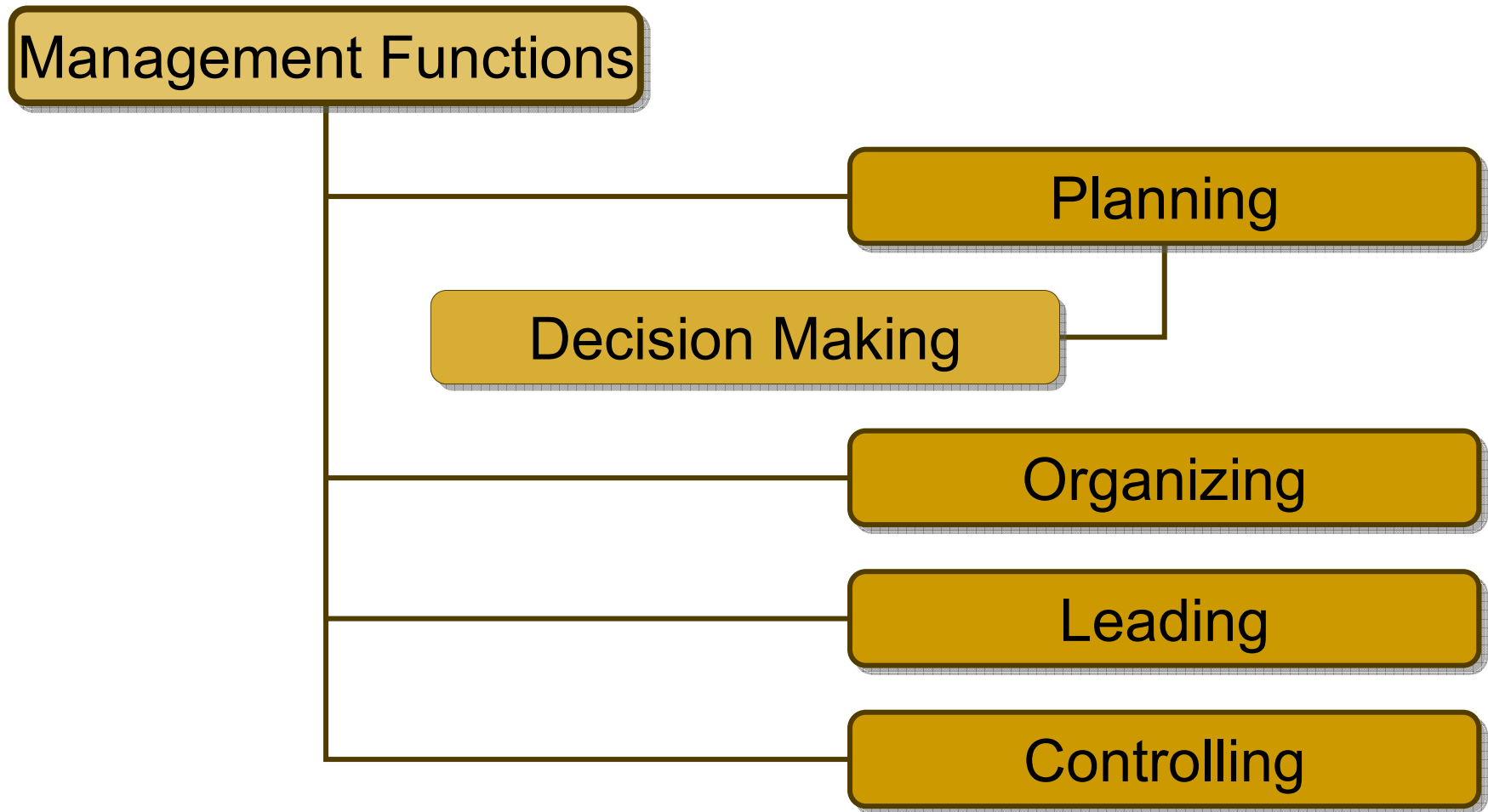

IENG 450
INDUSTRIAL MANAGEMENT

CHAPTER 8
CONTROLLING

Functions of Management

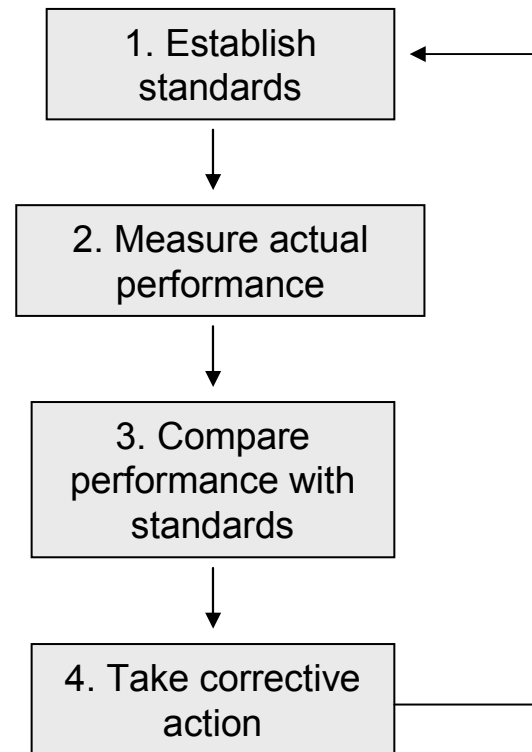


Controlling

- is a process of measuring performance and taking action to ensure the desired results.
- It is a critical function because it ensures that all the management functions of planning, organizing and leading as well as mechanical processes of an organization perform as planned.

The Process of Control

■ Steps in the Control Process



The Process of Control

■ Steps in the Control Process

1. Establish Standards
 - Standards should be measurable, verifiable and tangible to the extent problem.
 - Ex: standard rate of production established by work measurement, a budgeted cost of computer usage, a targeted value for product reliability, or a desired room temperature.
2. Measure Actual Performance achieved
3. Compare Performance with Standards
 - Comparison of the two measurement of the variance (deviation between them) and communicating this deviation promptly to the entity responsible for control of this performance.
4. Take Corrective Action as required to compel events to conform to plans.

Mechanical Process Control

- **Closed Loop Control** (Automatic or Cybernetic Control)
 - monitors and manages a process by means of a self-regulating system.
 - The essential feature of cybernetic control is a strong feedback system.
 - Ex: a desired (standard) temperature is set by adjusting a lever or wheel on the thermostat. A mechanism such as a bimetallic strip converts the actual temperature surrounding the thermostat into physical movement. When the variance between desired and actual temperature exceeds some design maximum, sensor movement creates an electrical contact that communicates a signal to the correcting entity (turns on the a/c).

Mechanical Process Control

- **Open Loop Control** (Noncybernetic Control)
 - requires an external monitoring system and/or an external agent to complete the control loop.
 - The automatic part of the control system provides a warning of a variance from planned values, but then human judgement is required to identify the reason for the variance and to determine corrective action.

Three Perspectives on the Timing Control

■ Feedback Control

- The output of a system can be measured and the variance between measured and desired output used to adjust the system.
- Ex: the previous thermostat example (called post-action or output control)

■ Screening or Concurrent Control

- A new engineer may be given an unfamiliar assignment one step at a time, with review by the supervisor at each step.
- A production schedule may include several in-process inspection points so that further investment in defective parts can be avoided.

Three Perspectives on the Timing Control

- Feedforward (or Preliminary or Steering) Control
 - The essence of feedforward control is a system that can predict the impact of current actions or events on future outcomes, so that current decisions can be adjusted to assure that future goals will be met.
 - Ex: a nuclear power reactor may take 10 years to produce, and the construction project or program needs management tools that will predict, as the project progresses, whether it is likely to be completed on time and within budget.

Characteristics of Effective Control Systems

- Effective
 - Control systems should measure what needs to be measured and controlled.

- Efficient
 - Control systems should be economical and worth their cost.

- Timely
 - Control systems should provide the manager with information in time to take corrective action.

- Flexible
 - Control systems should be tools, not straitjackets and should be adjustable to changing conditions.

Characteristics of Effective Control Systems

- Understandable
 - Control systems should be easy to understand and use.
- Tailored
 - Where possible, control systems should deliver to each level of manager the information needed for decisions.
- Highlight deviations
 - Good control systems will “flag” parameters that deviate from planned values by more than a specified percentage or amount for special management attention.
- Lead to corrective action
 - Control systems should either incorporate automatic corrective action or communicate effectively to an agent that will provide effective action.

Financial Controls

■ Financial Statements

- ❑ Engineers need to know about financial control because their continued employment may be dependent upon how they support and contribute to their company's "bottom line".
- ❑ The ***balance sheet*** shows the firm's financial position at a particular instant in time.
- ❑ This is usually the financial status at the end of a calendar year or a financial year.

Financial Controls

- Financial Statements
 - **Assets** are what the company “owns” and consist principally of;
 - *Current assets* (assets that can be converted into cash within a year) and,
 - *Fixed assets* (property, plant, and equipment at original cost, less the cumulative depreciation of plant and equipment and depletion of natural resources since they were purchased)
 - Liabilities are what the firm “owes” and consist of;
 - Current liabilities that must be paid within a year and
 - Long-term debt.
 - The difference between the assets and liabilities is the net worth or equity of the stockholders, and it consists of the original investment (what was paid in for common and preferred stock) plus the retained earnings (the cumulative profits over the years after dividends are paid).

Balance Sheet

Table 8-1 Balance Sheet, Sterling Chemicals, Inc., December 31, 2008

ASSETS		
Current Assets		
Cash	\$150,000	
Securities (at cost)	<u>100,000</u>	\$250,000
Accounts receivable		400,000
Inventories (at lower cost or market)		
Raw materials and supplies	200,000	
Work in progress	180,000	
Finished goods	<u>300,000</u>	680,000
Prepaid expenses		<u>30,000</u>
Total current assets		\$1,360,000
Property, plant, and equipment	4,500,000	
Less accumulated depreciation and depletion	<u>2,400,000</u>	
Net property, plant, and equipment		<u>2,100,000</u>
Total Assets		<u>\$3,460,000</u>
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities		
Accounts payable	\$100,000	
Installments due within one year on debt	30,000	
Federal income and other taxes	250,000	
Other accrued liabilities	<u>120,000</u>	
Total current liabilities		\$500,000
Long-term debt		<u>1,000,000</u>
Total Liabilities		\$1,500,000
Stockholders' equity		
Capital stock	500,000	
Retained earnings	<u>1,460,000</u>	
Total equity		<u>1,960,000</u>
Total Liabilities and Equity		<u>\$3,460,000</u>

Financial Controls

- **Income statement**, also called a profit and loss or revenue and expense statement, shows the financial performance of the firm over a period of time (usually a year or a month).
- Cash flow, or sources and uses of funds, statement shows where funds come from (net profit plus depreciation, increased debt, sale of stock, sale of asset) and what they are used for (plant and equipment, debt reduction, stock repurchase and dividends)

Income Statement

Table 8-2 Income Statement, Sterling Chemicals, Inc.,
December 31, 2008

Gross sales	\$3,200,000	
Less returns and allowances	<u>150,000</u>	
Net sales		\$3,050,000
Less expenses and costs of goods sold		
Cost of goods sold	2,000,000	
Depreciation and depletion	250,000	
Selling expenses	100,000	
General and administrative expenses	<u>200,000</u>	<u>2,550,000</u>
Operating profit		\$500,000
Plus interest and other income		<u>60,000</u>
Gross income		560,000
Less interest expense		<u>20,000</u>
Income before taxes		540,000
Provision for income taxes		<u>260,000</u>
Net income		280,000
Retained earnings January 1, 2008		<u>1,500,000</u>
		1,780,000
Dividends paid		<u>320,000</u>
Retained earnings December 31, 2008		<u><u>1,460,000</u></u>

Ratio Analysis

- Financial ratios are of two financial numbers taken from the balance sheet and/or the income statement.
- These ratios provide a framework for historical comparisons within the firm and for external benchmarking relative to industry performance.

Ratio Analysis

Table 8-3 Financial Ratios for Sterling Chemicals, Inc., 2008

Ratio		
Liquidity ratios		
Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$	$\frac{1,360,000}{500,000} = 2.72$
Acid test ratio	$\frac{\text{Current assets} - \text{inventory}}{\text{Current liabilities}}$	$\frac{680,000}{500,000} = 1.36$
Leverage ratios		
Debt-to-assets ratio	$\frac{\text{Total debt}}{\text{Total assets}}$	$\frac{1,500,000}{3,460,000} = 0.434$
Activity ratios		
Inventory turnover	$\frac{\text{Cost of goods sold}}{\text{Inventory}}$	$\frac{2,000,000}{680,000} = 2.94$
Asset turnover	$\frac{\text{Net sales}}{\text{Total assets}}$	$\frac{3,050,000}{3,460,000} = .88$
Accounts receivable turnover	$\frac{\text{Net sales}}{\text{Accounts receivables}}$	$\frac{3,050,000}{400,000} = 7.63$
Profitability ratio		
Profit margin	$\frac{\text{Net income}}{\text{Net sales}}$	$\frac{280,000}{3,050,000} = 9.18\%$

Ratio Analysis

- **Liquidity Ratios** measure the ability to meet short-term obligations.
 - **Current ratio** measures a firm's current assets to current liabilities.
 - 2.0 = prudent minimum
 - 10.0 = assets are not being efficiently employed
 - A ratio lower than that of the industry average suggests that the company may have liquidity problems.
 - **Acid test ratio** (quick asset ratio)
 - Over 1.0 is prudent.

Ratio Analysis

- **Leverage Ratios** identify the relative importance of stockholders and outside creditors as a source of the enterprise's capital.
 - A simple measure is the ratio of total debt to total assets.
 - An electric utility might well have a debt/asset ratio 0.5

Ratio Analysis

- **Activity Ratios** (operating ratios) show how effectively the firm is using its resources.
 - **Inventory turnover** measured by dividing the cost of goods sold (from income statement) by total inventory (both valued at the manufacturing cost invested in them).
 - **Asset turnover** (sales/asset) measures how well the firm is using its assets to produce sales.
 - **Accounts receivable turnover** – the ratio of net sales (income statement) to accounts receivable.

Ratio Analysis

- Profitability Ratios describe the organization's profit.
 - Profit margin measures the net income as a percentage of sales.

Budgets

- They are the plans for the future allocation and use of the resources over a fixed period of time.
 - Financial budgets describe where the firm intends to get its cash for the coming period and how it intends to use it.

Financial Budgets

- ❑ **Cash budgets** estimate future revenues and expenditures and their timing during the budgeting period, telling the manager when cash must be borrowed and when excess cash will be available for temporary investment.
- ❑ **Capital expenditure** budgets describe future investment in plant and equipment.
- ❑ **Operating budgets** can be created for responsibility centers (for the closer control of the organizations).