervision is inadequate
- Scheduling is poor

Timing of variance recognition

For maximum control, managers should note deviations the earliest possible.

- Direct materials purchase: Time of purchase or time materials are issued to production

Recognition of price variance at point of purchase allows the firm to take proper actions



- When materials price variance is calculated at point of purchase: **actual quantity** refers to quantity of materials **purchased (**therefore**, materials purchase-price variance)**

When recognizing materials price variances at time of purchase, firms can carry all units of the same material at one price (= the **standard normal cost** of the material).

If it is not recognized at purchase, but rather waited until used in production, the AQ refers to the quantity of materials **used** in production; direct materials are carried on the books at their actual purchase prices.

Interpretation of variances

- Reason for favourable material price variance and unfavourable material efficiency variance?
  - Substandard quality of material caused waste in the production process
- What could be a reason for unfavourable labor price variance and favourable labor efficiency variance?
  - More skilled workers are more expensive but also work more efficiently

Standard costs

Standard cost is the cost the firm should incur for the operation under relatively efficient conditions; it is usually expressed on a per-unit-of-output basis.
Standard costs are incorporated into budgets and as such can be used to monitor and control operations and evaluate performance.

Standard costs vs. a standard cost system

Standard cost prescribes expected performance. Can be applied to service firms as well.
A **standard cost system** refers to an accounting system in which standard costs (and associated standard cost variances) are recorded in the formal accounting system. It can be applied to job-order or process cost context.

Types of standards

= Different expectations for the proper level of standard costs

Ideal standards

This reflects the maximum efficiency in every aspect of an operation. They are difficult, but not impossible to achieve.

- Assume peak operating efficiency
- Assume absence of any production disruptions

Alternative: **continuous-improvement standards** (in function of time); they become progressively tighter
Analog to the Japanese use of Kaizen costing

Currently attainable standards

Sets performance expectation at a level that a person with proper training and experience can attain most of the time without having to exert extraordinary effort; emphasizes normality and allows for some imperfections and inefficiencies.

Selection of standards

Firms struggling for survival in competitive industries may choose ideal standards to motivate employees to put more effort in. Ideal standards are not effective if frequent failures in meeting the standards discourages employees.

When setting the standard, a firm can use an **authoritative** or **participative** procedure.

Authoritative procedure:

- Determined solely by management
- To ensure proper consideration of all operating factors
- To incorporate management's desires / expectations

Participative procedure:

- Active participation of employees affected by standard is aimed for
- To produce behavioral effects

Establishing standard costs

Standard cost for direct materials

Standard cost of a product has three facets:

1. Quality
2. Quantity
3. Price

First, you have to specify the quality of the direct materials which determines quality of product and affects many phases in the manufacturing process.
Quality, quantity and the timing of purchases can affect price standards.

Standard cost for direct labor

Vary with types of work, product complexity, employee skill level, nature of manufacturing process, type and condition of the equipment to be used.
Personnel department determines **standard wage rate** for the type and skill level of employees needed (includes rate for direct or indirect labor and fringe benefits provided to employees and required payroll taxes associated with wages and salaries).

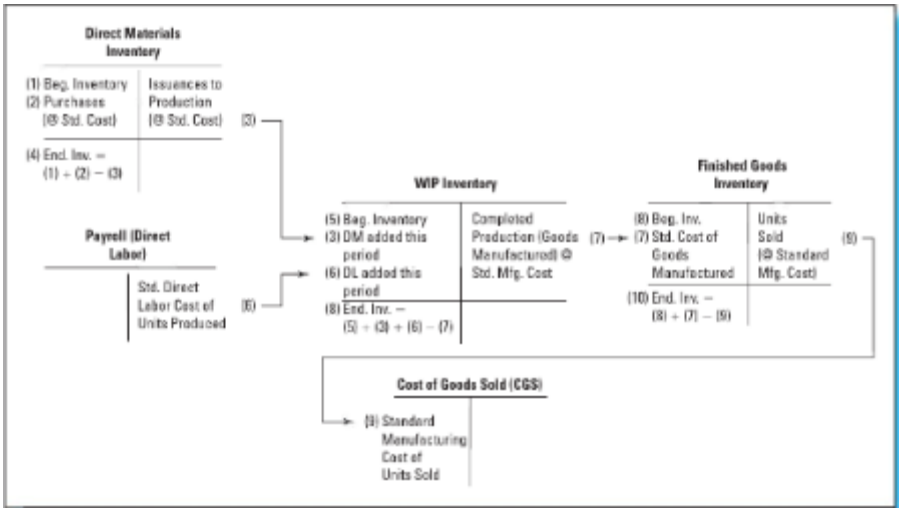
Overtime premiums are often treated as factory overhead.

Standard cost sheet

It specifies the standard costs for all manufacturing cost elements.

Recording cost flows and variances in a standard cost system

Standard cost systems use the same accounts for inventory and for recording manufacturing costs that actual or normal costing system use;
→ they have accounts such as materials inventory, accrued payroll, factory overhead etc.



Difference:

- Use standard costs instead of actual or normalized costs
- Include variance accounts
    - Favourable variances will have **credit** balances
    - Unfavourable variances will have **debit** balances

Direct materials cost

E.g. when recognizing materials price variances a point of purchase:

	Account	Amount
Debit:	Materials Inventory	Total standard cost of the purchased materials
	Direct Materials Purchase-Price Variance *(if unfavorable)*	Amount of *unfavorable* variance
Credit:	Cash or Accounts Payable	Purchase cost of materials
	Direct Materials Purchase-Price Variance *(if favorable)*	Amount of *favorable* variance

see more journal entries page 563

Direct labor cost

Cost of units manufactured is increased by direct labor costs.

	Account	Amount
Debit:	Work-in-Process Inventory	Total number of standard hours, at the standard hourly wage rate, for the units manufactured
	Direct Labor Rate or Efficiency Variance *(if unfavorable)*	Amount of *unfavorable* variance
Credit:	Accrued Payroll	Actual wage expense
	Direct Labor Rate or Efficiency Variance *(if favorable)*	Amount of *favorable* variance

Completion of production

Upon completion, the total standard cost of the units manufactured is transferred out of WIP inventory to Finished goods inventory.

Date	Account	Amount	
Oct. 31	Finished Goods Inventory (780 × $520)	405,600	
	Work-in-Process Inventory		405,600
	Completed 780 units of XV-1 at standard manufacturing cost per unit of $520.		

Strategic role of nonfinancial-performance indicators

Short term financial performance indicators have some limitations (regarding use of standard costs and variance analysis):

- Employees and decision makers may take actions to improve short term financial performance but are not considering long term effects
- Focusing on individual variances may optimize local, but not global, performance;
- Operating personnel may not be able to readily interpret or act upon financial-performance indicators such as cost variances
- Financial performance indicators are basically backward-looking measures (what about future drivers?)
- Designing standard costing systems may have significant costs

Therefore, nonfinancial performance measures can help. Performance indicators relate to basic **business processes**

Business processes

Common business processes include

- **Operating processes**
  - All raw materials from suppliers, producing output, delivering products or services to customers
- **Customer management processes**
- **Innovation processes**
- **Social / regulatory processes**

Organizations succeed when managing each of the four areas.

Just-in-Time (JIT) Manufacturing

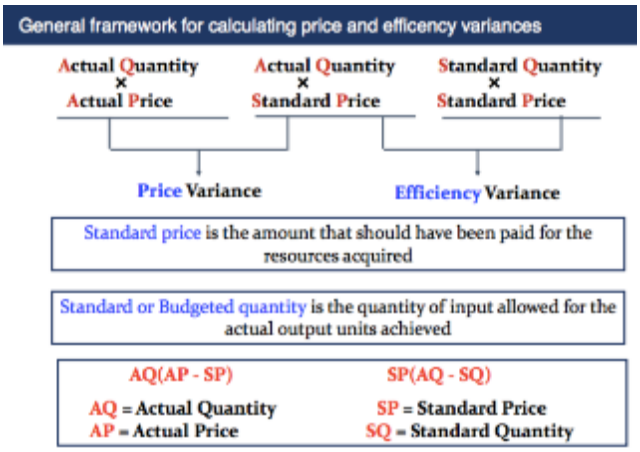
Manufacturing at any stage of a process does not take place until an order is received. Underlying system: **demand-pull**.

Benefits of JIT

- Reduction in out-of-pocket inventory-carrying costs
- Reduction in inventory-related holding costs
- Possible increase in sales
- Decreased production costs

Summary formulas

- Sales price variance = (Actual price – Planned price) * Actual quantity sold
- Direct material variance = (Actual DM cost – Planned DM cost) * Actual quantity sold
- Direct labor variance = (Actual labor cost – Planned labor costs) * Actual quantity sold



Summary

- Budgeting is fundamental firms for purposes of planning, resource allocation, decision-making and performance evaluation
    - Behavioural issues and link to incentive systems needs to be accounted for
- If Actual > Budget = Favorable
- If Actual < Budget = Unfavorable

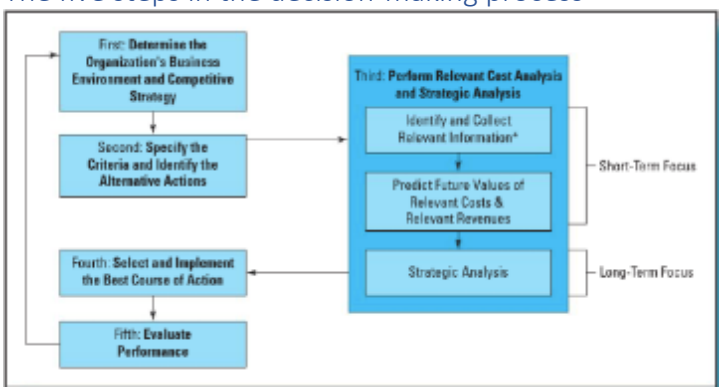
Lecture 5 - Decision making and pricing

Chapter 11 – Decision making with a strategic emphasis

Cost management provides two resources to improve decisions:

1. Relevant cost analysis
2. Strategic analysis

The five steps in the decision-making process



Relevant cost analysis

Relevant cost for decision making:

- **Cost allocation** – What resources are required by products, customers, projects,…?
- **Cost behavior –** Do cash costs of these resources change with the decision we take?
- **Opportunity cost –** Is there an alternative use for the required resources?

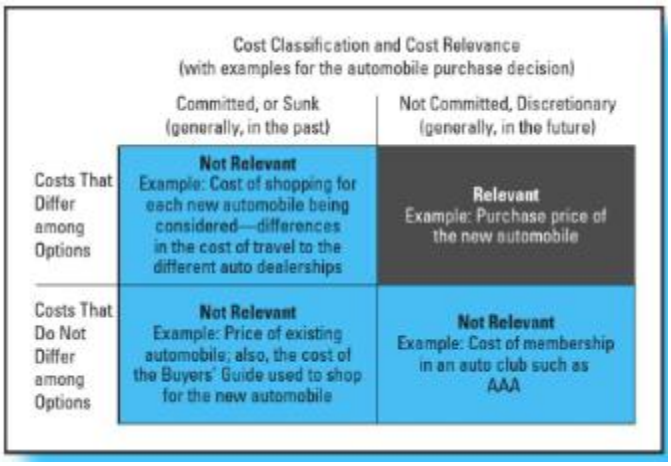
Relevant costs and revenues are those that

- **Differ** between alternative courses of action
- Affect **future cash** flows

Already incurred costs are '**sunk costs'** and thus irrelevant for decision.

Opportunity costs are the foregone benefits from the next best alternative. They are **always relevant**.

Example: Buying a new car:



- Costs are mostly relevant because they differ for each decision alternative and have not been committed
- Relevant costs *can* be **fixed** but most fixed costs are irrelevant

Differential cost analysis analyses the **difference** between the decisions, e.g. repair old machine versus buy new machine

Batch-level cost drivers

- **Setup costs** is a batch-level costs that varies with number of batches

Depreciation expense

Depreciation is an allocation of a cost *already incurred*, therefore it is **not relevant**.
Exception: When tax effects are considered in the decision making, then depreciation has a **positive** vale since it (as an expense) reduces taxable income and therefore tax expense.
Reduces tax liability.

Other relevant information

- Capacity usage information (potential relevance of **opportunity costs**)
    - Opportunity costs = The lost benefit when chosen option precludes the benefits from alternative option
- Time value of money: relevant when deciding among alternatives with cash flows over extended period of time
- Qualitative factors:
    - Functionality
    - Quality
    - Timeliness of delivery
    - Reliability in shipping
    - Service

Strategic cost analysis

Analyzing relevant costs and considering firm's strategy will help advance the strategy, performance and success.

Relevant cost analysis	**Strategic cost analysis**
Short-term focus	Long-term focus
Not necessarily linked to strategy	Linked to firm's strategy
Product-cost focus	Customer focus
Focused on individual product or decision situation	Integrative; considers all customer-related factors

Compare both analyses within framework of:

1. Special-order decision
2. Make vs. buy (lease vs. purchase)
3. Decision to sell before additional processing
4. Keep or drop product line
5. Decision on optimal short-term product mix (constrained optimization analysis)

Special order decisions

Relevant Cost analysis

- Occurs when a firm has a one-time opportunity to sell a specified quantity of its product or service
- Order frequently comes from customer rather than through normal sales of distribution channels
- Rather infrequent
- Small part of firm's overall business

Managers begin with relevant cost analysis for the special sales order.

Example
Three cost elements that are relevant for the firm:

1. Unit-level costs (vary with each shirt produced)
2. Batch-level costs (machine setup, inspection, materials handling)

3. Facilities-level costs (fixed in the SR, e.g. depreciation, insurance on machinery)

Strategic analysis

Before making a decision, consider additional factors:

- Is the company operating at full capacity?
    - If operating at full capacity, would accepting the order cause loss of other, maybe more profitable, sales?
    - Lost sales = opportunity costs
- Long term pricing issues
    - Relevant cost pricing can erode normal pricing policies and lead to a loss in LT profitability
    - Only focusing on ST can deny company's LT success
- Other factors
    - Qualitative factors such as credit history, potential complexities in the design

Value stream accounting and special-order decision

Value stream = all activities required to create customer value for a family of products or services.
When using special orders, they are evaluated within context of value stream. Analysis of costs includes relevant costs throughout the value stream and the strategic analysis is for the entire family of products in the value stream.

Make vs. Buy and Lease vs. Buy decisions

Relevant cost analysis

Firm's products are manufactured according to the specifications set in the **bills of materials** (detailed list of components of the manufactured product).

Relevant cost information for **make vs. buy**:

- All avoidable costs (costs that would be saved if the part were purchased)
- Compare these costs to the external purchase price for the part
- Fixed overhead costs is **not relevant** as long as we assume they are unavoidable

Relevant costs information for **lease vs. buy:**

- Similar to make vs buy

Strategic cost analysis

Firm using value-chain analysis could find that certain of its activities in the value chain can be more profitably performed by other firms.
Outsourcing = practice of choosing to have an outside firm provide a basic service function.

Relevant cost analysis

- Which costs differ between **insourcing** and **outsourcing** options?
    - Avoidable costs in our own production
    - Outside purchase price
    - Incremental profit next-best use of freed-up capacity if we outsource

Strategic analysis

- Other considerations in outsourcing decisions
    - Lower quality control with outsourcing
    - Deterioration in employee morale due to outsourcing
    - Dependence on supplier
        - E.g. "*BMW disrupted due to supply problems"*

Make vs. buy and lease vs. buy decisions are often made on a two-to-five-year basis using projections of expected relevant costs, taking into account the income taxes and time value of money.

Decisions to sell before or after additional processing

Relevant cost analysis

Additional processing might add features or functionality to a product. Determining appropriate product features is **joint production process** (= multiple outputs arise from one common resource input). The **split-off point** is the point where products with individual identities emerge. Prior to this point the **joint production costs** are incurred (not traceable to individual products). After the split-off point, **separable processing costs** are incurred.

Relevant costs:

- Costs **that are incremental to the decision**
- After split-off point, the joint costs are considered sunk and therefore irrelevant
- Before split-off point:
    - Supplies
    - Labor
    - Setup
    - Inspection
    - Materials handling
- Original manufacturing costs are sunk and do not affect the decision

Strategic analysis

Consider quality issues, will selling lower quality before split off point affect company's competitive position or reputation?

Product Line profitability analysis

Dropping a product or service line

Important is to regularly review product and service line profitability; assess issues such as:

- Most profitable products
- Properly pricing
- Which products should be promoted and advertised most aggressively
- Which product managers should be rewarded

→ Short-term focus addressed through relevant cost analysis

Relevant cost analysis

Relevant costs are:

- Fixed costs per unit are irrelevant (unavoidable in the ST)
- Variable costs associated with each product line are relevant
- Compare saved costs with opportunity costs from dropping one product line

Strategic analysis

- Potential effect of the loss of one product line on sales of another
- Employee morale

Service offering and not-for-profit organizations

Include variable costs as relevant (sales for directors, employees etc.)

Constrained optimization analysis: Short-term product-mix development

- Determine most profitable sales mix
- With no production constraints: higher contribution margin = more profitable product.
- Demand > production capacity: Management has to do trade-offs about quantity for each product

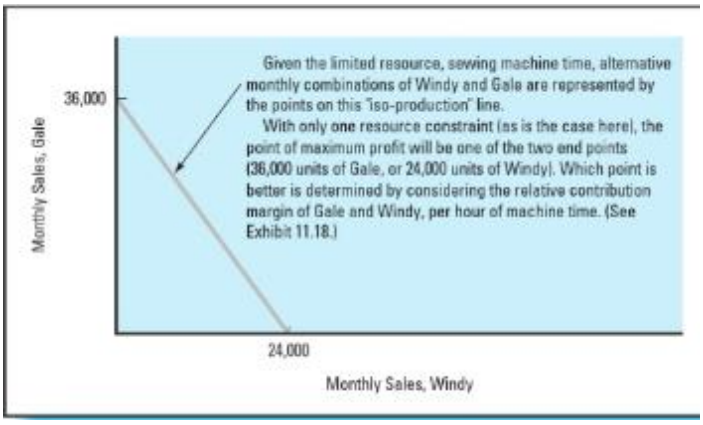
Case 1: One production constraint

Calculate **iso-production line**

Slope = -36 000 / 24 000 = -3/2

Intercept = 36 000

→ zero output Windy and 36 000 of Gale or zero output of Gale and 24 000 output of Windy

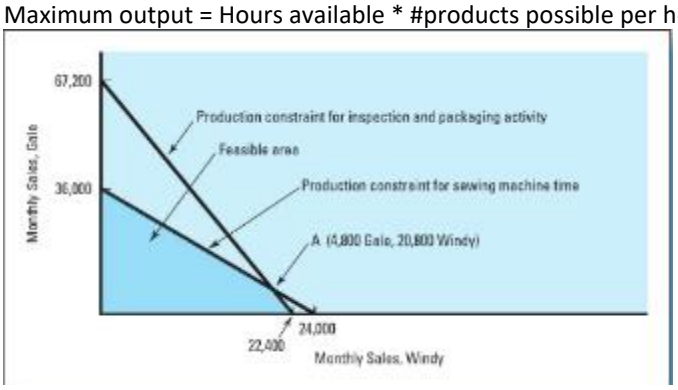


Check higher contribution margin per product

Case 2: Two or more production constraints

Calculate constraint for both activities (e.g. per day or per week); similar to OM analysis.

Maximum output = Hours available * #products possible per hour



Behavioral and implementation issues

Consideration of strategic objectives

Pitfall: focusing too much on short term objectives and neglect long-term strategic goals because compensation is linked to short term performance.
Important to consider long term strategic implications.

Predatory pricing practices

Predatory pricing = company has set prices below average variable cost and plans to raise prices later to recover the losses;
"dumping" products at anticompetitive prices;

Replacement of variable costs with fixed costs

Lower management wants to upgrade costs by replacing variable costs with fixed costs;

Proper identification of relevant factors

Management can fail to proper identify relevant costs. Fail to see that allocated fixed costs are irrelevant.

Identifying relevant costs is context specific:
What is relevant and what's not differs across decision problems:

- One-time-only special orders
- Outsourcing
- Product-mix
- Customer profitability

Relevant information in a firm context

Excess capacity or not?

- If capacity is constrained, producing one type of product means not producing another type of product (→ OC)

Are costs avoidable

- **One-time-only special orders**

Example:
Which costs are relevant:

- Variable costs are relevant
- Fixed production costs are irrelevant; they will be incurred in the future no matter what special one-time order is placed
- Fixed SG&A also not relevant

- **Outsourcing**

Relevant costs:

- Variable costs

Which costs differ between insourcing and outsourcing options?

- Avoidable costs in our own production
- Outside purchase price
- Incremental profit of next-best use of freed-up capacity if we outsource

Other considerations

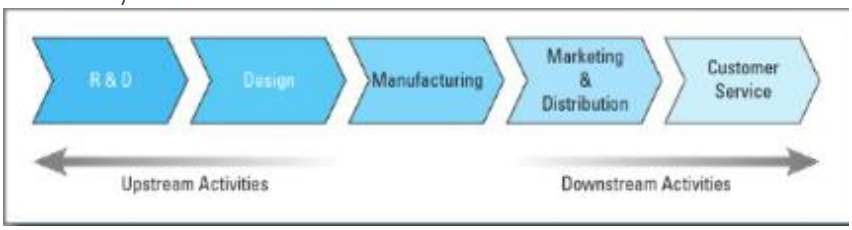
- Sdf

Example: BWM car production disrupted due to supply problems; Bosch (provider of critical part) couldn't deliver that part;

Chapter 13 – Cost planning for the product life cycle (Target costing, theory of constraints and strategic pricing)

Target costing used by Toyota in the 1980s. A company designs a product to achieve a desired profit while satisfying customers' expectations for quality and product features.
Balancing of costs, features and quality takes place throughout the design, manufacturing, sale and service.

Cost life cycle



The **cost life cycle** is the sequence of activities within the organization.

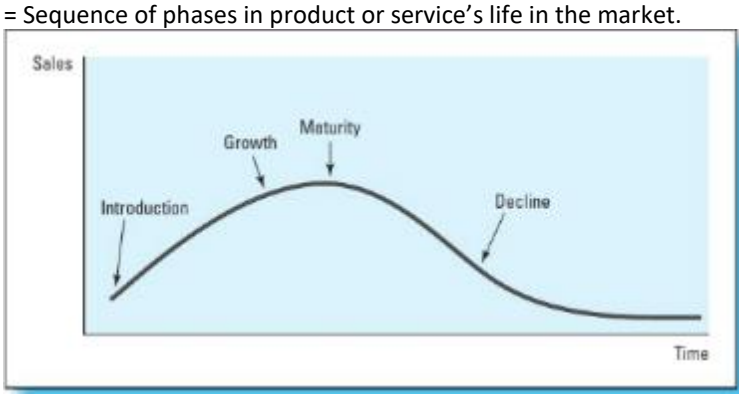
Target costing, theory of constraints and life-cycle costing are all based on the cost life cycle:

- **Target costing**:
  - considers the role of product design (upstream activity) in reducing cost in the manufacturing and downstream phases of life cycle
- **Theory of constraints**:
  - used in manufacturing phase to reduce manufacturing costs
  - speed up delivery
- **Life-cycle costing**:
  - Comprehensive evaluation of profitability of different products

Strategic pricing (fourth method) uses both cost life cycle and sales life cycle.

Sales life cycle

= Sequence of phases in product or service's life in the market.



Target costing

The firm determines the allowable (i.e. target) cost for the product or service, given a competitive market price so that the firm can earn the desired profit.

Target cost = Competitive price – Desired profit

Two options for managing costs to reach target level:

1. Integrate new manufacturing technology (using advanced cost management techniques, such as ABC) and seeking higher productivity
2. Redesign the product

Not really mutually exclusive options!

Steps of target costing:

1. Determine market price
2. Determine desired profit
    a. By unit profit
    b. Percentage of sales dollars
3. Calculate target cost at market price less desired profit
4. Use value engineering to identify ways to reduce product cost
5. Use kaizen costing and operational control to further reduce costs

Value engineering

Value engineering is used in target costing to reduce product cost by analyzing the trade-offs between different types of product functionality (features) and total product cost.

First, conduct consumer analysis during design stage to identify critical consumer preferences.

Type of value engineering depends on product's functionality

- Easily to be added or deleted (e.g. automobiles, computer software) → Use target costing
    - **Functional analysis** (examine performance and cost of each major function or feature of the product; balance between functionality and cost)
    - Benchmarking to see which features give competitive advantage
- Functionality has to be designed into product rather than added (when consumer preferences are stable) → industrial and specialized products
    - **Design analysis** (design team prepares several possible designs of the product with each having similar features with different levels of performance and costs)
    - Benchmarking and value-chain analysis help guide design team in preparing designs

Other cost-reduction approaches:

- **Cost tables**
    - Computer-based databases that include comprehensive information about the firm's cost drivers (e.g. size of product, materials used, number of features)
- **Group technology**
    - Method of identifying similarities in the parts of products manufactured so the same parts can be used in two or more products which reduces costs
- **Concurrent engineering** (Simultaneous engineering)
    - Integrated approach
    - Engineering/design process takes place throughout cost life cycle using cross-functional teams

Target cost and Kaizen

Kaizen = continuous improvement

- Occurs at manufacturing stage where effects of value engineering and improved designs are already in place
- Cost reduction at this stage is to develop new management techniques such as operational control, total quality management, theory of constraints

- Price is assumed to be stable or decreasing over time for firms with target costing
- Firms respond to competitive pressure by periodically redesigning their products using target costing to simultaneously reduce price and improve value

See example p.506

Illustration using Quality Function Deployment (QFD)

Quality function deployment = integration of value engineering, marketing analysis, and target costing to see which components of the product should be targeted for redesign or cost reduction.
Helps designers and managers break down the total product target cost into components that make up the product.

Steps:

1. Determine customer's purchasing criteria for this product and how these criteria are ranked (e.g. performance, safety, economy)
2. Identify components of the product and manufacturing cost of each component
3. Determine how each component contributes to customer satisfaction
4. Determine importance index of each component by combining information in steps one and three and then compare it to step 2

Example p.508

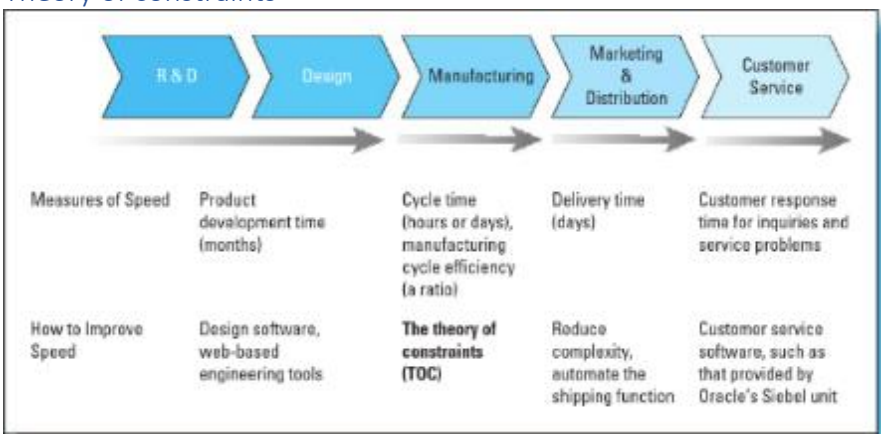
Benefits of Target Costing

- Orients the organization towards customer (design focused on customer values)
- Reduce costs through more effective and efficient design
- Helps firm to achieve desired profitability
- Can decrease total time required for product development
- Can increase communication and cooperation among departments
- Can improve overall product quality as design is carefully developed and manufacturing issues are considered explicitly in the design phase

Costs of target costing due to:

- Need to develop detailed cost data
- Time demands associated with cooperation and coordination throughout organization

Theory of constraints



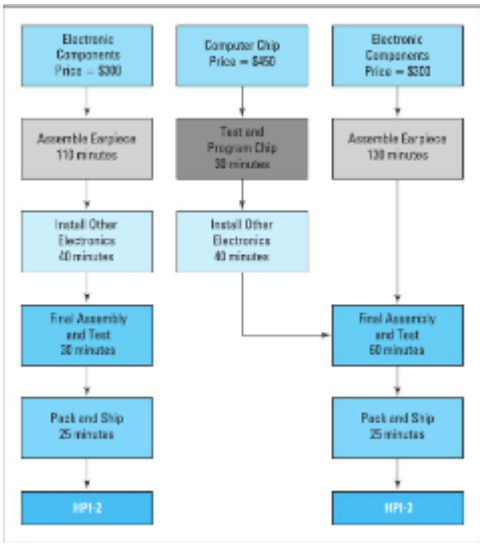
The **cycle time** (or lead time or throughput time) = Amount of time between receipt of a customer order and the shipment of the order

(Start time can also be time that production batch is scheduled, the time raw materials are ordered, or time that production on order has started;
Finish time can be time production is completed or time the order is ready for shipping).

Manufacturing cycle efficiency (MCE) = Processing time / Total cycle time

- Separates total cycle time into time required for each of the various activities:
  - Processing
  - Inspection
  - Materials handling

  - Waiting
  - Etc.
- MCE close to 1 = perfect (shows that less time wasted on moving, waiting, inspecting etc. = all non-value adding activities)



TOC helps managers to reduce cycle times and operating costs. Focus on activities that are **constraints** (= activities that slow a product's total cycle time).
→ TOC focuses attention on improving speed at the constraints; can be compared to JIT since both are aimed at reducing cycle time and reducing inventory levels.

Steps:

1. Identify constraint
   a. Can be identified with a **flow diagram**
   b. Used to analyze total time required for each process
2. Determine most profitable product mix given constraint
   a. **Throughput margin** = product price less materials costs
3. Maximize flow through constraint
   a. **Takt time =** Ratio of total time available to manufacture to expected customer demand
4. Add capacity to constraint
5. Redesign manufacturing process for flexibility and fast cycle time

Theory of constraints reports

The performance evaluation measures also focus on the critical success factors. Common approach to report throughput margin and other operating data is through **theory of constraints report.** They are useful for identifying the most profitable product and for monitoring success in achieving the critical success factors.

Activity based costing and theory of constraints

Firms using target costing and TOC might also use activity-base costing. ABC also assesses the profitability of products.

- TOC is short-term approach to profitability; emphasizes only materials-related costs
- ABC: long-term analysis; includes all product costs
  - Doesn't explicitly include resource constraints and capacities of production activities

→ TOC and ABC *complimentary* methods:

- ABC provides comprehensive analysis of cost drivers and accurate unit costs as basis for strategic decisions about long term pricing
- TOC is useful when improving short term profitability

	TOC	**ABC**
Main objective	Short term focus; throughput margin analysis based on materials and materials-related costs	Long-term focus; analysis of all product costs, including materials, labor, and overhead
Resource constraints and capacities	Included explicitly; a principal focus of TOC	Not included explicitly except as shown in time-driven ABC
Cost drivers	No direct utilization of cost drivers	Develop an understanding of cost drivers at the unit, batch, product and facility level
Major use	Optimization of production flow and short-term product mix	Strategic planning and profit planning

Life-cycle costing

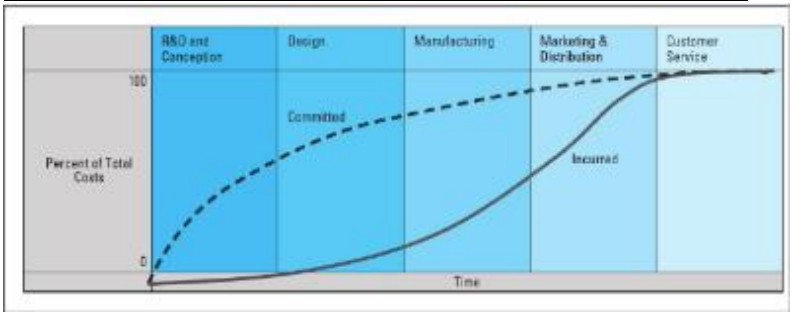
Life-cycle costing provides a long-term perspective because it considers the entire **cost life cycle** (see above) of the product or service → Provides more complete perspective of product or service costs and profitability.

- Industries with high upstream costs
  - Computer software
  - Specialized industrial and medical equipment
  - Pharmaceuticals
- Industries with high downstream costs
  - Fashion apparel
  - Perfumes, cosmetics

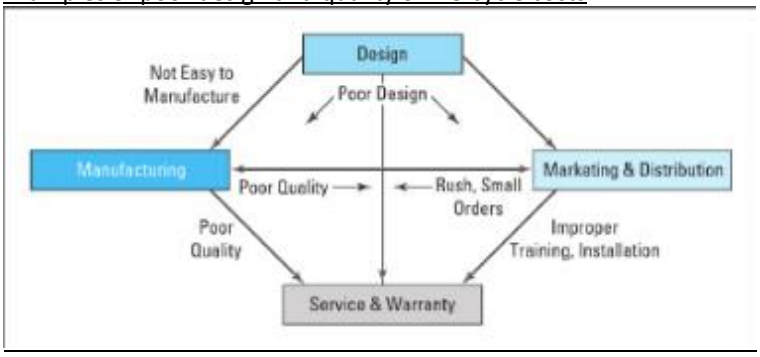
The importance of design

Since categorizing upstream and downstream costs, decision making at the design stage is critical.

Difference between when costs are committed and actually incurred



Examples of poor design and quality of life-cycle costs



The critical success factors at the design stage include:

- Reduced time to the market
- Reduced expected service costs
- Reduced product environmental impact
- Improved ease of manufacture
- Process planning and design

Strategic Pricing using the product life cycle

There are three pricing situations:

1. Special order decision (nonrecurring sales opportunities arise)
2. Target costing (firm faces market price and determines how to achieve desired profit by setting costs)
3. Long term strategic pricing decisions (not involving special orders ot market determined prices); more complex: accountant has to prepare cost information on basis of cost life cycle and sales life cycle

Pricing using cost life cycle

For differentiated firms, they can:

- Skimming: set initial high price followed by lower prices for cost-conscious customers

- Penetration: increase market share by lowering price
- Build longer-term customer relationship by utilizing “value pricing” (pricing is based on meeting specific customer pricing needs)

Cost information for pricing is based on one of four methods:

1. **Full manufacturing cost plus markup**
    a. Use total of variable and fixed manufacturing costs and apply markup percentage to cover operating costs and profit
    b. Markup percentage could be determined by industry practice, judgment, desired level of profit
2. **Life-cycle cost plus markup**
    a. Use full life-cycle cost instead of manufacturing cost (including SG&A costs)
3. **Full cost and desired gross margin percent**
    a. Price determined on achieving desired gross margin percentage
    b. Price = Full manufacturing cost / (1 – desired gross margin percentage)
    c. Price can also be determined based on life cycle costs
4. **Full cost plus desired return on assets**
    a. Markup rate = Desired before-tax profit / Life-cycle cost of expected sales
    b. Price = Life-cycle cost * 1.Markup

Strategic pricing for phases of the sales life cycle

Depends on the position of the product/service in the sales life cycle. As the cycle becomes shorter, the analysis of the life cycle becomes increasingly important.

Lecture 6 - Strategic management accounting; balanced scorecard

Chapter 2 – Implementing strategy: Value chain, balanced scorecard and strategy map

Key tools for strategy implementation:

1. SWOT Analysis
2. Focus on execution
3. Value-chain analysis
4. Balanced scorecard and strategy map

In general, five forces (Porter's five forces) influence profit potential. Firms choose between two basic strategies as a response:

- **Product differentiation**
  - Offer products and services perceived by customers as superior and unique relative to the products or services of its competitors
  - Leads to brand loyalty and willingness of customers to purchase at high prices
- **Cost leadership**
  - Organization is able to achieve lower costs relative to competitors through productivity and efficiency improvements, elimination of waste, tight cost control
  - Leads to lower selling prices

Key performance indicators (KPI) are the metrics managers use to steer the business and measure whether strategy execution is on track;

KPIs should be SMART:

- Specific
  - Widely accepted definition of the KPI
- Measurable
  - Performance against KPI is quantifiable
- Achievable
  - KPI target should be achievable if employee works hard
- Relevant
  - KPI has strong link with value creation
- Time-bound
  - Horizon over which KPI is measured should be defined

KPIs for retail

Measure	Calculation	Meaning
Gross Margin	Gross profit/revenue	Key profitability measure in retail
Inventory turnover	COGS/Average Inventory	Low (high) turnover rates mean overstocking (potential lost sales)
Utilization of floor space	Revenue/floor space	Floor space is usually the constraining factor in retail
Sales by product category	Sum Revenue	Information about which products to (de-)emphasize
Average order size	Total revenue / #orders	Tracks changes in sales mix
Click through rates	#production emails led to sale / #promotion emails sent	Effectiveness of mail promotions

KPI for software startups

Measure	Calculation	Meaning
Signup Growth	#Signup over the years	%increase in users
Conversion rate	#new paid subscription/#new free subscriptions$_{t-1}$	%of trial users upgrading to paid subscriptions
Churn rate	# paid subscription cancelled/#paid subscriptions$_{t-1}$	%of paying customers cancelling paid subscription
ARPA	$Total revenue / #paid subscriptions	Average revenue per account
CAC	$ Sales & marketing costs / #new customers added	Customer acquisition cost
Customer lifetime value	ARPA / Churn rate	Estimated average revenue a customer will generate
Net promotor score	*How likely is it that you would recommend our product to a friend?*	Loyalty of customer base
Cash Burn Rate	$ Net cash spent per month	Negative cash flow per month

SWOT Analysis

Identify firm's critical success factors:

- Internal strengths and weaknesses
  - Strengths: skills and resources the firm has more abundantly than other firms (=**core competencies**)
  - Most easily detected in:
    - Product lines
    - Management
    - Research and development
    - Operations
    - Marketing
    - Strategy
- External opportunities and threats
  - Identifiable in:
    - Barriers to entry
    - Intensity of rivalry among competitors
    - Pressure from substitute products
    - Bargaining power of customers
    - Bargaining power of suppliers

Final step of SWOT to identify quantitative measures for the critical success factors (CFS) (sometimes called **value proposition**).

Examples of CFS:

- Financial factors
  - Profitability
  - Liquidity
  - Sales
- Customer factors
  - Customer satisfaction
  - Marketing and selling
- Internal business processes
  - Quality
  - Productivity
- Learning and growth
  - Product innovation
  - Timeliness of new product
  - Skill development
- Other

  - Governmental and community regulations

Types and nature of CFS depends on the type of strategy:

- Cost leadership
  - Substantial capital investment and access to capital
  - Process engineering skills
  - Intense supervision of labor
  - Products designed for ease of manufacturing
  - Execution:
    - Tight cost control
    - Frequent, detailed control reports
    - Structured organization and policies
    - Incentives based on meeting quantitative targets
- Differentiation
  - Strong marketing capability
  - Product engineering
  - Corporate reputation for quality or technological leadership
  - Long tradition in the industry or unique skills drawn from other businesses
  - Execution:
    - Strong coordination among functions: Research, product development etc.

Value chain analysis

Strategic analysis stool used to better understand firm's competitive advantage. If identifies where value to customers can be increased or cost reduced; understand linkages with suppliers, customers and other firms in the industry.

Value chain because each activity is intended to add value to the product or service for the customer.
Three main phases:

1. Upstream: product development; firm's linkages with suppliers → *supply chain management*
2. Operations: manufacturing operations
3. Downstream: linkages with customers (delivery, service etc.) → *customer relationship management*

<u>Steps:</u>

1. Identify value-chain activities
   a. **Value activities** = activities that firms in the industry must perform in the process of designing, manufacturing and providing customer service
2. Develop a competitive advantage by reducing cost or adding value
   a. Identify competitive advantage
   b. Identify opportunities for added value
   c. Identify opportunities for reduced cost

The balanced scorecard and strategy map

The BSC implements strategy by providing comprehensive performance measurement tool that reflects the measures critical for the success of firm's strategy; provides means for aligning the performance measurement in the firm to the firm's strategy.

- BSC balances:
  - Financial and nonfinancial KPIs
  - Backward and forward looking KPIs
  - Outcome measures and value drivers

The strategy map develops and communicates strategy throughout the organization.

The Balanced Scorecard (BSC)

BSC enables firm to employ a strategy-centered performance measurement system (focuses on managers' attention on CFS and rewards them for achieving these CFS).

Four perspectives / groupings of CFS:

1) **Financial perspective** (financial performance measures; e.g. operating income)
    a. *How to we look to our investors?*
    b. KPI capture: Revenue growth, gross margin, ROIC, EVA
2) **Customer perspective** (measures of customer satisfaction)
    a. *How to we look to our customers?*
    b. KPI capture: customer satisfaction, market share, customer retention
3) **Internal process** perspective (productivity, speed)
    a. *What business processes drive value?*
    b. KPI capture efficiency of: R&D design, operations, selling, marketing, customer service, distribution
4) **Learning and growth perspective** (employee training hours)
    a. *How to we change, reinvent, improve?*
    b. KPI capture: Investments in employees, corporate culture, information flow

Benefits of BSC

- Means for tracking **progress toward achievement** of strategic goals
- Means for implementing strategy by drawing manager's **attention to relevant CFS**
- Framework for firms to **achieve desired organizational change** in strategy
- Fair and **objective basis** for firms in determining each manager's compensation and advancement
- Framework that **coordinates efforts** within firm to achieve CFS
- Motivates teamwork

Implementing BSC

The BSC should:

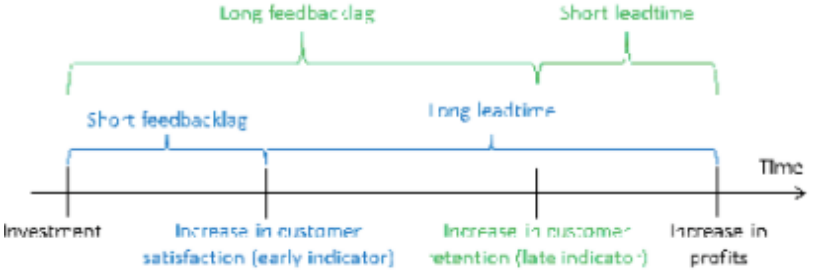
- Have strong support of top management
- Accurately reflect organization's strategy
- Communicate strategy effectively to all employees
- Have a process that reviews and modifies the scorecard
- Be linked to reward and compensation systems
- Include processes for assuring the accuracy and reliability of the information in the BSC
- Ensure that the relevant portions of the scorecard are readily accessible to those responsible
- Require managers involved in the implementation to also be involved in the selection in scorecard measures
- Be framed as strategy map with all of the linkages among perspectives

Timing, Cause-and-effect, and Leading Measures in the BSC

- Measures in the BSC will be updated regularly
- Some measures are known to have a cause-and-effect relationship with other measures (e.g. improved quality should increase sales and customer satisfaction)

The goal is to anticipate **future** results

- Leading (<u>nonfinancial</u>) indicators (instead of lagging financial indicators) → causally linked to end results
- Select indicators that create value



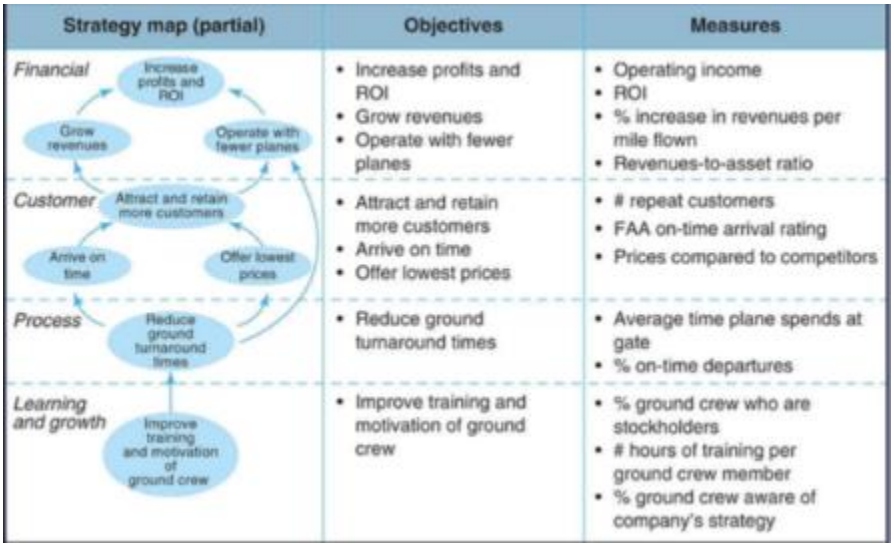
	Measures

Customer perspective	
Quality	Number of defects, delivered product quality
Price	Low price relative to competitive market price, sales volume
Delivery	Number of on-time deliveries
Shipments	Sales growth, number of customers that make up 90% of shipments
New products	Number of new products, percent of sales of new products
Support	Response time, customer satisfaction surveys
Internal capabilities	
Efficiency of manufacturing	Manufacturing cost, output per hour
New product introduction	Rate of new product introductions
New product success	New products' sales, number of orders
Innovation	
Technology leadership	Product performance compared to competition, number of new products with patented technology
Cost leadership	Manufacturing cost as percent of sales
Market leadership	Market share in major markets
Research and development	Number of new products, number of plants
Financial perspective	
Sales	Annual growth in sales and profits
Cost of sales	Gross margin percent
Profitability	Operating profit
Liquidity	Cash flows
Employees and Community Perspective	
Competitive benefits and salaries	Salaries compared to norm in local area
Opportunity	Individual contribution, personnel satisfaction
Citizenship	Company contributions to community

The strategy Map

- Links the perspectives in the order they contribute to the overall success of the firm
- Cause-and-effect diagram of relationship between these perspectives
- Ultimate goal stated in financial performance = target of strategy map

Sustainability is a new trend that organizations have to follow.
Triple bottom line: **social**, **economic** and **environmental** performance;



Sustainability measures for BSC

Environmental performance indicators

- Operational indicators (measure potential stresses to the environment)
- Management indicators (measure efforts to reduce environmental effects)
- Environment condition indicators (measure environmental quality)

Social performance indicators

- Working conditions indicators
- Community involvement indicators
- Philanthropy indicators

Chapter 5 – Activity-based costing and customer profitability analysis

See lecture 3

Chapter 16 – Operational performance measurement: Further analysis of profitability and sales

Extension of the flexible budget – productivity measures and additional sales variance measures;

Strategic Role of the Flexible Budget in analyzing productivity and sales

- Better understand reasons behind increase and decrease in total sales dollars over budgeted amount, or increase/decrease over prior year
- How did change in sales affect firm's profitability and growth in desired market areas

Key determinants of productivity:

1. Control of waste
    a. Achieved through work flow management and quality
    b. E.g. Toyota Production System (TPS):
        i. Long-term focus on relationship with suppliers and coordination with them
        ii. Emphasis on continuous flow manufacturing with stable production levels
        iii. Continuous improvement in product design and manufacturing processes with objective of elimination of waste
        iv. Flexible manufacturing systems
    c. = **lean manufacturing** (focus on waste and balanced production flows)
2. Product and manufacturing process innovation

   a. Often achieved via information technology
3. Fluctuations in demand due to changes in the business cycle or for other reasons
   a. Influenced by business cycle

Analyzing productivity

Productivity = Output / Input

- **Operational productivity**
  - Output units / Input units (physical measures)
- **Financial productivity**
  - Output / input (either one of the units have to be sales units)

A **partial productivity** measure is one that focuses on the relationship between one of the input factors and the output attained.
Examples of partial productivity:

- Direct materials productivity (output/unit of materials)
- Workforce productivity (output per labor hour or per person employed)
- Process productivity (output per machine hour or kilowatt-hour)

When you include all input resources used in production is a **total productivity** measure.

	Partial productivity		**Total productivity**	
	Operational	**Financial**	**Total Units of Output**	**Sales Value of Output**
Numerator (output)	Units of output	Units of output	Units of output	Sales value of output
Denominator (input)	Units of input	Dollar value of input	Dollar value of input	Dollar value of input
Productivity measure (output/input)	Units of output per unit of input	Units of output per dollar value of input	Units of output per dollar value of input	Dollar value of output per dollar value of input

In general, increased productivity decreases costs and increases operating income. Changes in the productivity of different resources, however, do not always occur in the same direction or at an equal rate.

Partial productivity

Partial productivity = Number of units manufactured / Number of units or cost of a single input resource

Partial operational productivity

When assessing productivity, firms often use benchmarks which include past productivity measures of the firm, the productivity of another firm in the same industry, the average/standard or a benchmark established by top management as goal for the firm to attain.

Changes in productivity can also be examined by computing the amount of input resources that the firm would have used in 2016 had it maintained the 2015 partial productivity
See p. 648

Partial financial productivity

It indicates the number of units of output manufactured for each dollar the firm spent on the input resource.

- Panel 1:
  - Factors that may contribute to difference in manufacturing costs between two operations are:
    - Output level
    - Input costs

        - Productivity
    - Flexible budget can be used for determining the effects of each of these factors
    - Point A: actual operating result in 2015
        - Amounts are the actual 2016 figures: units of output, productivity, input costs
    - Point B: cost to manufacture the 2016 output at the 2015 productivity level and 2016 input costs
        - → Difference between A and B = productivity (any difference in A and B is attributable to changes in productivity between 2016 and 2015)
    - Point C: cost to manufacture the 2016 output at the 2015 productivity level and 2015 input cost
        - → Difference between B and C is the unit cost of the input resource in each of the years (B: 2016 cost per unit, C: 2015 cost per unit)
    - Point D: Cost to manufacture the 2015 output at 2015 productivity and 2015 unit cost of input resource
        - → Difference between C and D is because of different output levels between these points

Partial productivity: Operational vs. Financial

Input of partial operational productivity is physical units. This makes it easy to use partial operational measures for operational personnel. Operational partial productivity is unaffected by price changes or other factors; easier to benchmark.

Partial financial productivity considers both cost and quantity of an input resource on productivity. Effect of cost is the main concern. It can also be used in operations that use more than one production factor. (Whereas partial operational productivity only measures one input resource at a time).

Limitations of partial productivity analysis

- Only measures the relationship between an input resource and the output (ignores any effect that changes in other manufacturing factors have on productivity)
- Ignores any effect that changes in other production factors have on productivity
- Analysis and interpretation of partial productivity should include effects that changes in the firm's operating characteristics have on the productivity of the input resource
- Improved partial productivity doesn't necessarily mean that the firm or division operates efficiently

Partial productivity, flexible budget and standard costs (Review chapter 14)

Productivity analysis usually uses year-to-year framework.

The use of the flexible budget in chapters 14 and 16 is quite similar, but there are different objectives:

- Chapter 14: identify volume and flexible budget variances for materials and labor for changes in volume relative to the master budget
    - Work with materials or labor standard of a certain number of materials units or labor hours *per unit of output*
- Chapter 16: identify changes in input prices and productivity from year-to-year (and not compared to master budget)
    - Work with number of *units of output per unit of materials or labor input*

Total productivity

Total productivity is the ratio of output to the total cost of all input resources used to produce the output.

Total productivity = Units or sales value of output / Total cost of all input resources

- Financial productivity measure
    - Numerator: number of units or sales value of output attained
    - Denominator: total dollar amount of all direct (variable cost) resources used in the production of the output

ERIE PRECISION TOOL COMPANY
Total Productivity

Panel 1: Total Productivity in Units	**2016**	**2015**
(a) Total units manufactured	4,800	4,000
(b) Total variable manufacturing costs incurred	$1,000,000	$ 760,000
(c) Total productivity: (a) ÷ (b)	0.004800	0.005263
(d) Decrease in productivity: 0.005263 − 0.004800 = 0.000463, or 8.8% (0.000463 ÷ 0.005263)		
Panel 2: Total Productivity in Sales Dollars		
(a) Total sales	$2,400,000	$2,000,000
(b) Total variable manufacturing costs incurred	$1,000,000	$ 760,000
(c) Total productivity: (a) ÷ (b)	$ 2.4000	$ 2.6316
(d) Decrease in productivity: $2.6316 − $2.4000 = $0.2316, or 8.8% ($0.2316 ÷ $2.6316)		

- Panel 1:
  - Determine output of each period
  - Calculate total variable costs incurred to produce the output
  - Compute total productivity by dividing the amount of output by the total cost of variable input resources

Limitations of total productivity

It measures the combined productivity of all operating factors. Therefore, it decreases the possibility of manipulating some of the manufacturing factors to improve the productivity measure of other manufacturing factors.

Limitations however are:

- Since its financial nature, personnel at operational level may have difficulty linking financial productivity measures to their day-to-day operations
- Deterioration in total productivity can result from increase in cost of resources or decrease in productivity of some of the input factors → beyond control of manager
- Productivity measure can ignore the effects of changes in demand for the product, changes in selling price of the goods or services, and changes in special purchasing or selling arrangements on productivity

Comparison with master budget

Here, we use the flexible budget to answer strategic questions about sales performance.

Sales volume variance = Budgeted sales price * Changes in sales volume
Selling price variance = Actual sales units * Change in price

Sales volume variance partitioned into sales quantity and sales mix variances

Sales quantity variance

Sales quantity variance = Budgeted sales units – Actual sales units

- Focuses on deviations between number of units sold and number of units budgeted to be sold
- Measures the effect of these deviations on contribution and income

Three elements:

1. Difference in total units of all products between actual units sold and units budgeted to be sold
2. Budgeted sales mix ratio of the product (sales mix for a product is its sales in units as a percentage of total sales units)
3. Budgeted contribution margin per unit of the product

We use budgeted amounts for the other two elements, sales mix and contribution margin per unit, to compute sales quantity variance:

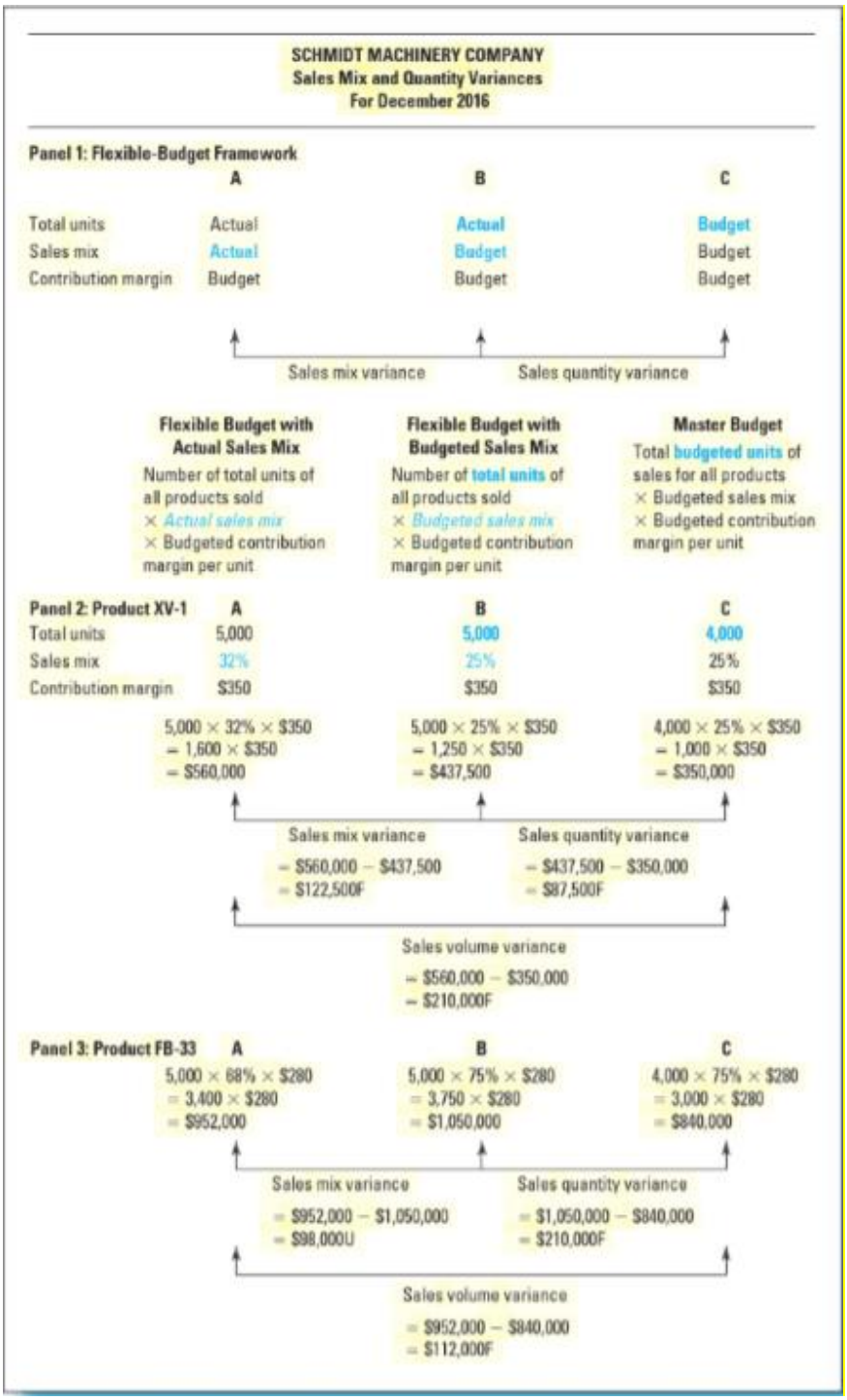
Sales quantity variance = (Total units of all products sold – Budgeted total units of all products) * Budgeted sales mix of the product * Budgeted contribution margin per unit of the product

Sales mix variance

Sales mix is the relative proportion of a product's sales to total sales.
Product's sales mix variance = effect that a change in the relative proportion of the product from the budgeted proportion has on the total contribution margin of the period.

Sales mix variance = (Actual sales mix of product – Budgeted sales mix of product) * Total units sold * Budgeted contribution margin per unit of the product

Illustration see p. 655



SCHMIDT MACHINERY COMPANY
Sales Mix and Quantity Variances
For December 2016

Panel 1: Flexible-Budget Framework

	A	B	C
Total units	Actual	Actual	Budget
Sales mix	Actual	Budget	Budget
Contribution margin	Budget	Budget	Budget

Sales mix variance | Sales quantity variance

Flexible Budget with Actual Sales Mix	Flexible Budget with Budgeted Sales Mix	Master Budget
Number of total units of all products sold × *Actual sales mix* × Budgeted contribution margin per unit	Number of total units of all products sold × *Budgeted sales mix* × Budgeted contribution margin per unit	Total budgeted units of sales for all products × Budgeted sales mix × Budgeted contribution margin per unit

Panel 2: Product XV-1

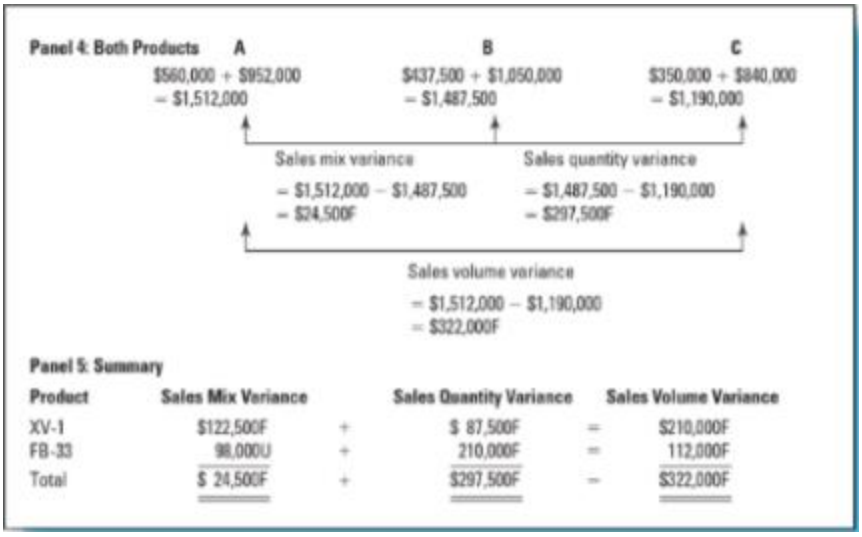
	A	B	C
Total units	5,000	5,000	4,000
Sales mix	32%	25%	25%
Contribution margin	$350	$350	$350
	5,000 × 32% × $350 = 1,600 × $350 = $560,000	5,000 × 25% × $350 = 1,250 × $350 = $437,500	4,000 × 25% × $350 = 1,000 × $350 = $350,000

Sales mix variance = $560,000 − $437,500 = $122,500F
Sales quantity variance = $437,500 − $350,000 = $87,500F
Sales volume variance = $560,000 − $350,000 = $210,000F

Panel 3: Product FB-33

A	B	C
5,000 × 68% × $280 = 3,400 × $280 = $952,000	5,000 × 75% × $280 = 3,750 × $280 = $1,050,000	4,000 × 75% × $280 = 3,000 × $280 = $840,000

Sales mix variance = $952,000 − $1,050,000 = $98,000U
Sales quantity variance = $1,050,000 − $840,000 = $210,000F
Sales volume variance = $952,000 − $840,000 = $112,000F



Sales quantity variance partitioned into market size and market share variance

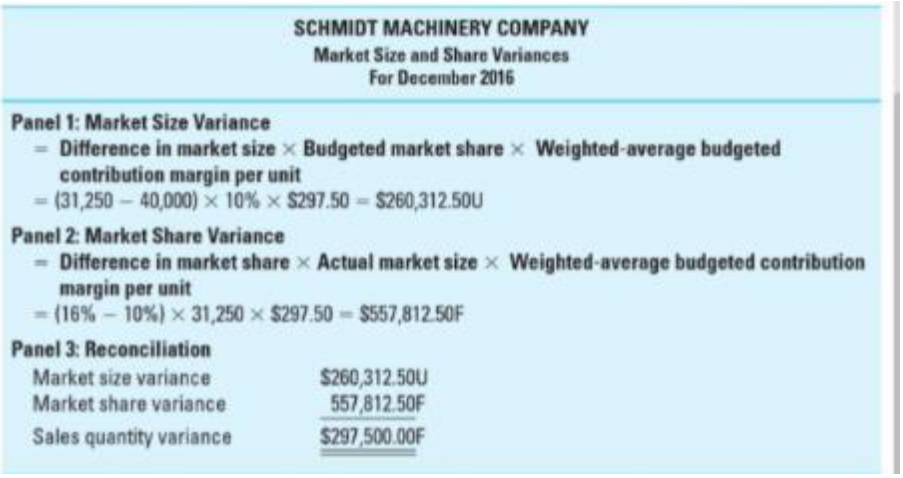
When market share increases, firm is more likely to sell more units; when global market for product increases, firm is also more likely to sell them more.

Market size variance

It measures the effect of changes in market size on a firm's total contribution margin. As market size expands, firms are likely to sell more units.

Market size variance = (Actual market size in units – Budgeted market size in units) * Budgeted market share * Weighted-average budgeted contribution margin per unit

(Weighted average budgeted contribution margin per unit = divide the total units of the firm into the total contribution margin of the firm)
= *composite contribution margin per unit*



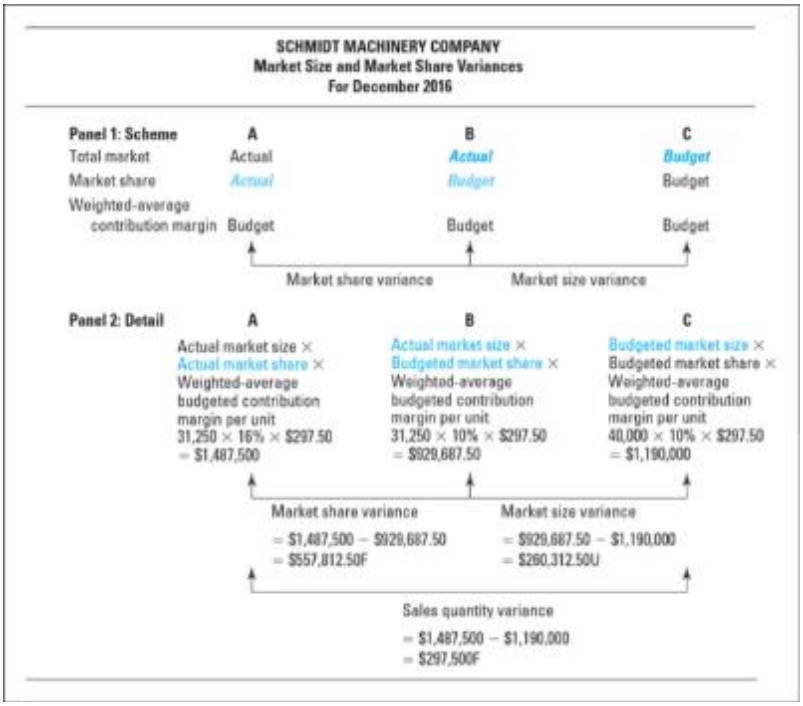
Market share variance

It compares the firm's actual market share to its budgeted market share and measures the effects of the difference in market shares on the firm's total contribution margin and operating income.

Market share variance = (Actual market share – budgeted market share) * Total actual market size in units * Weighted-average budgeted contribution margin per unit

→ see calculation Panel 2 in previous table

Market share variance + market size variance = sales quantity variance (Panel 3)



→ results are the same as previous exhibit

- Point A: budgeted total contribution margin that the firm would have earned from the actual number of units sold
- Point B: budgeted total contribution margin the firm would have earned, given the actual market size, had it maintained the budgeted market share
- Point C: Master budget (budgeted market size * budgeted market share)
    - → difference between B and C: total market size (actual market size at B and budgeted market size at C)

Five steps of strategic decision making

1. Determine strategic issues surrounding the problem
2. Identify alternative actions
3. Obtain information and conduct analyses of alternatives
4. Based on strategy and analysis, choose and implement the desired alternative
5. Provide ongoing evaluation of effectiveness of implementation

Analyzing sales: Comparison with prior year results

Actual data:

	January 2017	December 2016
Sales units	5,100	5,000
Sales mix for each product		
XV-1	30%	32%
FB-33	70%	68%
Price		
XV-1	$805	$800
FB-33	590	600
Variable cost per unit		
XV-1	450	450
FB-33	320	320
Contribution margin per unit		
XV-1	355	350
FB-33	270	280

Comparative income statement

	January 2017	December 2016
Sales XV-1	$1,231,650	$1,280,000
Sales FB-33	2,106,300	2,040,000
Total sales	3,337,950	3,320,000
Variable costs	1,830,900	1,808,000
Contribution margin	1,507,050	1,512,000
Fixed costs	600,000	600,000
Operating income	$ 907,050	$ 912,000

Selling price and volume variances for Jan 2017

	January 2017	Sales Price Variance	Flexible Budget	Sales Volume Variance	December 2016
Sales					
XV-1	$1,231,650	$ 7,650	$1,224,000	$(56,000)	$1,280,000
FB-33	2,106,300	(35,700)	2,142,000	102,000	2,040,000
Total sales	3,337,950	(28,050)	3,366,000	46,000	3,320,000
Variable costs					
XV-1	688,500	–	688,500	(31,500)	720,000
FB-33	1,142,400	–	1,142,400	54,400	1,088,000
Total variable costs	1,830,900		1,830,900	22,900	1,808,000
Contribution margin					
XV-1	543,150	7,650	535,500	(24,500)	560,000
FB-33	963,900	(35,700)	999,600	47,600	952,000
Total contribution margin	1,507,050	$(28,050)	$1,535,100	$ 23,100	1,512,000
Fixed costs	600,000				600,000
Operating income	$ 907,050				$ 912,000

see p 663

	Sales Mix Variance	Sales Quantity Variance	Volume Variance
XV-1	$(35,700)U	$11,200F	$(24,500)U
FB-33	28,560F	19,040F	47,600F
Contribution margin	$ (7,140)U	$30,240F	$ 23,100F

Analysis of Mix and quantity variances

The mix variances are determined as follows:

Change in mix × Units sold in January 2017 × December 2016 unit contribution

XV-1: (.3 − .32) × 5,100 × $350 = $35,700 unfavorable
FB-33: (.7 − .68) × 5,100 × $280 = 28,560 favorable

The quantity variances are determined as follows:

Change in total units sold × December 2016 sales mix × December 2016 contribution margin

XV-1: (5,100 − 5,000) × .32 × $350 = $11,200 favorable
FB-33: (5,100 − 5,000) × .68 × $280 = $19,040 favorable

→ total of the mix and quantity variances = volume variance for each product

Analysis of variable cost variances

Above approach can be extended to analyze changes in unit variable costs:

- Calculate price and usage variances for material and labor (similar to CH 14)
- Flexible budget based on actual output and prior year actual unit variable costs as framework

Customer profitability analysis

- Estimate customer-related costs and assess profitability of a specific customer or group of customers
- Determine profitability for each customer or group
- Similar to ABC analyisis:
    - Identify customer service activities and cost drivers
    - Use customer cost hierarchies to categorize costs related to customers

- Allows firms to choose customer mix, determine after-sale services, decide on discounts etc.

Customer cost hierarchy

- Customer output unit-level costs
  - Product handling costs
- Customer batch-level costs
  - Delivery costs
- Customer sustaining costs
  - Customer visits
- Distribution-channel costs
  - Salary of manager
- Sales sustaining costs
  - Related to sales and service activities that cannot be traced otherwise

Other considerations in customer mix decisions:

- What could we do that would freed up capacity after dropping the customer
- Growth potential of customer
- Spillover effects from having well known customers
- Potential to learn from customers

Lecture 7 - Management-Level Control

Part 4 is about management-level control. It provides a variety of tools that top management use to evaluate mid-level managers and the organization as a whole.

Chapter 18 – Strategic Performance measurement

It is important to align managers' incentives with the organization's strategic goals.
A key tool for aligning performance and strategic goals is the **balanced scorecard**. It is particularly important in difficult economic times, when traditional profit-based measures are distorted and difficult to benchmark against established benchmarks such as prior year earnings, industry earnings etc.

Manager's objective during difficult times is to look for actions taken currently which are expected to lead to profit growth in the future. The company also needs to change strategic direction, to move from a focus on product development and innovation to cost control.

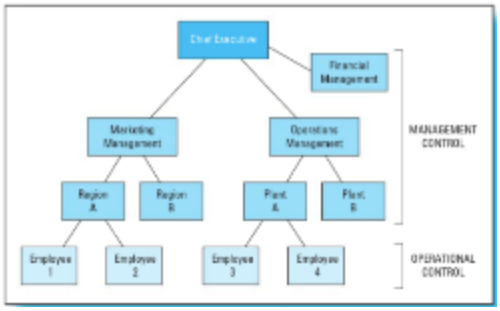
Performance measurement and control

Performance measurement is the process by which managers at all levels gain information about the performance of tasks within the firm and judge that performance against pre-established criteria as set out in budgets, plans and goals.

Performance is evaluated at many different levels in the firm: Top management, mid-management and operational level.

- **Management control** refers to the evaluation of the performance of mid-level managers by upper-level managers (covered by chapter 18-20).
    - Control = strategic performance measurement;
- **Operational control** refers to the evaluation of operating-level employees by mid-level employees (covered by chapter 14-17)
    - Control = operational performance measurement

Operational control vs. management control



- Operational control
    - Focuses on detailed short-term performance measures
    - Management-by-exception approach (identify units or individuals whose performance doesn't comply with standards/expectations)
- Management control
    - Focuses on higher-level managers
    - Long-term, strategic issues
    - Management-by-objectives approach (long-term objectives such as growth and profitability are determined and performance is periodically measures against these goals)
    - Broader and more strategic objective: evaluate unit's overall profitability *and* performance of its managers to decide whether the unit should be retained or closed
    - More performance measures than in operational control

Objectives of management control

Top management uses **management-by-objectives** approach:

- Assign set of responsibilities to each mid-level manager (nature of responsibilities depends on **functional** area involved, operations, marketing etc. and **scope of authority** of mid-level manager)

These areas of responsibility = **Strategic business units (SBUs)**

- Consists of a well-defined set of controllable operating activities over which SBU manager is responsible

- SBUs = center, division, business unit

Objectives of management control:

- Motivate managers to exert a high level of effort to achieve the goals set by top management
- Provide the right incentive for managers to make decisions consistent with the goals set by top management → align managers' efforts with desired strategic goals (alignment = **goal congruence**)
- Determine fairly the rewards earned by managers for their effort and skill and the effectiveness of their decision making

The **employment contract** between manager and top management is a common mechanism for achieving all the objectives.
It specifies the manager's desired behaviors and the compensation to be awarded for achieving specific outcomes by using these behaviors. It can be implicit or explicit, legal and enforceable by the courts.

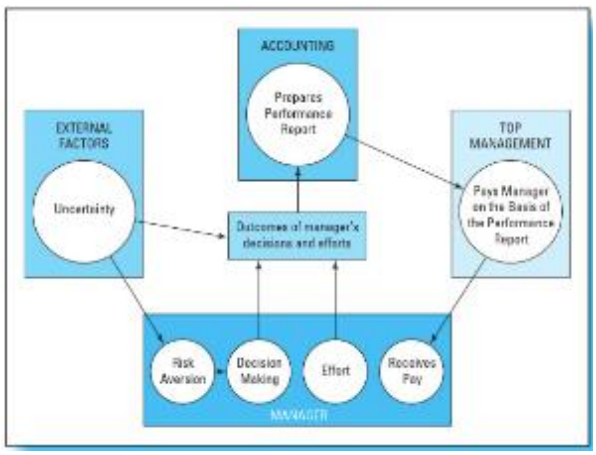
Employment contracts

The **principal-agent model** contains the key elements that contracts must have to achieve the desired objectives. The model sets out three important aspects of management performance that affect the contradicting relationship:

1. **Uncertainty**
    a. Sometimes the manager has a lack of control over uncertain events (external events, machine breakdowns etc.) → there is uncertainty over effectiveness of manager's actions
2. **Risk aversion**
    a. Manager's risk preference is important because they can have unexpected and undesirable effects on the manager's behavior
    b. Risk-averse managers are more likely to be motivated by supervision and rewards that reduce risks
3. **Lack of observability**
    a. Efforts and decisions made by the manager are not observable to top management
    b. Top management can only observe the observable outcomes and not the effort

Due to these three factors, the contract has to rely on effective incentives that specifically incorporate uncertainty and lack of observability. Three principles:

1. Because of uncertainty, the contract should recognize that other factors inside and outside the firm also influences the outcomes of decisions. The contract should separate the outcome of manager's actions from the effort and decision skills employed by the manager
    a. (separate performance of the manager from the performance of the SBU)
2. Contract must include only factors the manager controls
    a. Contract should exclude known uncontrollable factors from the contract
3. Risk-averse managers might make decisions to avoid risk when top management might prefer risky choices



Top management supplies compensation to the manager who operates in an environment of uncertainty. The manager supplies effort and decision-making skills as well as degree of risk aversion.

Design of management control systems for motivation and evaluation

Clearly include:

1) *Who is interested in evaluating the organization's performance?*
    a. Firm's owners, directors, shareholders
    b. Creditors
    c. Community / governmental units affected by operation
    d. Employees
2) *What is being evaluated*
    a. Individual manager (effectiveness and efficiency)
    b. SBU under manager's control → invest or divest SBU?
    c. Team of managers
3) *When is the performance evaluation conducted?*
    a. Evaluation done on basis of resources input to manager
        i. Use master budget
    b. Evaluation done on basis of output of manager's efforts
        i. Use flexible budget
    c. Tie evaluation to product life cycle

Stage of Product's Sales Life Cycle	Appropriate Performance Evaluation Measures
Early	Revenue, market penetration
Growth	Profitability, asset management
Mature	Profitability, strategy

The systems for management control have two types:

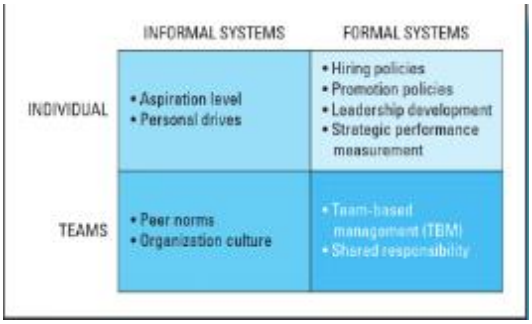
1. **Formal systems**
    a. Developed with explicit management guidance
    b. There are four formal management control systems at the individual employee level:

1. Hiring policies
    a. Critical in all organizations
    b. Supplement strategic performance measurement systems
2. Promotion policies
    a. Critical in all organizations
    b. Supplement strategic performance measurement systems
3. Leadership development
    a. Training, readings meetings, policies and procedures that help managers become more effective
4. Strategic performance measurement systems
    a. Most common method for evaluating managers

In each system, management sets expectations for desired employee performance.

At the team level, there is less information about the control systems. Increases importance of teamwork recently led to team-based management (TBM) programs and resources.

2. **Informal systems**
    a. Arise form unmanaged, unintended behavior of managers and employees
    b. Used in firms at both individual and team level
        i. Individual level: employees' performance is influenced by individual drives and aspirations they bring to workplace (separate from incentives and guidance provided by management)
        ii. Team level: team norms influence outcome
        iii. Organization-level norms can influence teams and individual employees



Strategic performance measurement

Strategic performance measurement is a system used by top management to evaluate SBUs managers.

Delegation of responsibility = **Decentralization**

Decentralization

Top management chooses to delegate a significant amount of responsibility to SBU managers.

Opposite = **centralization**

- Top management retains control over key business functions
- Can ensure desired level of performance
- Expertise of top management can be effectively utilized
- Activities of the different units can be effectively coordinated

Decentralization is preferred when:

- Top management cannot manage operations at a very detailed level (lacks local knowledge)
- Use of local or specialized knowledge by SBU manager
- Motivating for employees
- Training for future top-level managers
- Better basis for performance evaluation (more objective, more opportunity for advancement of hard-working, effective managers)

Pro Decentralization	Con Decentralization
Use of local knowledge	Can hinder coordination among SBUs
Allows timely and effective response to customers	Can cause potential conflict among SBUs
Trains managers	
Motivates managers	
Offers objective method of performance evaluation	

Types of strategic business units

- **Cost centers**
  - Firm's production or support SBUs
  - Evaluated on basis of cost (e.g. plant's assembly department, data processing department, shipping department)
- **Revenue centers**
  - Defined by product line or geographical area
- **Profit centers**
  - SBU both generates revenues and incurs major portion of the cost for producing those revenues
  - Managers are responsible for both revenues and costs; seek to achieve desired operating profit
- **Investment centers**
  - Includes assets employed by the center as well as profits in the performance evaluation (CHAPTER 19)
  - When firm has different profit centers because it has many product lines

The choice between these three centers depends on the nature of the production and selling environment of the firm.

- Cost centers: Products have little need for coordination between manufacturing and selling functions (commodity products such as food, paper products) → standardized products for customers; therefore *production managers* focus on *reducing costs*
- Revenue centers: *Sales managers* focus on sales
- Profit centers: products need close coordination between production and selling functions, e.g. high-fashion and consumer products (customer information coming into the selling function promptly reaches the design and manufacturing functions → specially designed products)

The balanced scorecard

Each of the four centers focuses on critical financial measure of performance. Rather than focusing on financial performance only, most firms use multiple performance measures to evaluate centers, often in form of the **balanced scorecard**.

It provides a more comprehensive performance evaluation, includes motivation, fairness, proper incentives for the alignment of managers' performance with strategic goals.

Cost centers

They include **manufacturing plants** or **direct manufacturing departments** such as assembly or **manufacturing support departments**, such as materials handling, maintenance or engineering.
In all of these departments, managers have significant direct control over costs but little control over revenues or investment decisions.

Strategic issues related to implementing cost centers

There are three issues when implementing cost centers:

1) Cost shifting
    a. Occurs when the department replaces controllable costs with non-controllable costs
    b. E.g. manager of production cost center that is evaluated on controllable costs has the incentive to replace variable costs with fixed costs, since manager is generally not held responsible for increases in non-controllable fixed costs
    c. Requires analysis and justification of equipment upgrades and any changes in work patterns that affect other departments
2) Excessive short-term focus
    a. Many performance measurement systems focus excessively on annual cost figures: motivation for managers to attend only short-term costs and to neglect long-term strategic issues
    b. Cost centers should use nonfinancial strategic considerations as well
3) Role of budget slack
    a. **Budget slack** = difference between budgeted and expected performance
    b. Managers often aim for specific slack to allow for unexpected unfavorable events
    c. Significant amount of slack might result from SBU manager's attempts to simply make their performance goals easier to achieve

Implementing cost centers in departments

Production and support departments

There are two methods for implementing cost centers:

1) **Discretionary-cost method**
    a. Input-oriented approach
    b. Costs are considered to be largely uncontrollable and fixed
    c. Discretion is applied at planning stage → planning approach: Top management can effectively budget for expected costs in each discretionary-cost center
    d. Beginning-of-period planning
    e. Cost centers have relatively ill-defined output (e.g. R&D), less well-defined goals
2) **Engineered-cost method**

a. Output-controlled
b. Costs are variable and controllable
c. End-of-period evaluation
d. Operations are well defined; output goals are clearly determined

Cost behavior is important in choosing the cost department method. The behavior of an activity measure depends on the level of analysis (facility, product, batch, unit). Therefore, we must know at which level of analysis the cost center operates.

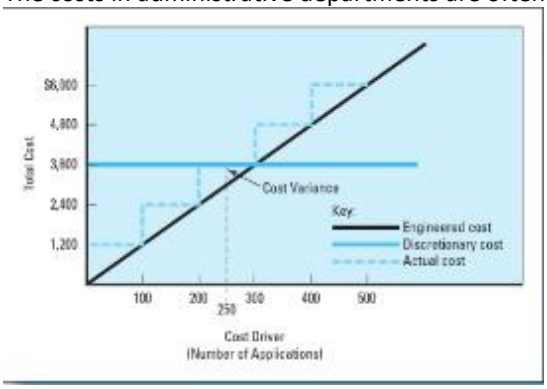
- Cost in engineering department: **product-level activity**
- Costs in inspection department: **batch-level activity** (number of production runs etc.)
- Few cost drivers **at facility level** (most costs are fixed and don't fluctuate with changes) → mostly **discretionary cost centers**
- Product, batch- or unit-level: **engineered-cost method**

Discretionary Cost Approach	Engineered Cost Approach
Costs are mainly fixed and uncontrollable	Costs are mainly variable and controllable
Firms use an input-oriented planning focus	Firms use an output-oriented evaluation focus
Outputs are ill-defined	Outputs are well-defined
The focus is on planning	The focus is on evaluation

Administrative support departments

These are human resources, R&D, IT services and printing etc. They are commonly evaluated as cost centers as well, since they seldom have a source of revenue but only incur costs.
Whether to use discretionary-cost method of the engineered-cost method depends on the cost behavior in the department or the manager's goals. It can also be changed over time.

The costs in administrative departments are often **step-costs**



Outsourcing or consolidating cost centers

Outsourcing is the term used to describe a firm's decision to have a service or product currently provided by a support department supplied by an outside firm.

- Can obtain reliable product / service at a reasonable cost
- Enable firm to gain access to new technologies

However, with outsourcing, the firm loses control over potentially strategic resource.

Another option is that firms consolidate decentralized cost centers into one or a few centralized cost centers.

Cost allocation

When the cost center is centralized, an important issues is how to allocate the jointly incurred costs of service departments.

Cost allocation methods = CHAPTER 7
Criteria for choosing the methods are the same as the objectives for management control:

- Motivate managers to exert a high level of effort
- Provide an incentive for managers to make decisions consistent with top management's goals
- Provide a basis for a fair evaluation of manager's performance

To achieve the three criteria, firms can make use of **dual allocation** which is the cost allocation method that separates fixed and variable costs.

Revenue centers

To evaluate the performance in these centers, managers often make use of **revenue divers** which are factors that affect sales volume (price changes, promotions, discounts, customer service, changes in product features, delivery dates, other value-added factors).
In service firms, factors are nearly the same but focus more on quality of service (courtesy, quality, level of helpfulness).

Marketing and **sales departments** can be seen as cost and revenue centers. They are both generating revenues, so that the manager must report these revenues (typically by product line, and often by sales area and sales person). Top management uses the revenue report to assess performance in achieving desired sales goals.
This analysis is often done at detailed level to determine separate effects of changes in price, quantity and sales mix on overall sales dollars.

However, these two departments can also be seen as cost centers. In cosmetics, software, games and toys, pharmaceuticals and specialized electrical equipment industries, the cost of advertising and promoting is a significant portion of the total costs.
The marketing and sales department incur two types of costs:

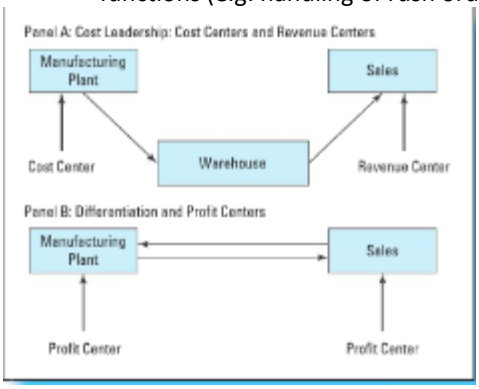
1) **Order-getting costs**
    a. Expenditures to advertise and promote product (samples, commissions, market research)
    b. Often discretionary cost method since it's difficult to determine the affected sales from these costs)
2) **Order-filling costs**
    a. Freight, warehousing, packing, shipping, collections
    b. Clear relationship with sales = engineered cost center

Profit centers

Goals: Earn profits
Advantage of profit centers: It brings manager's incentives into congruence with those of top management (improve firm's profitability).

Strategic role of profit centers

- Profit centers provide incentive for desired coordination among the marketing, production, support functions (e.g. handling of rush orders)



- Panel A: Cost leadership firm
- Panel B: Differentiation
    - E.g. fashion apparel

- Motivates managers to consider their products and services as marketable to outside customers
- Motivates managers to develop new ways to make profit from products/services

The contribution income statement

Common form of profit center evaluation. It is based on the contribution margin developed for each profit center and for each relevant group of profit centers.

- Shows contribution margin and contribution margin less traceable fixed costs, **contribution by profit center (CPC)**
- Measures profit after all traceable costs and is therefore controllable by profit center manager
- More complete and fair measure of performance than either contribution margin or operating income

Controllable fixed costs = fixed costs that the profit SBU manager can influence in approx. 1 year or less (e.g. advertising, sales promotion, certain engineering, data processing, research projects)
Non controllable fixed costs = cannot be controlled (e.g. facilities-related costs such as depreciation, taxed, insurance).

By subtracting controllable fixed costs from the contribution margin, you determine the **controllable margin.**

Complications when completing the contribution income statement:

- Some costs that are not traceable at detailed level are traceable at higher level of aggregation

It can also be used to determine whether a profit center should be dropped or retained.

Variable costing vs. full costing

The use of the contribution income statement is often called **variable costing** because it separates variable and fixed costs.
Only variable costs are included in determining the cost of sales and the contribution margin.
Operating income using variable costing is not effected.

Full costing includes fixed cost in product cost and cost of sales. It is a conventional costing system because it is required by financial reporting standards and by the IRS for determining taxable income. It satisfied the **matching principle** (in determining the cost of goods sold, it matches the revenues from of the period with the full cost of the product)
→ Chapter 3-7

see p.756 for details

Full costing income exceeds variable costing income (by amount of fixed cost in the inventory change) when inventory in units increases.
Variable costing income is higher than full-costing income when inventory in units decreases.

The contribution income statement and international accounting standards

IASB is a London-based independent organization that develops and interprets international financial reporting standards (IFRSs).

Before GAAP

Page 758

The contribution income statement and value streams

The application of lean accounting, products and services are grouped in families called *vales streams.* The value stream income statement shows the contribution of each of the organization's value streams in much the same way as the contribution income statement (each value stream is a profit center).

Strategic performance measurement and the balanced scorecard

Critical performance measurement contains all critical success factors of the business, including nonfinancial measures.
For that the balanced scorecard is used. It has four perspectives:

1) Customer satisfaction
2) Financial performance
    a. Cost, revenue and profit centers
3) Internal business processes
4) Learning and innovation

Implementing the BSC and the Strategy map for performance evaluation

There are several issues in implementing the BSC and the strategy map for performance evaluation:

- The BSC and strategy map are more likely to be used in an evaluation of performance over time rather than for performance of an SBU relative to another SBU
    - Difficult to compare two SBUs
- BSC is widely used for strategic planning and often performance evaluation but less often in management compensation
- Successful implementation requires validation of the links between measures that are assumed to improve performance throughout the scorecard
- Managers must provide information on the strategic linkages in the scorecard
- Enterprise resource planning systems (ERPs): provide information system base that stores the detailed information for the BSC → don't need the BSC anymore

Read more p. 759

Implementing the BSC

1. Develop a causal model
2. Gather data
3. Turn the data into information
4. Continually refine model
5. Base actions on finding
6. Assess outcomes

Management control in service firms and not-for-profit organizations

- Commonly implemented as cost or profit center
    - **Cost center** when manager's critical mission is to control costs (most common)
    - Profit center when manager must manage both costs and revenues or manage costs without exceeding budgeted revenues

Chapter 19 – Strategic performance measurement: Investment centers and transfer pricing

Disadvantage of decentralization: performance is measured more difficulty. Therefore, the subunits of a decentralized organization (and managers) should as much as possible be evaluated only on factors they can control / influence by their actions.

Investment centers are the highest subunit level of an organization. Managers of these units exercise control over revenues, costs and level of investment. Therefore, the evaluation of financial performance should include invested capital. These measures allow top management to compare the financial performance of difference investment centers within the organization.

It is getting complicated when units exchange goods and services with one another. In such situations, "**transfer prices"** between units must be chosen to evaluate the financial performance of both the buying and the selling unit.

Five steps in the evaluation of the financial performance of investment centers in an organization

Example p.784/785

1. Determine the strategic issues surrounding the problem
2. Identify alternative actions
    a. E.g. alternative SR measures such as ROI, residual income (RI), economic value added (EVA)
3. Obtain information and conduct analyses of the alternatives
4. Based on strategy and analysis, choose and implement desired alternative
5. Provide an ongoing evaluation of the effectiveness of the implementation
    a. E.g. use benchmarking

Part 1 – financial performance indicators for investment centers

Connected to *controllability*, it is important for top management to evaluate the profitability of each investment center in relation to the amount of capital invested in the subunit.
Top management can use one or combination of following metrics:

- Return on investment (ROI)
- Residual income (RI)
- Economic value added (EVA)

We evaluate these metrics on the basis of:

- Extent to which the measure motivates a high level of effort on the part of investment center managers
- Extent to which the use of the measure results in goal congruency
- Extent to which the measure rewards managers fairly for their effort and skill, and for the effectiveness of decisions they make

Return on investment

The **return on investment (ROI)** is a measure of profit divided by some measure of investment in the business unit. The larger the %, the better the ROI.

Level of ROI depends on:

- General economic conditions (e.g. current economic conditions for firm's industry)
    - Cyclical industries have ROI that vary significantly under differing economic conditions (e.g. airlines, home construction)

When calculating ROI, the "profit" for an investment center is typically defined as divisional operating income. The "investment" is often determined by the assets of the business unit.

ROI is the product of **returns on sales** and **asset turnover**
ROI = Return on sales * Asset turnover

ROI = (Profit/Sales) * (Sales/Assets)

- Sales and profits relate to period of time
- Amount of assets is usually determined from the simple average of the amount of assets at the start of the period and the amount at the end of the period

The **return on sales** (or **profit per sales dollar**) measures the manager's ability to control expenses and increase revenues to improve profitability. It is also called **profit margin**.

The **asset turnover**, the amount of sales dollars generated per dollar of investment, measures the manager's ability to increase sales from a given level of investment.

Together, they provide a complete story of manager's short-term performance and therefore enhance top management's ability to evaluate and compare different units within the organization.

Illustration of short-term financial-performance evaluation using ROI

E.g. in a company, each of the three product lines is considered to be an investment center for performance evaluation purposes.

Using ROI enables the company to evaluate the short-term financial performance of each of the three product lines. It can set performance goals for each product line in terms of returns on sales and asset turnover.

ROI: Measurement issues

Keep the following guidelines in mind:

1) Income and investment, to the extent possible, should be measured in the same way for each business unit
    a. All units to be evaluated should use the same inventory cost-flow assumption (FIFO or LIFO) and the same depreciation method
2) The measurement method must be reasonable and fair for all business units
    a. E.g. if some units have much older assets than other units, the use of net book value (NBV) for assets can bias the ROI measures in favor for the older units

Which assets to include in the ROI calculation

Key criterion: To what extent does the business unit control the asset

- Long-lived assets are commonly included in investment if they are traceable to the business unit
    - If they are leased or some part is idle, then it's a problem:
        - Leasing requires clear firm-wide policy regarding how to treat leases in determining the ROI (but still include them since they represent assets used to generate income)
        - Idle assets require controllability: If they have an alternative use or are readily saleable, include them as an asset; or if you want to encourage the divestment of idle assets, include them; if management sees potential advantage holding the idle assets, exclude them

Measuring investment: Allocating shared assets

Ch 7: Jointly cost allocation

Management should trace the assets to the business units that used them and allocate (on a basis that is as close to actual usage possible) the assets that cannot be traced.

If the required capacity and therefore the investment in the joint facility are sometimes large because the user units require high levels of service at periods of high demand, the assets should be allocated according to the **peak demand** by each individual business unit.
Units with higher peak-load requirements have a larger portion of total investment costs.

Measuring investment: Current values

Investment is typically the **historical cost** of divisional assets (= book value of current assets + net book value of long-lived assets).
Net book value for a depreciable asset is the difference between the original cost of the asset and accumulated depreciation on that asset.

There is a problem when long-lived assets are a significant portion of the total investment base because most long-lived assets are stated at historical cost, and price changes since their purchase can make the historical-cost figures irrelevant and misleading.

- If you use small historical-cost value to measure the level of investment, ROI can be *significantly overstated* relative to ROI determined on the basis of current value of the assets
    - Can mislead decision makers

Moreover, the use of current values helps to reduce the unfairness of historical-cost NBV when comparing among business units with *different aged assets*. Unit with older assets under the NBV method may have significantly higher ROI than business units with newer assets because of the effect of price changes and accumulated depreciation over the life of the assets.

There are three measures of current value:

1) **Gross book value**
    a. Historical cost without reduction for accumulated depreciation
    b. Rough estimate of current value of assets
    c. Improves NBV because it removes the bias due to differences in the age of assets and differences in depreciation methods used across different business units
    d. Preferred when valuing objectivity of historical cost number (original purchase cost is reliable, verifiable9
2) **Replacement cost**
    a. Estimated cost to replace the assets at the current level of service and functionality
    b. Purchase price
    c. Generally higher than liquidation value
    d. Preferred when ROI is used to evalute manager of the business unit as a continuing enterprise because using replacement cost is consistent with idea that the assets will be replaced at the current cost and business will continue
3) **Liquidation value**
    a. Estimated price that could be received from the sale of the assets of a business unit
    b. Sales price
    c. Preferred when top management is using ROI to evaluate the business unit for potential disposal and relevant current cost is the sales (i.e. liquidation) value of the asset of the unit

Example

		Measure of Assets			
Region	Operating Income	Net Book Value	Gross Book Value	Replacement Cost	Liquidation Value
Financial data:					
Midwest	$26,000	$192,500	$250,500	$388,000	$ 332,000
Boston region	38,500	212,000	445,000	650,000	1,254,600
South Florida	16,850	133,000	155,450	225,500	195,000
Return on investment (ROI):					
Midwest		13.5%	10.4%	6.70%	7.8%
Boston region		18.2	8.7	5.9	3.1
South Florida		12.7	10.8	7.5	8.6

- Stores in Boston are the oldest, located in areas where real estate values have risen significantly
- ROI based on NBV: Boston is most profitable
- GBV shows that since Boston is somewhat older, ROI figures for all three are kind of comparable
- Replacement cost is useful when evaluating manager's performance: it best measures the investment in the continuing business; all regions are somewhat comparable
- Liquidation value for Boston is relatively low → value is quite high due to rising appreciation of the value

Strategic issues regarding the use of ROI

There are some limitations when using the ROI:

- *Value creation in the new economy*
    - Today, the economy is called a *knowledge-based economy* where you have to manage intangible and tangible assets
    - Therefore, a broader performance-measurement and control system is demanded (e.g. BSC)
- *Short term focus of the metric*
    - ROI is a short-term measure of profitability → subject to manipulation on the part of the business-unit manager
    - The use of ROI to evaluate short-term financial performance might not motivate decisions that increase the value of the business
- *Decision model and performance model inconsistency*
    - Long-term investment projects should be evaluated using a discounted cash flow decision model, e.g. use of NPV
    - In practice, managers often judge investment using ROI
- *ROI: Disincentive for new investment by the most profitable units*
    - ROI encourages units to invest only in projects that earn a higher rate of return than the unit's current ROI
    - This rejects investment projects that would be beneficial

- It provides disincentive for the best units to grow; inventive for low ROI units to invest in new projects to improve their ROI

Residual income

The **residual income (RI)** is a dollar amount equal to the income of a business unit less an imputed charge for the level of investment in the unit.
The charge is determined by multiplying a desired minimum rate of return by the level of investment in the business unit. Residual income can be interpreted as the income earned after the division has 'paid' a charge for the funds invested in the business unit by top management.

The issues regarding measuring investment and income for RI are the same as for the ROI.
Advantages of RI:

- RI motivates business unit to pursue an investment opportunity as long as the investment's *expected return exceeds the minimum return* set by the firm
- Can adjust required rates of return for **differences in risk**. Businesses with higher risk can be evaluated at a higher minimum rate of return
- It is possible to calculate different investment charge for different types of assets (a higher minimum rate of return could be used for long-lived assets that are more likely to be specialized in use and thus not readily saleable)

Time period of analysis: Single vs. multiperiod perspective

- RI and ROI are short-term indicators of financial performance (one-year performances)
- Therefore, evaluate these indicators over multiple years; trend analysis combined with competitive benchmarking

Limitations of RI

- Not useful when comparing business units, since it is not a percentage
- Relatively small changes in the minimum rate of return can dramatically affect the RI

Summary ROI and RI

	Advantages	Limitations
Return on investment (ROI)	• Easily understood by managers • Comparable to interest rates and rates of return on alternative investments • Widely used	• Disincentive for high-ROI units to invest in projects with ROI higher than the minimum rate of return but lower than the unit's current ROI • Can lead to goal-congruency problems (e.g., suboptimal investment decision making)
Residual income (RI)	• Supports incentive to accept all projects with ROI above the minimum rate of return • Can use the minimum rate of return to adjust for differences in risk • Can use a different minimum rate of return for different types of assets	• Favors large units • Can be difficult to determine a minimum rate of return for organizational subunits
Both ROI and RI	• *Comprehensive financial measure;* includes key elements important to top management: revenues, costs, and level of investment • *Comparability;* expands top management's span of control by allowing comparison of business units	• *Can mislead strategic decision making;* not as comprehensive as the balanced scorecard, which includes customer satisfaction, business processes, and learning, as well as financial measures; the balanced scorecard is linked to strategy • *Measurement issues;* variations in the measurement of inventory and long-lived assets and in the treatment of nonrecurring items, income taxes, foreign exchange effects, and the use/cost of shared assets • *Short-term focus;* investments with long-term benefits might be neglected; captures financial performance for only a single year; may cause goal-congruency problems within the organization • Failure to capture value-creating activities (i.e., managing an organization's intangible assets)

Economic value added

EVA is an estimate of a business's economic profit generated during a given period.

EVA = Profit – imputed charge for the use of assets (capital) during the period

Sales
Less: Operating expenses (including taxes)
Less: Financial expenses (Cost of capital * Amount of invested capital)
= EVA

It is a potentially useful metric for evaluating financial performance. It incorporates the level of invested capital in the measure. Similar to RI, no measure of return **on** investment is indicated until there is a recovery of the cost **of** capital.
It motivates managers to increase investment as long as such investment return is at least $1 beyond the cost of capital.

RI is calculated entirely using reported accounting data. Therefore, it suffers from all of the limitations associated with historical-based accounting.
EVA approximates economic, and not accounting, earnings and level of invested capital.
→ EVA provides estimate of *value added;* it is one approach of *value-based management*

Estimating EVA

EVA = NOPAT – (k * Average invested capital)

NOPAT = After-tax **cash** operating income, after depreciation (total pool of cash funds available to suppliers of capital)
= Revenues – Cash operating costs – Depreciation – Cash taxes on operating income
EVA is referred to as *net* operating profit after tax since depreciation is deducted.

Invested capital = economic capital = cash contributed by suppliers of funds to the business

K = weighted-average cost of capital (WACC)

EVA = (r – k) * Invested capital

R = rate of return on capital (cash on cash return)
= NOPAT / Invested capital

k = WACC

→ if r > k, shareholder value was increasing during that period and EVA is positive

In order to calculate EVA, we need to estimate both NOPAT and capital. Adjustments to the capital figures reported in the financial statements are referred to as *equity-equivalent adjustments.*

<u>Common EVA Adjustments</u>

- Adjustments to "Capital"
  - Deferred income tax expense reserves
  - LIFO reserve
  - R&D expenses
  - Bad-debt reserve
- Adjustments to NOPAT
  - Change in deferred tax reserved
  - Change in LIFO reserve
  - Change in bad debt reserve
  - Unusual gain / loss

Alternative approaches to estimating EVA NOPAT and EVA CAPITAL

Financing approach

NOPAT is estimated by building up to the rate of return on capital from the standard return on equity (ROE) in three steps:

1. Eliminate financial leverage
2. Eliminate so-called financial distortions
3. Eliminate so-called accounting distortions

NOPAT will represent the total returns available to all providers of capital to the company. Therefore, it represents the productivity of capital employed in the business, irrespective of how investments in that capital were financed.

EVA capital is calculated by first determining the total of interest-bearing debt plus capitalized leases. To this, you would add the book value of common equity (pay value of stock, capital excess of par, retained earnings), the book value of preferred stock, and noncontrolling interests (if any). Finally, it is necessary to adjust for equity equivalents, e.g. present value of noncapitalized leases, balance sheet amount of deferred taxes, the LIFO reserve.

Operating approach

It consists of starting with (cash) sales and then subtracting depreciation and recurring cash economic expenses.
Then, we deduct the amount of operating taxes, after which we are left with the EVA NOPAT.
In estimating the amount of taxes paid, we adjust reported income tax expense by the change in the deferred tax account during the period. (Ignore interest expense! It's a financing charge!)

Using average total assets

Accountants use the average of the beginning and ending balances of the year for total assets in the performance metrics.

Part 2 – Transfer pricing

When is transfer pricing important?

Transfer pricing is most common in firms with a high degree of vertical integration. These firms engage in a number of different value-creating activities in the value chain.

Objectives of transfer pricing

1. Motivate a high level of effort of business-unit manager (i.e. extent to which a particular transfer-pricing method maintains autonomy of the business units)
2. Achieve goal congruency between decisions made by managers of business units and the goals of top management
    a. E.g. Minimize, within allowable limits, income tax consequences of internal transfers of goods and services
3. Reward business-unit managers fairly for their effort and skill and for the effectiveness of the decisions they make

Specific transfer-pricing alternatives can also be evaluated in terms of implementation/administrative costs.

Transfer-Pricing methods

1) **Variable cost method**
    a. Set transfer price equal to selling unit's variable cost (with or without a markup)
    b. Desirable when selling unit has excess capacity and the selling unit's variable cost is less than external purchase price
    c. Low transfer price encourages buying internally → many companies add a markup to variable cost when determining the price (e.g. add a lump-sum to variable costs)
2) **Full-cost method**

   a. Set transfer price equal to the variable cost plus an allocated share of unit's fixed costs (with or without a markup)
   b. Well understood approach
   c. Information for determining the transfer price is readily available in accounting records
   d. However, including fixed costs can lead to improper decision making
   e. To improve: use ABC method
3) **Market-price method**
   a. Set transfer price equal to current price of the product in external market
   b. Objective approach: best satisfies the arm's length criterion desired for both management and tax purposes
   c. Market prices generally provide proper incentives
   d. However, market prices are not always available
4) **Negotiated-price method**
   a. Negotiating and arbitration to determine transfer price between two units
   b. Desirable when units have a history of conflict and negotiation can result in an agreed-upon price
   c. Consistent with theory of decentralization
   d. However, method can reduce desired autonomy of the units
   e. Costly and time-consuming

Firms can also use two or more methods, called **dual pricing**.

Summary of the transfer-pricing methods

Method	Advantages	Limitations
Variable cost	• Provides the proper motivation for the manager to make the correct *short-term decision*, in which the seller's fixed costs are not expected to change. When the seller's variable cost is less than the buyer's outside price, the variable cost transfer price will cause internal sourcing, the correct decision	• Inappropriate for long-term decision making in which fixed costs are relevant and prices must cover fixed as well as variable costs • Unfair to seller if seller is profit or investment center (i.e., no profit recognized on the transfer)
Full cost	• Easy to implement • Intuitive and easily understood • Preferred by tax authorities over variable cost • Appropriate for long-term decision making in which fixed costs are relevant and prices must cover fixed as well as variable costs	• Irrelevance of fixed cost in short-term decision making; fixed costs should be ignored in the buyer's choice of whether to buy inside or outside the firm • If used, should be standard rather than actual cost (allows buyer to know cost in advance and prevents seller from passing along inefficiencies)
Market price	• Helps to preserve unit autonomy • Provides incentive for the selling unit to be competitive with outside suppliers • Has arm's-length standard desired by taxing authorities • Usually provides proper economic incentives	• Intermediate products often have no market price • Should be adjusted for any cost savings associated with an internal transfer, such as reduced selling costs
Negotiated price	• Can be the most practical approach when significant conflict exists • Is consistent with the theory of decentralization	• Need negotiation rule and/or arbitration procedure, which can reduce autonomy • Potential tax problems; might not be considered arm's length • Can be costly and time-consuming to implement • Resulting profitability measures (e.g., ROI or RI) are partly a function of the negotiating skills of the manager, rather than the operational performance of the business unit

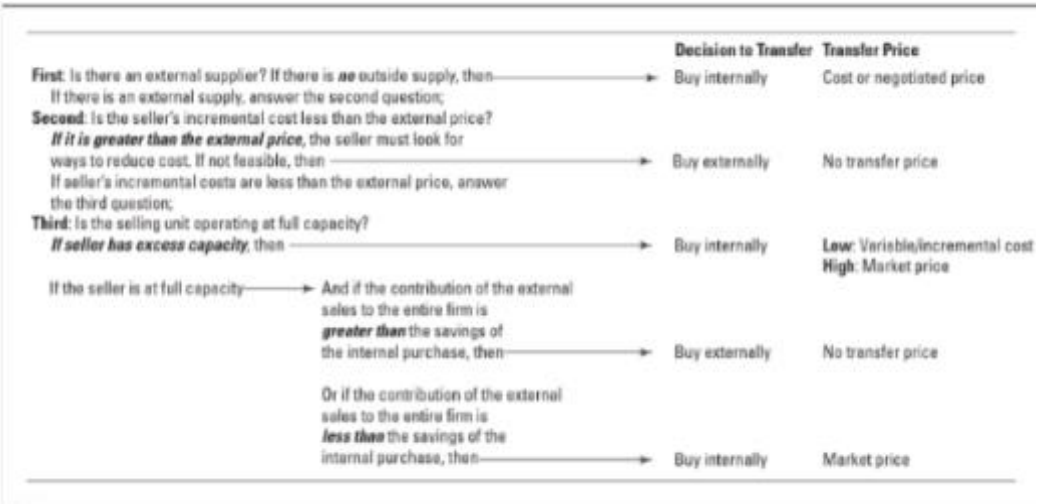
Choosing the right transfer-pricing method: The firmwide perspective

Will the transfer price lead to actions that benefit the organization as a whole? Does the transfer price motivate an internal transfer and whether it motivates an external sale when such a sale is warranted (from organizationwide perspective)?

Three basic questions:

1. *Is there an outside supplier?*
   a. If not, there is no market price → Use **negotiated price**
   b. If yes, consider the relationship between inside seller's variable cost to the market price of external supplier by answering second question
2. *Is the seller's variable cost less than the external market price?*
   a. If not, seller's costs are too high, from standpoint of organization, buyer should buy externally

   b. If seller's incremental costs are less than market price, use third question
3. *Is the selling unit operating at full capacity?*
   a. Will the order from the internal buyer cause the selling unit to deny other sales opportunities?
      i. If not, transfer price between variable cost and market price
      ii. If full capacity is used, determine and compare the cost savings of internal sales vs. selling division's opportunity cost of lost sales



Example p.805/806

General transfer-pricing rule

The ultimate transfer-pricing method depends on complex considerations.

Minimum transfer price = Incremental (i.e. out of pocket) cost of the producing division + Opportunity cost to the organization by making internal transfer

International issues in transfer pricing

- **Arm's-length standard** calls for setting transfer prices to reflect the price that unrelated parties acting independently would have set. Applied in three ways:
  - **Comparable price method**
    - Establishes an arm's-length price by using sales prices of similar products made by unrelated firms
    - Most common and preferred
  - **Resale-price method**
    - Used for distributors and marketing unit when little value is added
    - Transfer price based on appropriate markup using gross profits of unrelated firms selling similar products
  - **Cost-plus method**
    - Transfer price based on selling unit's costs plus a gross profit percentage determined by comparing the seller's sales to those of unrelated parties or by comparing unrelated parties' sales to those of other unrelated parties

Other issues

- Tax issues
- Risk of expropriation
  - Expropriation occurs when a government takes ownership and control of assets that a foreign investor has invested in the company
- Minimization of customs charges
- Currency restrictions

The **advance pricing agreements** (APA) is an agreement between the Internal Revenue Service (IRS) and a firm established an agreed-upon transfer price.