Advanced Budgeting & Forecasting

23 – 27 September 2013



Manjit Biant
Senior Consultant

Consultant's profile:

Manjit Biant

- Mr. Manjit Biant is a Senior Consultant with EuroMaTech specializing in Accounting which includes Finance & Business including Finance for Non Finance Managers, IFRS, IPSAS, Risk Anaylisis & Strategy Management, Forensic Accounting & Auditing and Corporate Governance.
- His degree in Business Administration included a placement year with Deloitte Haskins & Sells, one of the top five Accountancy firms at the time. He proceeded to continue his career with the newly merged firm Coopers & Lybrand Deloitte. He worked in Financial Services for a number of years with Lloyds TSB and AMP(UK Financial Services).
- He went on to work for Hays PLC as a Commercial Accountant, then finally decided to run his own business and get street experience, putting his entrepreneurial skills to the test. After selling his business at a young age, he now enjoys semi-retirement, working as a part-time lecturer, free-lance trainer, business consultant & Internet Marketing Coach.
- Manjit has had extensive training in the Thompsett Project Management program, Quality Management Techniques and Customer care implementation. Manjit has conducted courses in Europe, Africa, USA and the Middle East.

Opening

- Introductions
- Expectations
- Disclaimer
- Confidentiality
- Health and Safety



Disclaimer

- The information in this seminar or any manual, which does not purport to be comprehensive, has not been independently verified. While this information has been prepared in good faith, no representation or warranty, express or implied, is or will be made and no responsibility or liability is or will be accepted by EuroMaTech or by the presenter or by any of their respective officers, employees or agents in relation to the accuracy or completeness of this seminar or manual or any other written or oral information made available to any delegate or its advisers and any such liability is expressly disclaimed.

The Course

This programme provides an overview of the tools and the skills to build world class standards into your planning, budgeting, performance measurement and reporting system and will discuss new and best practice techniques, explain how they complement the traditional financial planning tools, and introduce new concepts for measuring and reporting performance and shareholder wealth creation. Important elements of this programme include:

- Making your budgeting process more cost effectively
- Motivate managers to “buy in” to the budget process
- Many case studies and illustrations of real companies will be used to help delegates understand how to apply different planning, forecasting and analysis techniques
- Participants will also be given a detailed set of handouts that will enable them to review the topics covered at a later date

The Objectives

- Implement advanced planning and control techniques into your budgeting process
- Integrate the budgeting process with the development of the company's long-term strategic vision
- Provide a decision support structure that provides timely and useful information to decision makers
- Successfully build an integrated planning, budgeting and reporting process
- Forecast costs and revenues with greater confidence
- Apply management tools to the budgeting process that contribute to strategic goals
- Effective manage the budgeting process
- Identify key performance indicators for effective and focused decision making
- Increase profitability and performance through stream lined planning and reporting

Training Methodology

- Your programme leader will present, guide and facilitate learning, using a range of methods including the use of the programme material, case studies and discussion of “real life” issues in organizations, to ensure the development of skills as well as knowledge
- Participants will learn by active participation preparing both budgets and forecasts using a variety of statistical tools and by using budgets to make management decisions.

Programme Summary

- This programme provides the essential skills necessary to ensure the successful development of budgeting and forecasting techniques, thereby improving your understanding, development, management and control of budgets within your organization.

Seminar Outline

DAY 1

Budgets in Today's International environment

•Organizational Planning and Control Framework
•The Product / Information / Decision Support Cycle
•Strategic, Tactical, and Operational Forecasts
•The recognition of risk in Models
•Using Budget Models for Simulation Purposes
•The Drive toward Shareholder Value (EVA®)

The Strategic Plan

•The purpose of planning and budgeting in business
•Defining the strategic approach to business planning
•Defining strategic assumptions
•Building the strategic planning model using financial data
•Various strategic and tactical approaches to business planning
•Defining the Decision-Support model: Assumptions/Goals and Key Success Factors

DAY 2 - Analysing the Historical Data Using Excel®

•Recognizing the Basic Patterns Inherent in Historical Data
•Using the Exploratory Data Analysis Tools Available in Excel®
•Development of Time Series Models using histograms, moving averages, exponential smoothing and regression analysis
•Using Regression Analysis as a predictor and estimator
•Mastering the use of Exponential Smoothing as a Data Analysis tool
•Single Regression vs. Multiple Regression
•Validation of Time Series Analysis

Seminar Outline

DAY 3

Approaches to Budget Development

- Zero Base Budgeting
- Activity based Budgeting
- Rolling Budgets
- Operational Unit Budgeting
- Programme budgeting
- Developing the Cash Budget

Using Activity based Budgeting

- Developing the ABB application model
- Budgeting for Processes rather than Departments
- Defining Key Cost Drivers
- Defining Key Activities
- Development of ABB Cost Standards
- Developing the Activity-Based Budget

DAY 4

Strategic and Operational Cost Analysis Techniques

- Identifying fixed, variable and semi-variable costs
- Application of Regression in the development of budgets
- Building the financial simulation model using articulated financial statements
- Building the financial simulation model using deterministic simulation
- Building the financial simulation model using probabilistic (Monte Carlo) simulation

Developing Manufacturing Standards

- Material Standard Development
- Labour Standard Development
- Factory and Corporate Overhead Standard Development
- Variance Analysis

Seminar Outline

DAY 5 - Defining and Testing Optimisation Techniques in Models Using Excel®

- Basic Structure of All Optimisation Models
- Different Forms and Applications of Optimization Models
- Developing a Financial Optimisation Model
- Performing Sensitivity Analysis of an Optimisation Model
- Interpreting the Solution of an Optimisation Model to a Non-technical Manager
- Lessons Learned and Lessons to be Learned

Advanced Budgeting & Forecasting

DAY 1

Budgets in Today's International environment

Budgets in Today's International environment

- Organizational Planning and Control Framework
- The Product / Information / Decision Support Cycle
- Strategic, Tactical, and Operational Forecasts
- The recognition of risk in Models
- Using Budget Models for Simulation Purposes
- The Drive toward Shareholder Value (EVA®)

Organizational Planning and Control Framework

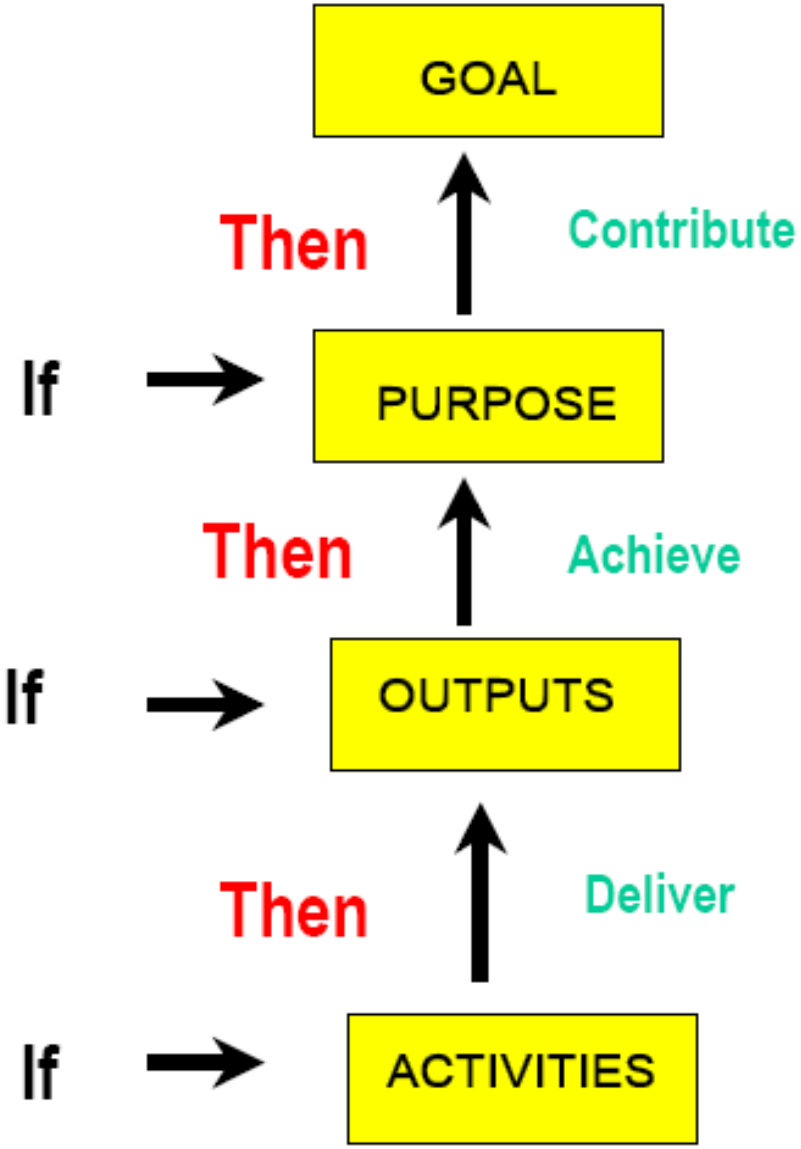
Organizational Planning and Control Framework

- Case Study

Logical Framework (4x4 Matrix)

Objectives & Activities	Indicators	Means of Verification	Important Assumptions
Organisation Goal:			
Outcome:			Assumptions for the Organisation Goal:
Outputs:			Assumptions for the Outcome:
Activities:			Assumptions for the Outputs:

The Logic of the Framework



The Product/Information/Decision Support Cycle

- Case Study

Strategic, Tactical & Operational Forecasts

Four Functions of Management

Cost management information is assembled to aid management in the following functions:

- Strategic management
- Planning and decision-making
- Management and operational control
- Preparation of financial statements

Management Functions

Strategic management

- Most important management function
- Involves identifying and implementing goals and action plans to maintain a competitive advantage
- Monitoring of Critical Success Factors (CSFs) is necessary
- Critical to a firm's success due to global competition and rapidly changing markets

Management Functions

Planning and decision-making

- Information is needed to support recurring decisions such as scheduling production and pricing
- Information is needed for short-run planning (budgeting) and profit planning (Cost-Volume-Profit analysis)

Management and operational control

- Information is needed to identify inefficient operations and reward effective management practices

Preparation of financial statements

- Information is needed to guarantee compliance with regulatory reporting requirements

The Recognition of Risk in Models

1
Budgeting fundamentals

Budgeting fundamentals

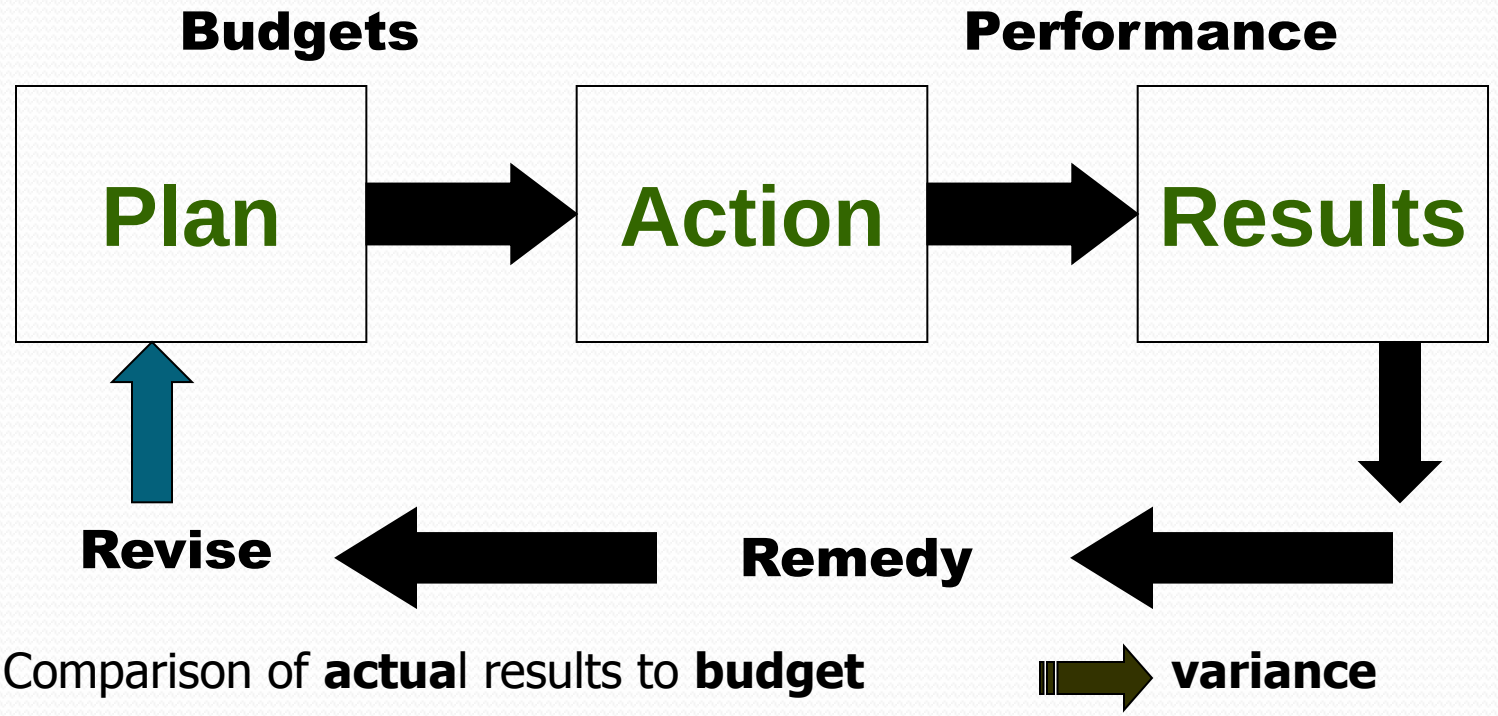
- Budgeting is the process used to develop:
  - A formal written statement
  - Of managements plans for the future
  - Expressed in financial terms

Types of plans

- Long term: 5 to 10 years
- Medium term: 1 to 5 years
- Short term: up to 1 year

The planning cycle

Budgets are the mechanism by which management control of an organisation becomes possible.



Benefits of budgets

1. Forces managers to do **planning.**
2. Realistic performance targets.
3. Basis for **controlling** what happens within the organisation.
4. Helps **coordinate** the activities of the various centres that make up the business.
5. **Communication** – managers exchange information on ideas, etc.
6. **Motivating** tool – if the process involves staff.

Limitations of budgets

- Only estimates, not statements of facts.
- No substitute for sound management practices.
- Need to be amended if circumstances change.
- Preparation does not guarantee success.
- Aspects of people's behaviour may undermine the value of the process.

Budget classification

- **Static (fixed) budgets**: prepared for one level of activity, usually around the forecasts made for sales.

- **Flexible budgets**: a series of fixed budgets set to different levels of sales activity within which the organisation may operate.

Cost/volume relationships

- **Fixed costs**: in **total** remain the **same** for a period of time and over a particular range of activity.

- **Variable costs**: in **total** tend to **change** as the level of activity changes.

Budget processes

- **Zero-based budgeting**: sets the initial figures for each activity to zero.
- **Period budgets**: developed for a specific period of time, e.g. a month.
- **Rolling (continuous) budgets**: are continually updated by periodically adding a new incremental time period and dropping the period just completed.

Types of budgets

- **Revenue budgets**: estimates of the income of an organisation from the sale of goods and/or provision of services for a specific period.
- **Operating budgets**: estimate activities that will affect profit.
- **Budgeted financial statements**: show the estimated results and projected financial position of a business. That is budgeted income statement, balance sheet and statement of cash flows.

Master budget

A combination of all the budgets of an organisation.

Master budget

Merchandising firm	Professional services	Manufacturing firm
Sales budget	Fees or fees & sales budget	Sales budget
Purchases budget	Professional & support labour budget	Cost of production budget
Cost of goods sold budget	Cost of supplies used	Cost of goods sold budget
Other operating expense budgets	Other operating expense budgets	Other operating expense budgets

Master budget

- Irrespective of the type of organisation, the following budgets will be part of the master budget:
  - Statement of financial performance [revenue budget]
  - Statement of financial position [balance sheet]
  - Statement of cash flow

2
Revenue budgets

Forecasting methods

- **Qualitative methods**: rely on attitudes, beliefs, feelings and experience.
  - Jury of executive opinion
  - Sales force composite
  - Delphi technique
  - Market research
- **Quantitative methods**: more objective, use mathematical models.
  - Time serious models
  - Causal models

Factors affecting revenue budgets

- Past sales levels for business and entire industry.
- General economic trends.
- Economic trends in the business's industry.
- Climatic changes affecting industry.
- Political and legal events.
- Intended pricing policy.
- Planned advertising.
- Expected actions of competitors.
- Market research studies.

Types of revenue budgets

- Sales by product.
- Sales by product and period.
- Sales by area and period.
- Sales by product, area and period.
- Fees income by type of service.
- Sales and fees income by period.

Sale by product

Sales budget for the year ending June 30

Type of biscuit	**Sales volume kg**	**Sales price $**	**Sales $**
Sweet Hearts			
Cherry Surprises			
Chocolate Supremes			
Almond Delights			
Total sales $			

Sales by product and period

Sales budget for the quarter ending
31 March

	Jan	Feb	March	Total
Hot Dogs				
Sales volume				
Selling price $				
Sales $				
Pies				
Sales volume				
Selling price $				
Sales $				

Fees income budget for the quarter ended 30 September

	July	Aug	Sept	Total
Normal consultations				
No. of patients				
Fee per visit $				
Fees income $				
Home visits				
No. of patients				
Fee per visit $				
Fees income				
Total fees income $				

3
Operating budgets

Operating budgets

- Purchases budget
- Cost of goods sold budget
- Operating expense budgets
    1. Marketing expense budget
    2. Administration expense budget
    3. Financial expense budget
- Specialised service industry budgets
    1. Professional and support labour budget
    2. Materials usage budget
- Budgeted income statement of financial performance

Purchases budget in dollars for 3 months ending 30 June

	April $	**May $**	**June $**	**Quarter $**
Cost of sales				
a*dd* ending stock				
Total requirements				
less beginning stock				
purchases				

Purchases budget in units for quarter ending 31 March

	Jan	**Feb**	**March**	**Quarter**
Sales [units]				
Ending stock [units]				
Total req**.** [units]				
less beginning stock [units]				
Purchases [units]				
Cost per unit **$**				
Cost of purchases **$**				

Cost of goods sold budget for 3 months ending 30 June

	April $	May $	June $	Quarter $
Beginning stock				
Purchases				
Goods available for sale				
Ending stock				
Cost of sales				

Marketing expense budget for 3 months ending 30 June

	April $	May $	June $	Quarter $

Administration expense budget for 3 months ending 30 June

	April $	May $	June $	Quarter $

Financial ~~expense budget~~ for 3 months ending 30 June

	April $	May $	June $	Quarter $

Budgeted income statement for 3 months ending 30 June

	April $	**May $**	**June $**	**Quarter $**
Sales				
less COGS				
Gross Profit				
Operating exp.				
Marketing				
Administration				
Financial				
Total Expenses				
Net Profit				

4
Cash budgets

Cash budgets

- Cash receipts budget:
  Estimated receipt of cash from **all** sources.
- Cash payments budget:
  All estimated payments of cash by the business.

GST (VAT) and cash budgets

- Many businesses are registered for GST (VAT) and pay their liability monthly.
- Collection of Goods & Services Tax (GST) when the business makes a taxable supply.
- **Taxable supply:** a sale of a good or service that is not GST-free or input taxed.
- **GST input tax credits:** a credit for the GST included in the purchase of a good or service.

Sample cash receipts budget where all receipts are GST-free or input taxed

Cash receipts budget for the quarter ending 30 September				
	July	August	Sept.	Total
	$	$	$	$
Consultion fees received	12510	11970	10880	35360
Cash sales	3200	2980	2740	8920
Rental income	500	500	500	1500
Interest received			150	150
Total cash receipts	16210	15450	14270	45930

Sample cash payments budget where some acquisitions include GST

Cash payments budget for the quarter ending 30 September (p. 61)				
	July	August	Sept	Total
	$	$	$	$
Cash purchases				
Rent				
Laundry				
Telephone				
Insurances				
Stationery				
Vehicle running costs				
Massage table				
Payments including GST				
GST input taxcredit				

Cash budget format

- Cash balance @start
- *add* cash receipts
- *add* GST refund

  ⇒ total cash available for needs
- cash payments
- *add* GST payable

  ⇒ total payments
- Cash balance @end

Collections from debtors

- Calculate cash and credit sales.
  - work out cash sales GST exclusive
  - work out GST payable on cash sales
  - work out credit sales GST inclusive
- Prepare a collection from debtors schedule for the budget period.
- Show separately at bottom of schedule the GST payable included in the figures.

Dermott Jewellers

Schedule of collections from debtors for the quarter ending 31 March						
			Month received			
			Jan	Feb	March	Total
Month of sale		$	$	$	$	$
October		33600				
November		38400				
December		42000				
January		39600				
February		31200				
March		40800				
Total collections						
GST included above						

GST reported on accrual basis

- GST is payable at point of sale.
- Input tax credit is receivable when the entity receives the tax invoice.
- GST adjustment for a bad debt is made when the debt is actually written off as bad.
- GST adjustment for discount allowed is made when discount is given.
- GST collected each month is not the same as GST payable.

Collection from debtors with discount allowed and doubtful debts

Schedule of collections from debtors for the quarter ending 30 September								
					Month received			
			D. Debts	Dicount	July	August	Sept	Total
Month of sale		$	$	$	$	$	$	$
May		39900						
June		44100						
July		50400						
August		35700						
September		25200						
Total collections								
GST included above								

Desired balance and financial requirements

- Management may desire to have a minimum cash balance.
- May involve borrowing funds to attain required balance.
- Borrowings are made in the month that a deficit is likely.
- There may be conditions attached to the amounts that can be borrowed.

5
Budgeted financial statements

Budgeted financial statements

- Income statement of financial performance
- Balance sheet of financial position
- Cash flow statement

The above budgets summarise the forecasts made in all other budgets.

Budgeted income statement is a summary of the following budgets

- Sales and/or fees
- Cost of goods sold
- Operating expenses
  - marketing
  - administration
  - financial

This budget is not affected by GST accounts.

Budgeted balance sheet

- This budget is prepared from asset, liability and owners equity accounts.
- If GST payable is >GST input tax credits, the net GST payable is shown as a current liability.
- If GST payable is <GST input tax credits, the net GST input tax credit is shown as a current asset.

Preparation budgeted balance sheet

Examples of the information needed:

- Net profit or loss
- Accounts receivable balance
- Accounts payable balance
- Pattern of paying expenses
- Rates and methods of depreciation
- Any acquisition or disposal of assets
- Any drawings made by the owner
- Any capital contributions made by the owner

Budgeted statement of cash flows

- A cash budget is an essential part of planning.
- If the GST payable is >input credits receivable in the relevant period the resultant amount is paid to the Inland Revenue.
- If the GST payable is <input credits receivable in the relevant period the resultant amount will be refunded by the Inland Revenue

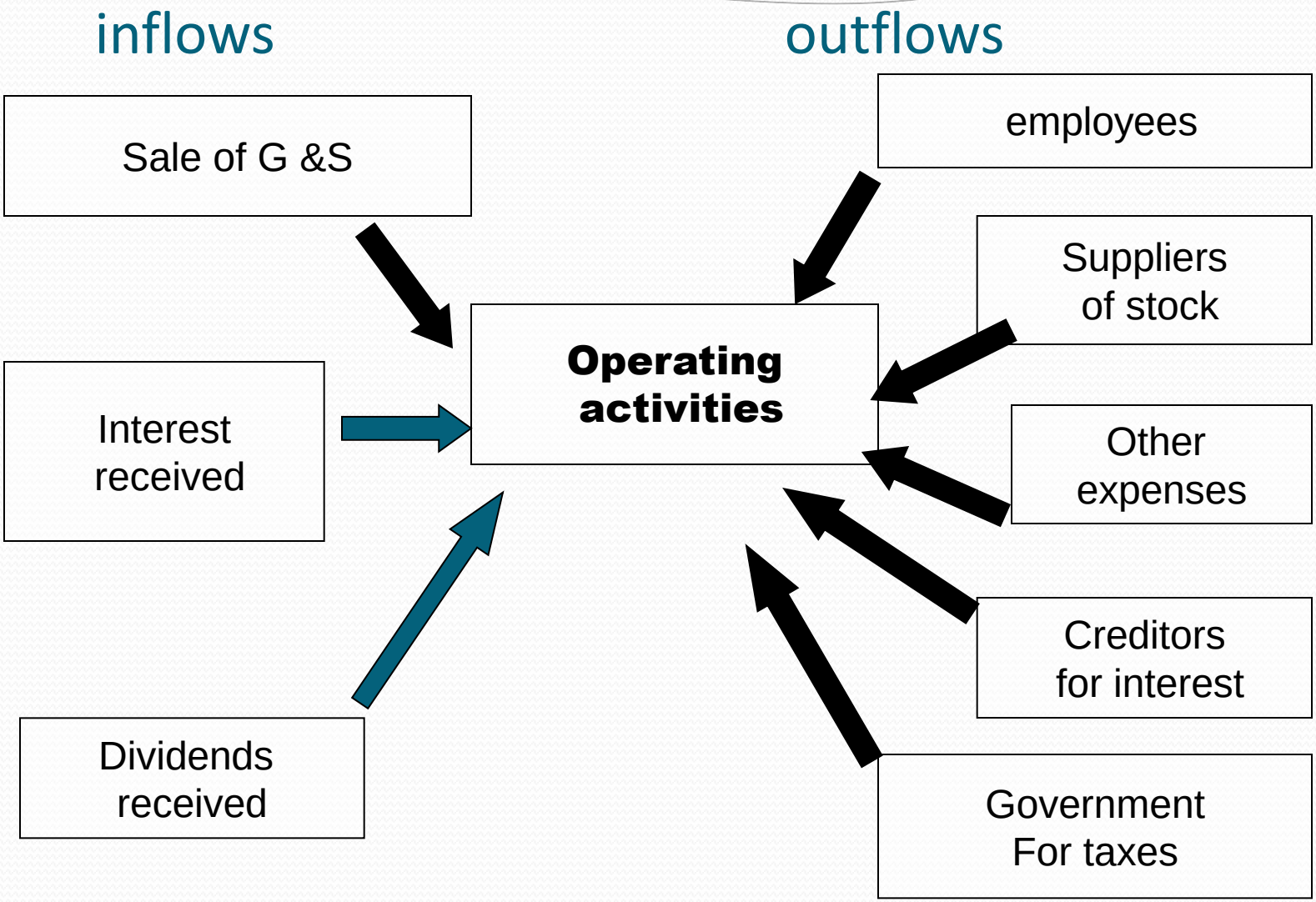
The budgeted cash flow statement is divided into 3 main categories

- **Operating activities:** provision of goods and services.

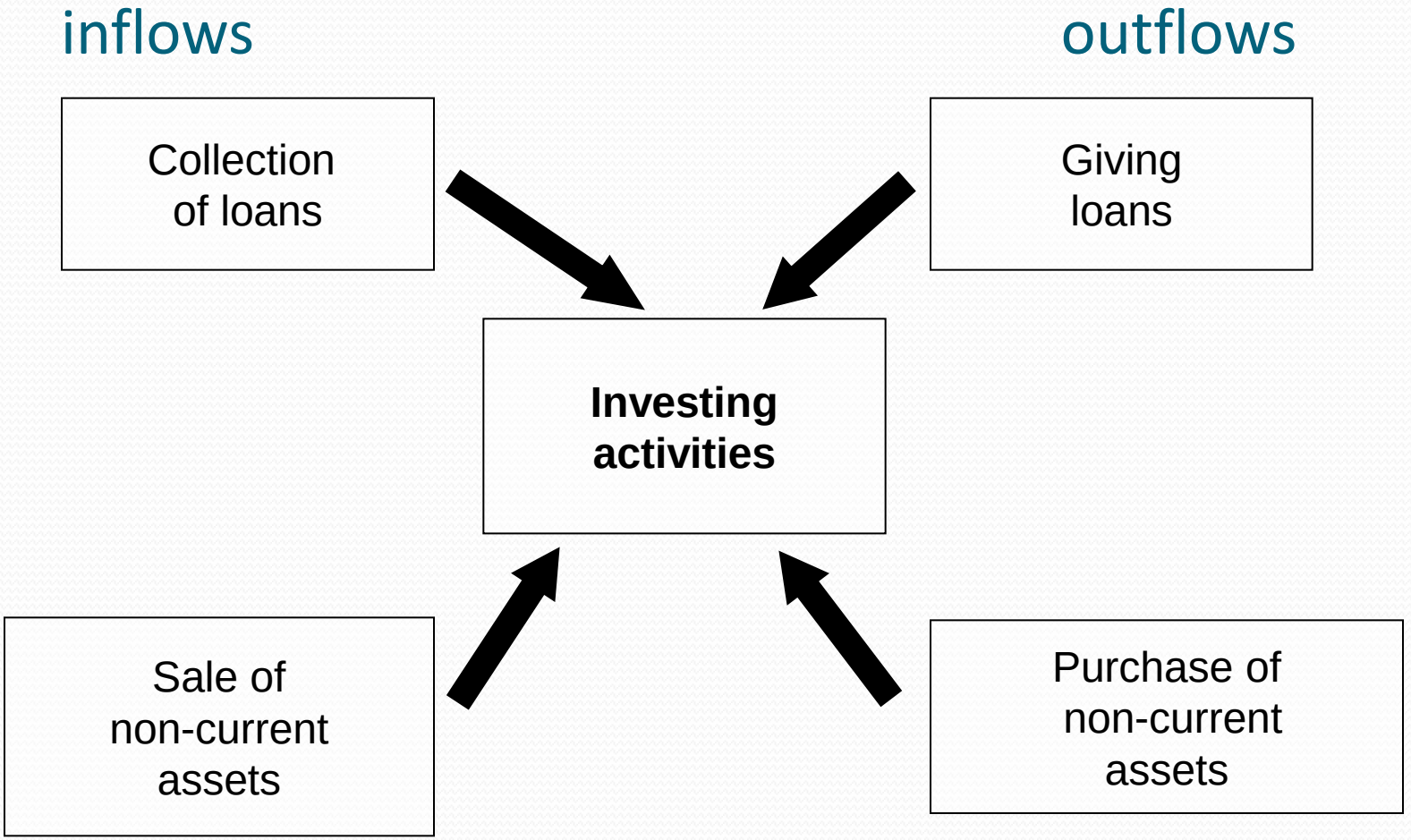
- **Investing activities:** acquisition and disposal of non-current assets.

- **Financial activities:** changes to the financial structure of the business.

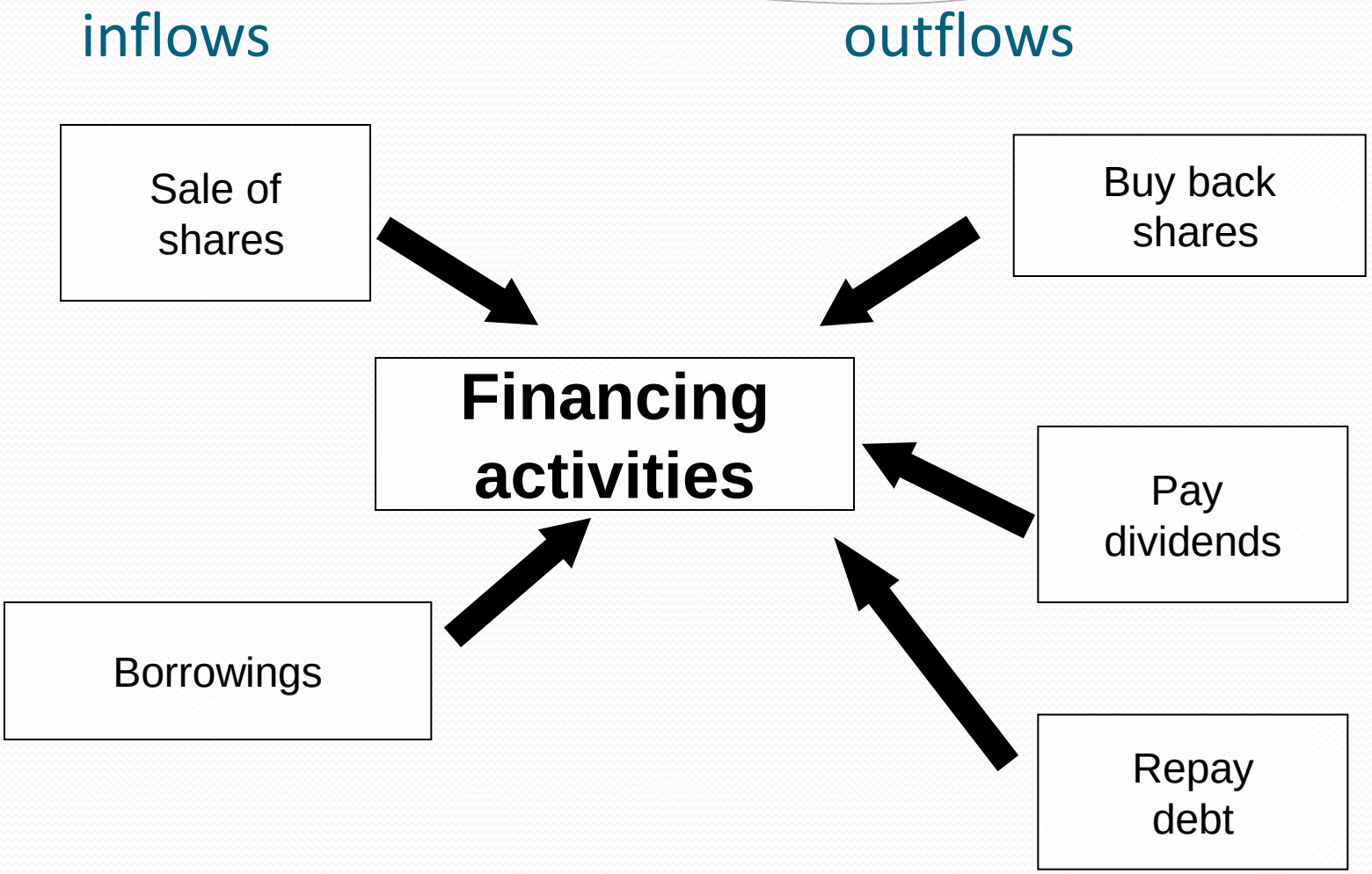
Classification of cash



Classification of cash



Classification of cash



Budgeted statement of cash flows for period ended...

	$	$
Cash flows from operating activities:		
Net cash inflow (outflow) from operating activities		
Cash flows from investing activities:		
Net cash inflow (outflow) from investing activities		
Cash flows from financing activities:		
Net cash inflow (outflow) from financing activities		
Net increase (decrease) in cash held		
Cash at beginning of period		
Cash at end of period		

6
Master budget for manufacturing organisations

Cost classifications

- **Product costs** are the costs of converting raw materials into a finished product.
    1. Raw materials
    2. Direct labour
    3. Factory overhead

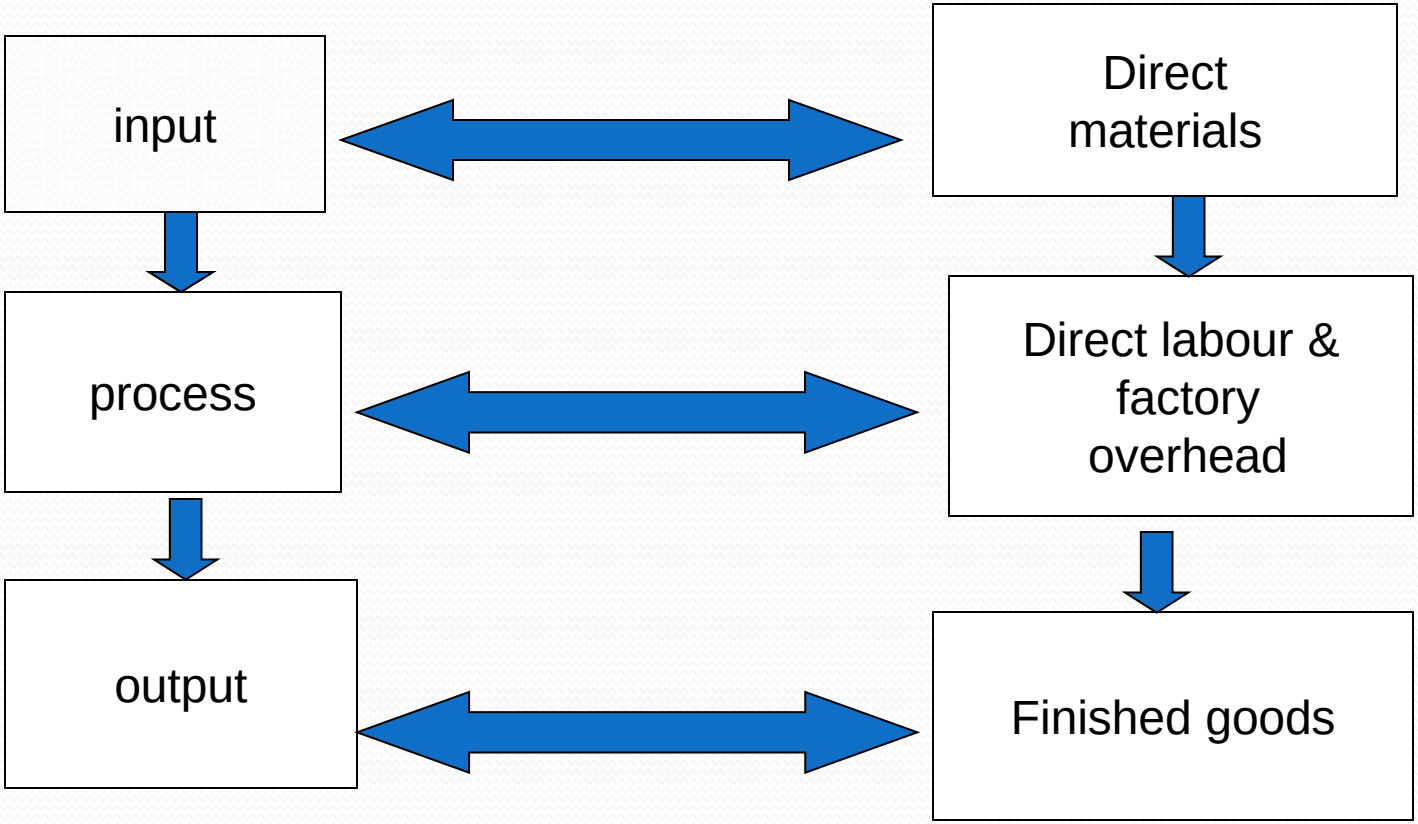
- **Period costs** are all **other** costs associated with the business.
    1. Marketing expenses
    2. General and administration expenses
    3. Financial expenses

Product costs

- **Direct costs:**
  major items of cost that can be relatively easily traced to the product, such as raw materials and direct labour.
- **Raw materials and direct labour**
  Prime cost

- **Indirect costs:**
  cannot **not** be easily traced directly to the product. All factory overhead.
- **Factory overhead:**
  all indirect costs of running a factory.
  Examples: indirect materials, indirect labour, factory insurance.

Manufacturing process



Cost of production requires the preparation of the following budgets

- Sales
- Production
- Direct materials usage
- Direct labour
- Factory overhead

Production budget for the year ending 30 June				
			Units	
sales				
add desired ending inventory				
total units needed				
less beginning inventory				
Units to be produced				

Factory overhead budget

Factory overhead budget for year ended 30 June				
				$
Indirect materials				
Indirect labour				
Light & power				
Rates				
Factory insurances				
Depreciation on factory equipment				
Total factory overhead				

Direct materials and labour budget

***less* beginning inventory**						
Direct material usage budget for period ending June 30						
Boxes to be prduced						
kg per box						
Cardboard needed for production(kg)						
Cost per kg						
cost of cardboard to be used in production ($)						
Direct labour budget for period ending June 30						
Boxes to be produced						
Boxes produced per hour						

Factory overhead application rate

- This allows the business to charge the product with an estimated amount.

- Application rate can be calculated on different bases:
  - per unit
  - direct labour cost
  - direct labour hours
  - machine hours.

Cost of goods sold budget

- **Merchandising business**
  stock @ beginning
  add **net purchases**
  cost of goods available for sale
  less
  stock @ end
  cost of goods sold

- **Manufacturing business**
  stock @ beginning
  add **cost of production**
  cost of goods available for sale
  less
  stock @ end
  cost of goods sold

Flexible budgets

Flexible budgets

- **Static budget:** prepared for **one** level of planned activity.
- **Flexible budget:** covers **a range** of activity within a business.
- **Fixed costs:** in **total remain constant** in the short run within a given range of activity.
- **Variable costs:** in **total vary** as the level of activity changes.

Cost behavior:

The more knowledge of cost behavior, the more accurate the budgeting process.

- **Fixed costs:** in **total remain constant** in the short run within a given range of activity.
- **Variable costs:** in **total vary** as the level of activity changes.
- **Semi-variable costs:** have a fixed and a variable component.

Flexible budget equation

	Total budgeted expenses=					
	Budgeted Variable costs per activity unit		X	Total activity units	+	Budgeted fixed costs

Budgeted Variable costs per activity unit		=	budgeted variable costs / budgeted units sold		

Statement of financial performance (applying cost behavior principles)

Anshar Manufacturing

	$	$	$
Sales			
Less **variable costs**			
Contribution margin			
Less **fixed costs**			
Net profit			

Flexible budget analysis

- **Activity volume variance:**

  shows what portion of the variance was due to the actual volume being different from the desired volume as per master budget.

- **Volume levels may be based on:**
  - Number of units sold
  - Professional hours
  - Machine hours
  - Student contact hours

- **Flexible budget variance:**

  shows the variance when the actual volume achieved is used to recalculate the budget figures

Summary

- **Static budget variance:**
  - Difference between actual results and master budget figures.
- **Activity volume variance:**
  - Difference between master budget figures and budgeted figures recalculated for actual volume achieved.
- **Flexible budget variance:**
  - Difference between actual results and budgeted figures recalculated for actual volume achieved.

8
Performance reports

Performance reports

- **Responsibility accounting:**

  A management accounting system that encourages individuals to work together towards the achievement of organisational goals.

- **Performance reports:**

  A yardstick which compares actual results with the budget.

Responsibility accounting

- Where each division, branch or other sub-unit is known as a **responsibility centre**, the manager of which is accountable for the performance of the sub-unit.

- **Responsibility centers:**
  - Cost centre
  - Revenue centre
  - Profit centre
  - Investment centre

- **Performance reports** show any variance that may arise when actual figures are compared with budget figures.

- **Favourable variance (F)** means that actual income is >budgeted income or actual cost is <budgeted cost.

- **Unfavourable variance (U)** means that actual income is <budgeted income or actual cost is >budgeted cost.

- **Significant variances** (exceed an acceptable limit) are investigated by the manager of the organisational sub-unit.What is considered significant varies from business to business.

- **Reasons for variances** are numerous but fall into two main groups:
  1. are a result of external factors that management have no control over, and
  2. are a result of internal factors that management maybe able to change.

Objective of responsibility accounting

- Management by exception means that an appropriate person is notified when there is a significant deviation from plan.
- Performance reports highlight the areas that need attention.
- Major objective is to ensure that the set targets are achieved at all costs, not trying to find who is to blame.

9
Purpose of budgets

Purpose of budgets

- **Planning:**
  Necessitates setting of goals and establishing actions needed to attain goals.
- **Organising:**
  Involves the allocation of resources.
- **Leading:**
  Two main aspects are communicating & motivating.
- **Controlling:**
  Process of setting standards, measuring current performance and taking remedial action if needed.

Behavioral aspects of budgeting

- To maintain supportive and cooperative relationships with staff.
- The use of punishment (authoritarian style) tends to encourage attempts to 'beat the system'.
- Padding the budget means overestimating costs and/or underestimating revenue.
- Participation in the budgetary process tends to result increased productivity and satisfaction.

Advantages arising out of staff participation

- Improved communication.
- Greater understanding of what is involved.
- Opportunity to thrash out problems.
- Increased acceptance.
- Improved commitment.

Factors affecting behaviour

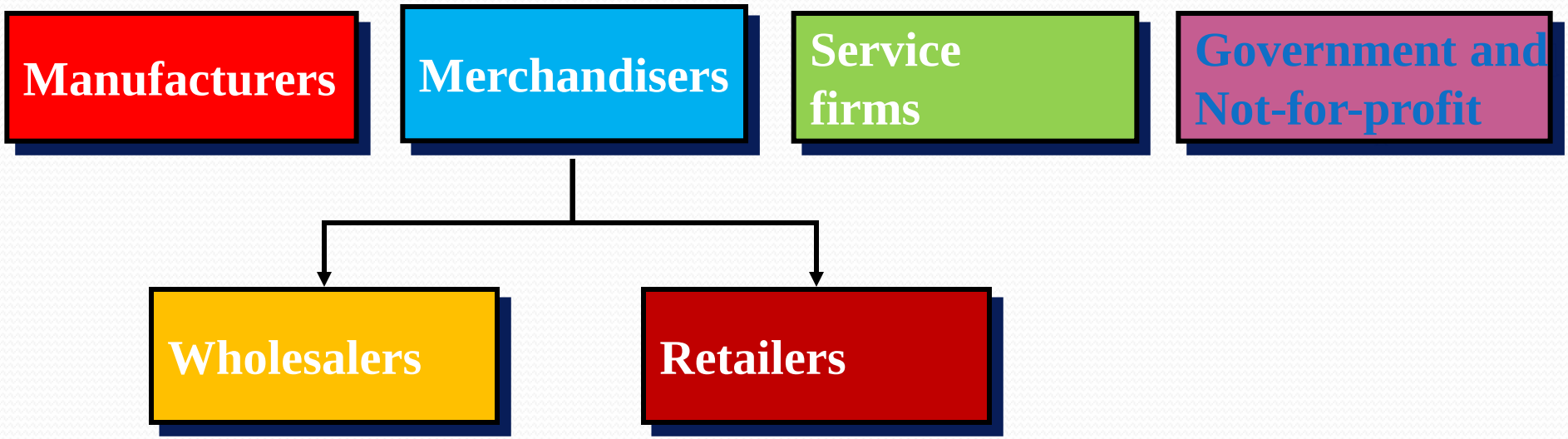
- Targets perceived by employees as being too difficult.
- Targets that do not provide any challenge.
- Insufficient flexibility.
- Narrow-minded managers.
- Emphasis on financial goals to the detriment of non-financial goals.

The Strategic Plan

- The purpose of planning and budgeting in business
- Defining the strategic approach to business planning
- Defining strategic assumptions
- Building the strategic planning model using financial data
- Various strategic and tactical approaches to business planning
- Defining the Decision-Support model: Assumptions/Goals and Key Success Factors

Strategy and Master Budget

Types of Organizations



Changes in the Contemporary Business Environment

1. **Shift to a global business environment**
   - Economic interdependence and increased competition
2. **Lean Manufacturing**
   - Just-in-time (JIT) inventory methods, inventory reduction and quality control
   - Emphasis on *speed-to-market* (i.e., time-based competition)
   - Flexible manufacturing systems

Changes in the Contemporary Business Environment (continued)

3. **Importance of information technology**
   - Increased use of the internet has reduced processing time and facilitated information exchange
4. **Focus on the customer**
   - Consumers expect functionality, quality and customization
   - Shorter product life-cycles have intensified competition

Changes in the Contemporary Business Environment (continued)

5. **Shifts in management organization**
   - The focus has shifted from financial measures and hierarchal command-and-control organizations to nonfinancial measures and flexible organizational structures
6. **Social, political, and cultural considerations**
   - Changes include a more diverse workforce, a renewed sense of ethical responsibility, and increased deregulation of business

The Strategic Focus of Cost Management: Kaplan's Phases for Developing Cost Management Systems

Stage One	Cost-management systems are basic transaction reporting systems
Stage Two	Cost-management systems focus on external reporting–decision-usefulness of cost-management data is limited
Stage Three	Cost-management systems track key operating data and relevant cost information for decision-making
Stage Four	Strategically relevant cost-management information is an integral part of the system

How do the Changes in The Contemporary Business Environment Affect Cost Management?

The management accountant's role:

- Provide strategically relevant cost management information to help the organization keep up with the ever-changing environment
- Thirteen Contemporary Management Techniques developed and employed by the management accountant

Contemporary Management Techniques

1. The Balanced Scorecard and Strategy Map
2. The Value Chain
3. Activity Based Costing and Management
4. Business Intelligence
5. Target Costing
6. Life Cycle Costing
7. Benchmarking
8. Business Process Improvement
9. Total Quality Management
10. Lean Accounting
11. The Theory of Constraints
12. Sustainability
13. Enterprise Risk Management

Contemporary Management Techniques

1. The Balanced Scorecard and the Strategy Map

- **The Balanced Scorecard (BSC)**
  - An accounting report that addresses a firm's performance in four areas: financial, customer, internal business processes, and innovation and learning
- **The Strategy Map**
  - The strategy map is a method, based on the balanced scorecard, which links the four perspectives in a cause-and-effect diagram.

Contemporary Management Techniques

2. The Value Chain

- An analysis tool used to identify the specific steps required to provide a competitive product
- Helps identify steps that can be eliminated or outsourced

3. Activity-Based Costing and Management

- Activity-Based Costing (ABC) improves the tracing of costs to individual products and customers
- Activity-Based Management (ABM) improves operational and management control

Contemporary Management Techniques

4. Business Intelligence

- an approach to strategy implementation in which the management accountant uses data to understand and analyze business performance.

5. Target Costing

- Target Cost = Market-determined price – Desired Profit
- A method that has resulted from intensely competitive markets

Contemporary Management Techniques

6. Life-Cycle Costing

- Costs should be monitored throughout a product's life cycle – from research and development to sales and service

7. Benchmarking

- Process by which a firm identifies its CSFs, studies the best practices of other firms in achieving these CSFs, and institutes change based on the assessment results

Contemporary Management Techniques

8. Business Process Improvement

- This technique involves managers and workers committing to a program of continuous improvement in quality and other CSFs

9. Total Quality Management (TQM)

- A technique by which management develops policies and practices to ensure the firm's products and services exceed customer's expectations

Contemporary Management Techniques

10. Lean accounting uses value streams to measure the financial benefits of a firm's progress in implementing lean manufacturing.

11. The Theory of Constraints (TOC)

- Helps firms improve *cycle-time* (i.e., the rate at which raw materials can be converted to finished products)

Contemporary Management Techniques

12. **Sustainability** means the balancing of the company's short and long term goals in all three dimensions of performance – social, environmental, and financial.
13. **Enterprise risk management** is a framework and process that firms use to managing the risks that could negatively or positively affect the company's competitiveness and success.

Competitive Strategies

- A firm succeeds by implementing a set of policies, procedures, and approaches to business called a strategy
- Strategy must have a long-term focus and adapt to the changing environment
- Cost management information should be used to develop and monitor strategic information

Michael Porter: Strategic Positioning

- **Cost Leadership**—outperform competitors by producing at the lowest cost, consistent with quality demanded by the consumer
- **Differentiation**—creating value for the customer through product innovation, product features, customer service, etc. that the customer is willing to pay for

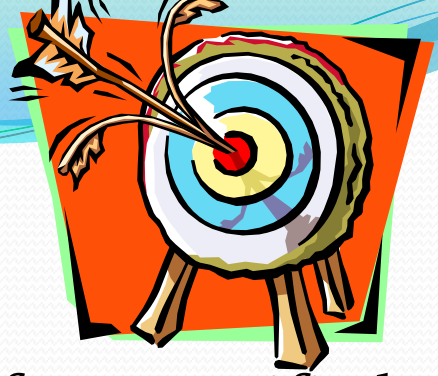
Competitive Strategies

Aspect	Cost Leadership	Differentiation
Strategic Target	Broad cross section of the market	Focused cross section of the market
Basis of competitive advantage	Lowest cost in the industry	Unique product or service
Product line	Limited selection	Wide variety
Production emphasis	Lowest possible cost and essential features	Innovation in differentiating products
Marketing emphasis	Low price	Premium price and innovative features

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 On-going Evaluation of the Effectiveness of implementation in Step 4.

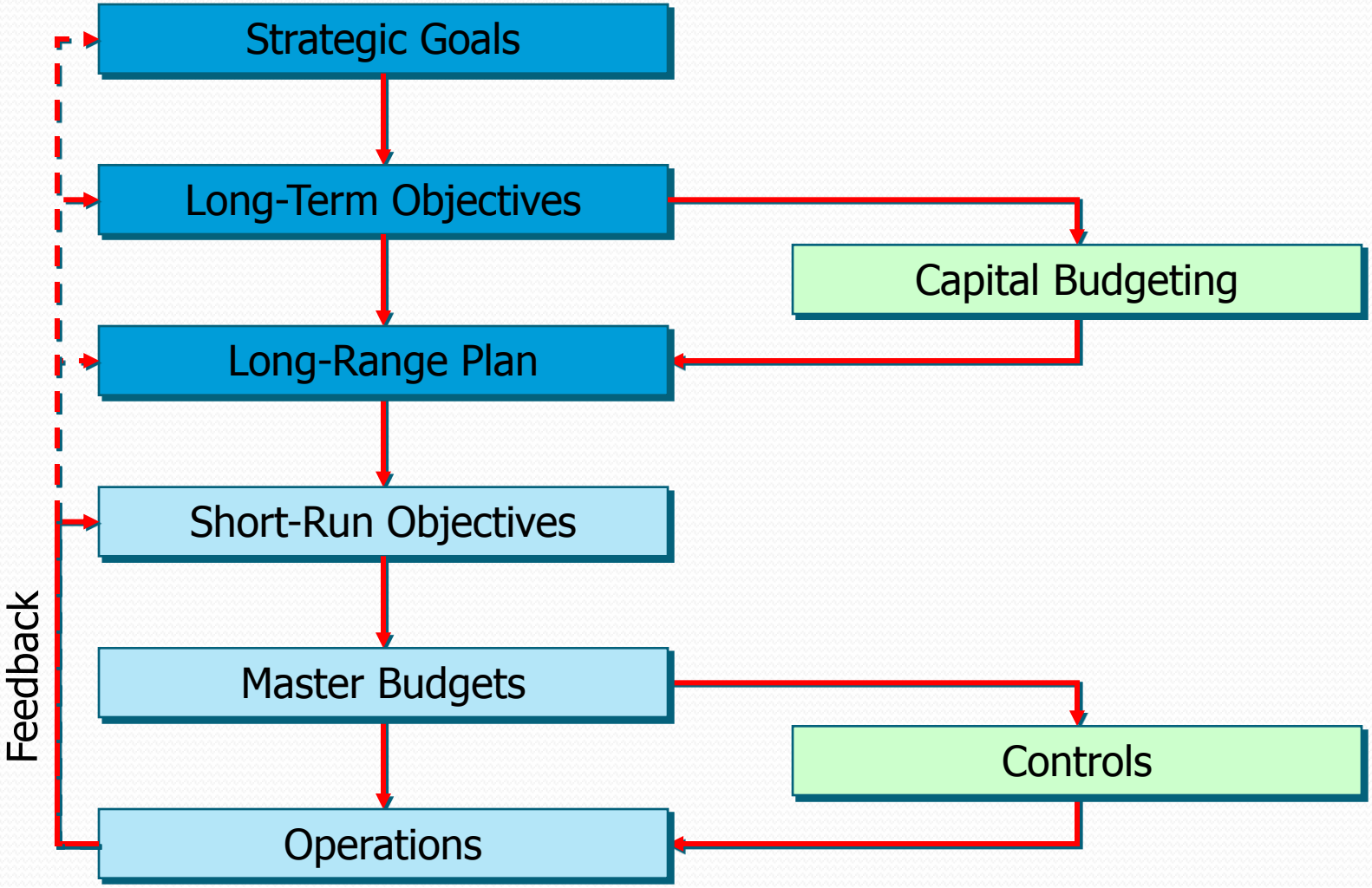
Role of Budget



- A budget is an organization's operation plan for a specified period
- It identifies the resources and commitments required to fulfill the organization's goals for the period.

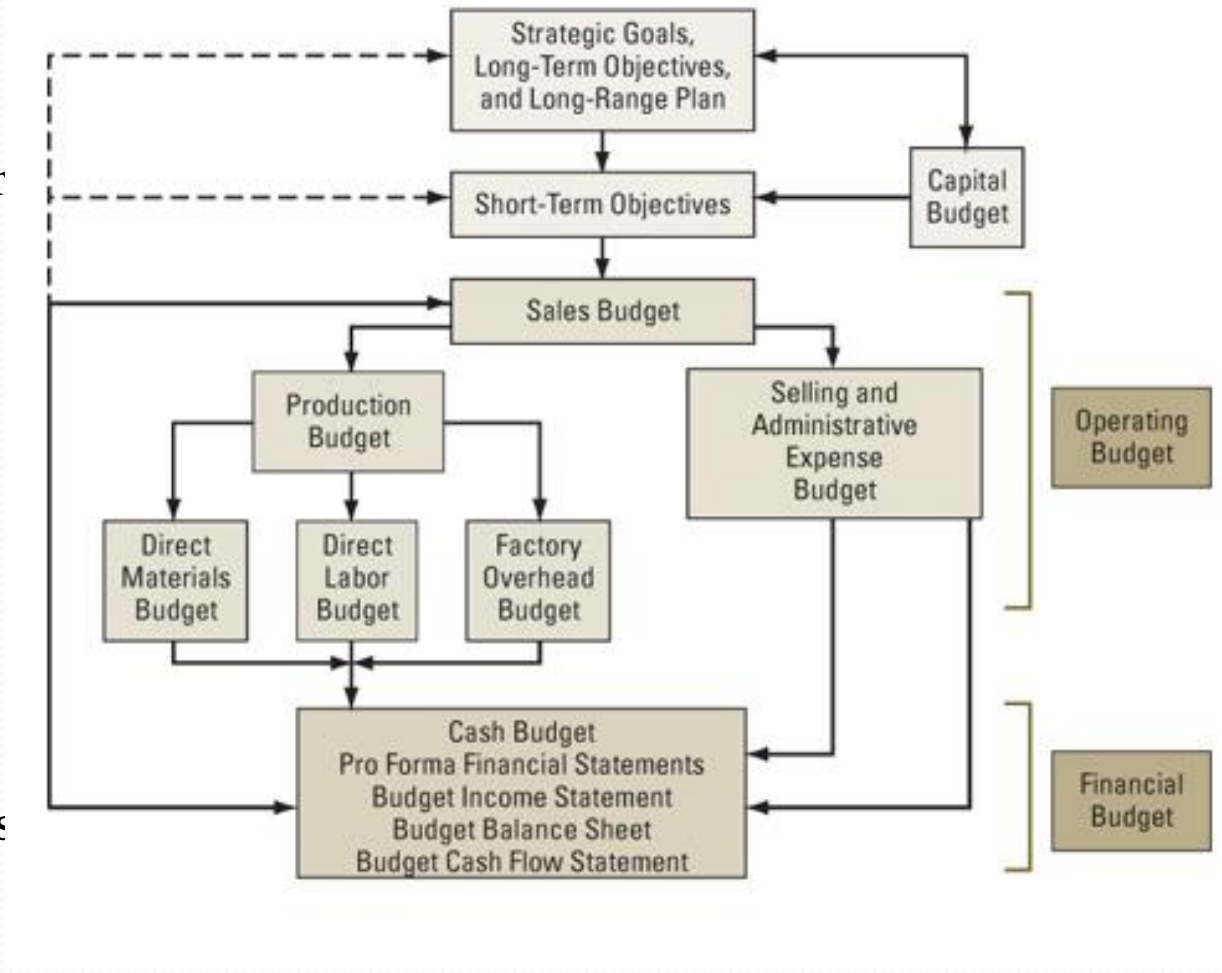
- Budget is…
  1. a plan of operations.
  2. a basis for allocating resources.
  3. a communication and authorization device.
  4. a device for motivating and guiding implementation.
  5. a guideline for operations and gauge for controlling operations.
  6. a basis for performance evaluation.

Budget Relationship



Master Budget

- A master budget is a comprehensive budget for a specific period
- It consists of **many interrelated operating and financial budgets**
- A **sales budget** often is regarded as the cornerstone of the entire budget
- The starting point in preparing a sales budget is **sales forecasts**



Sales Budget

- A sales budget shows expected sales in units at their expected selling prices
- A firm prepares the sales budget for a period based on the forecasted sales level, production capacity for the budget period, and long-term plan and short-term goal of the firm
- A sales budget is the cornerstone of budget preparation because a firm can complete the plan for other activities only after it identifies the expected sales level

Sales Budget

Kerry Industrial Products Company
Sales Budget
For the First Quarter Ended June 30, 2007

Sale Forecast

	April	May	June	Quarter
Sales in units	**20,000**	**25,000**	**35,000**	**80,000**
Selling price per unit	**x $30**	**x $30**	**x $30**	**x $30**
Total sales	**$600,000**	**$750,000**	**$1,050,000**	**$2,400,000**

Production Budget



- A firm prepares a production budget **after determining the number of units that it expects to sell**
- A production budget is a plan for acquiring the resources needed to carry out the manufacturing operations **to satisfy the expected sales and maintain the desired ending inventory**
- The total number of units to be produced depends on the budgeted sales, the desired units of finished goods ending inventory, and the units of finished goods beginning inventory.

Production Budget

Kerry expects to have 5,000 units on hand on April 1 and wants to have 30% of the following month's projected unit sales on hand at the end of each month.

Determining the budgeted units of production:

Budgeted Production (in units)	=	Budgeted Sales (in units)	+	Desired Ending Inventory (in units)	–	Beginning Inventory (in units)



Production Budget

Kerry Industrial Products Company
Production Budget
For the Quarter Ended June 30,2007

	April	May	June	Quarter
Budgeted sales in units	20,000	25,000	35,000	80,000
Desired ending inventory	7,500	10,500		
Units needed	27,500	35,500		
Beginning inventory	5,000	7,500		
Budgeted production	22,500	28,000		

30% of June's budgeted sales



July sales are budgeted at 40,000 units,

Direct Material Budget

- The information in the production budget becomes the basis for preparing several manufacturing-related budgets
- A direct materials usage budget shows the direct materials required for production and their budgeted cost

Total direct materials needed in production	+	Desired direct materials ending inventory	=	Total direct materials purchase for the period	+	Direct materials beginning inventory

Direct Material Budget

Each unit produced requires 3 pounds of alloy at a cost of $2.45 per pound. Kerry expects to manufacture 36,000 units in July. On April 1, 7,000 pounds of alloy were in inventory.

Budgeted unit production in April is 22,500. At 3 pounds per unit direct material needs are 67,500 pounds.

Desired ending inventory is 10 % of the next period's production needs. In May production needs will be 28,000 units, so 28,000 × 3 pounds = 84,000 × 10% = 8,400 pounds.

Determine the total cost of direct material purchase pf April.

Direct Material Budget

KERRY INDUSTRIAL COMPANY
Direct Materials Usage Budget
For the Quarter Ended June 30, 2007

Line	Item	April	May	June	Quarter	Calculation
A.	*Production Requirement*					
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	× $ 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	10,800	*
10.	Cost per unit	× $ 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)

* = Exhibit 8.8

Direct Material Budget

EXHIBIT 8.8
Direct Materials Purchase Budget

KERRY INDUSTRIAL COMPANY
Direct Materials Purchase Budget
For the Quarter Ended June 30, 2007

Line	Item	April	May	June	Quarter
1.	Total direct materials needed in production (from part A of Exhibit 8.7)	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	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

Direct Labor Budget

- To prepare the direct labor budget, a company would use its production budget
- The direct labor budget enables the personnel department to plan for hiring and repositioning of employees
- A good labor budget helps the firm to avoid emergency hiring, prevent labor shortages, and reduce or eliminate the need to lay off workers
- Firms usually prepare labor budget for each type of labors. For example, for each skill requirement.

Direct Labor Budget

Each unit of output requires .5 hours of semi-skilled labor at an average cost of $8.00 per hour, and .2 hours of skilled labor at an average cost of $12.00 per hour.

Kerry Industrial Production Company
Direct Labor Budget
For the Quarter Ended June 30, 2007

	April	May	June	Quarter
Budgeted production	22,500	28,000	36,500	87,000

22,500 × .5 × $8.00 = $90,000

22,500 × .2 × $12.00 = $54,000

Factory Overhead Budget

- A factory overhead budget often includes all production costs other than direct materials and direct labor
- Unlike direct materials and direct labor, manufacturing overhead costs include costs that vary in direct proportion with the units manufactured as well as costs that vary with either the kind of facilities the firm has or the way in which the firm carries out it operations

Factory Overhead Budget

The variable overhead rate is $4.40 per direct labor hour. Fixed factory overhead is $44,300 during April and May, and $54,300 in June.

Kerry Industrial Production Company
Factory Overhead Budget
For the Quarter Ended June 30, 2007

	April	May	June	Quarter
Budgeted production (Production Budget)	22,500	28,000	36,500	87,000
Semi-skilled hours required (Labor Budget)	11,250	14,000	18,250	43,500
Skilled labor hours required (Labor Budget)	4,500	5,600	7,300	17,400
Total direct labor hours	15,750	19,600	25,550	60,900
Variable factory overhead ($4.40 per hour)	$ 69,300	$ 86,240	$ 112,420	$ 267,960
Fixed factory overhead	44,300	44,300	54,300	142,900

Also see Exhibit 8.10

Cost of Goods Manufactured Budget

- The cost of goods manufactured production cost and the cost of goods sold budget reports the total budgeted cost of units sold for a period
- Upon completion of the cost of goods manufactured and sold budget for a period, two items in this budget appear in other budgets for the same period
- The income statement budget uses the cost of goods sold to determine the gross margin of the period, and the balance sheets includes the finished goods ending inventory it total assets

Selling and General Administrative Expense Budget

- A selling and general administrative expense budget delineates plans for all non-manufacturing expenses
- This budget serves as a guideline for selling and administrative activities during the budget period
- Many selling and general administrative expenditures are discretionary



Cash Budget



- A cash budget depicts effects of all budgeted activities on cash
- By preparing a cash budget, management can:
  1. take steps to ensure having sufficient cash on hand to carry out the planned activities
  2. allow sufficient time to arrange for additional financing that may be needed during the budget period (and thus avoid high costs of emergency borrowing)
  3. plan for investments of excess cash on hand to earn the highest possible return
- A cash budget includes all items that affect cash flows and pulls data from almost all parts of the master budget
- A cash budget generally includes three major sections:
  1. Cash available
  2. Cash disbursements
  3. Financing

Cash Budget: Receipts

- Management at Kerry expects 70% of all sales to be for cash and credit card sales, of which 40% are credit card sales that result in a 3% processing fee.
- Of the company's accounts receivable 80% are paid in the month following the month of sale, and 60% of these are paid within the discount period (2% discount allowed).
- Of the remaining accounts receivable, 15% are collected in the second month following the month of sale, and 5% of accounts receivable eventually prove uncollectible.
- Sales during March were $450,000.

Cash Budget

Kerry Industrial Production Company
Cash Receipts Budget
For the Quarter Ended June 30, 2007

	April	May	June	Quarter
Total sales	$ 600,000	$ 750,000	$ 1,050,000	$ 2,400,000
Total cash sales	420,000	525,000	735,000	1,680,000
Customers paying cash	252,000	315,000	441,000	1,008,000
Credit card collections	162,960	203,700	285,180	651,840
Collection on account:				
Within discount period	63,504	84,672	105,840	254,016
After the discount period;				
Previous month	43,200	57,600	72,000	172,800
Two months earlier	18,000	20,250	27,000	65,250
Cash collections	$ 539,664	$ 681,222	$ 931,020	$ 2,151,906

$420,000 × 40% × 97% = $162,960

$450,000 × 30% × 80% × 40% = $43,200

$450,000 × 30% × 80% × 60% x 98% = $63,504

$400,000 × 30% × 15% = $18,000

Budget Income Statement

- The budgeted income statement estimates the expected operating income from the budgeted operations
- A budgeted income statement allows management a glimpse of the likely operating result upon completion of the budgeted operation
- Once the budget income statement has been approved, it becomes the benchmark against which the performance of the period is evaluated

Budget Balance Sheet

- The last step in a budget preparation cycle usually is to prepare the budget balance sheet
- The starting point in preparing the budget balance sheet is the expected financial positions at the end of the current operating period--the beginning balances of the budget period

Using Budget Models For Simulation

Using Budget Models for simulation

- Case Study

The Probability Race Game

Player 1:

Finish

Winning horse →

Player 2:

Finish

Winning horse →



How to Play

2	3	4	5	6	7	8	9	10	11	12

Start

die 1

+	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

die 2



2	3	4	5	6	7	8	9	10	11	12

Start

Game

Class Results

2	3	4	5	6	7	8	9	10	11	12
0	0	1	6	12	26	18	4	2	0	0

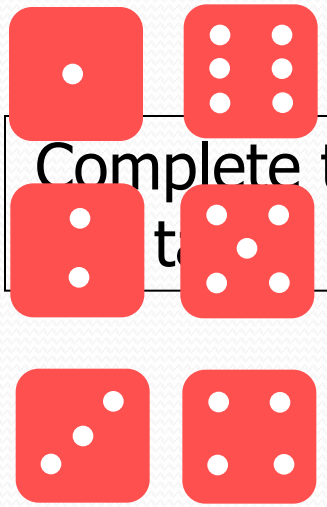
P(7) = 6/36 = 1/6

Die 1

Die 2

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

We can use the table to calculate probabilities for other outcomes.



Did you know that the numbers on opposite faces of a die add to 7?

Class Results

2	3	4	5	6	7	8	9	10	11	12
0	0	1	6	12	26	18	4	2	0	0

P(7) = 6/36 = 1/6

Die 1

Die 2

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Calculate the probabilities of the following events.

(a) P(5) = 4/36

(b) P(12) = 1/36

(c) P(even) = 18/36

(d) P(odd) = 18/36

(e) P(prime) = 15/36

(f) P(>4)= 30/36

(g) P(<9)= 26/36

(h) P(multiple of 3) = 12/36

The Probability Race Game

Player 1:

Finish Winning horse →

2	3	4	5	6	7	8	9	10	11	12

Start





die 1

+	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

die 2

Player 2:

Finish Winning horse →

2	3	4	5	6	7	8	9	10	11	12

Start

Worksheet

The Drive Towards Shareholder Value (EVA)

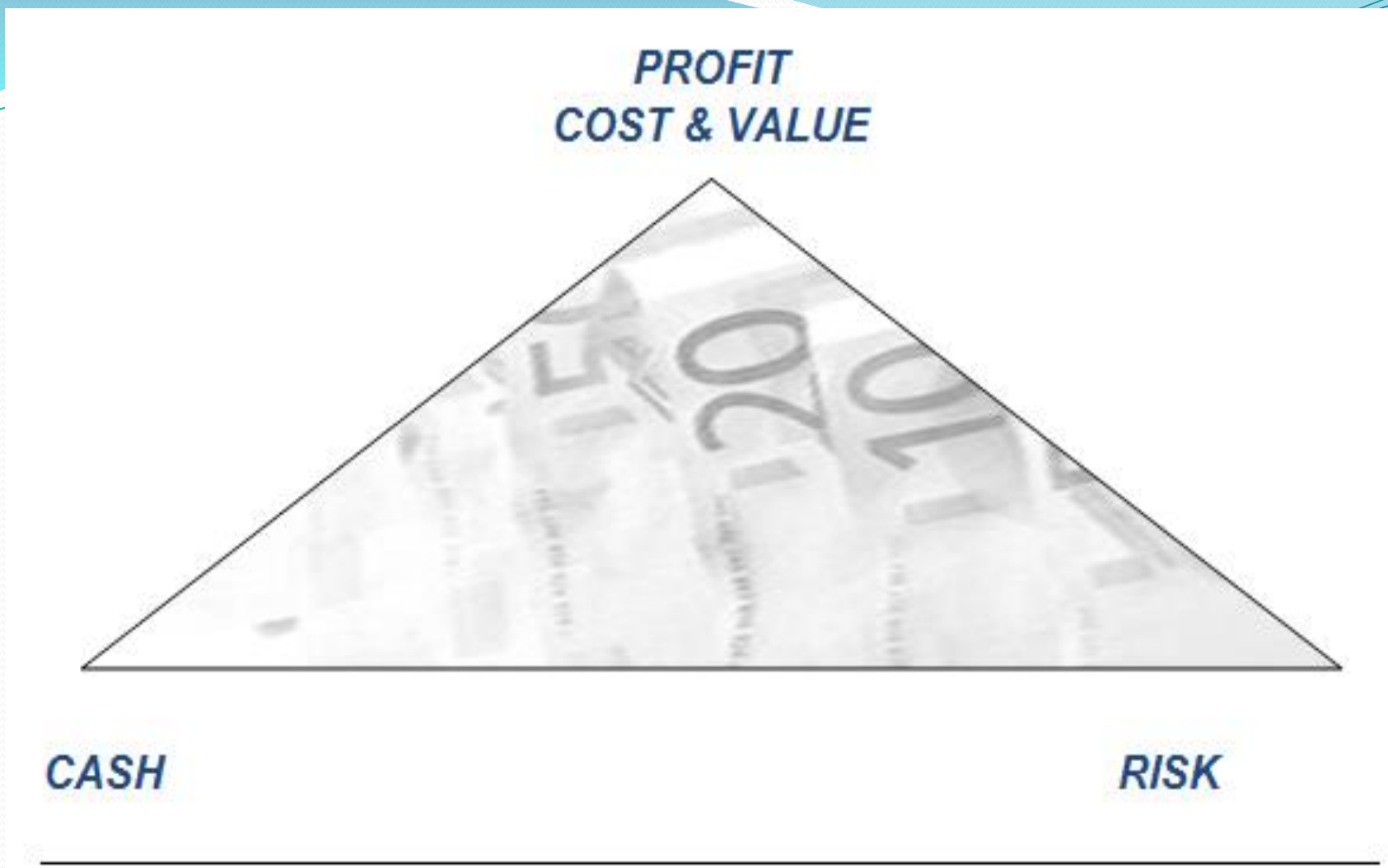
EVA – Economic Value Added

- Adding value to shareholders

The Strategic Plan

- The purpose of planning and budgeting in business
- Defining the strategic approach to business planning
- Defining strategic assumptions
- Building the strategic planning model using financial data
- Various strategic and tactical approaches to business planning
- Defining the Decision-Support model: Assumptions/Goals and Key Success Factors

The Strategic Basis of Budgeting


PROFIT
COST & VALUE
CASH
RISK

Profit & Cash

Profit Is Vanity

Cash Is Sanity

Value



"There is little money in making"





What about Commodities?







Cut Cost Not Value









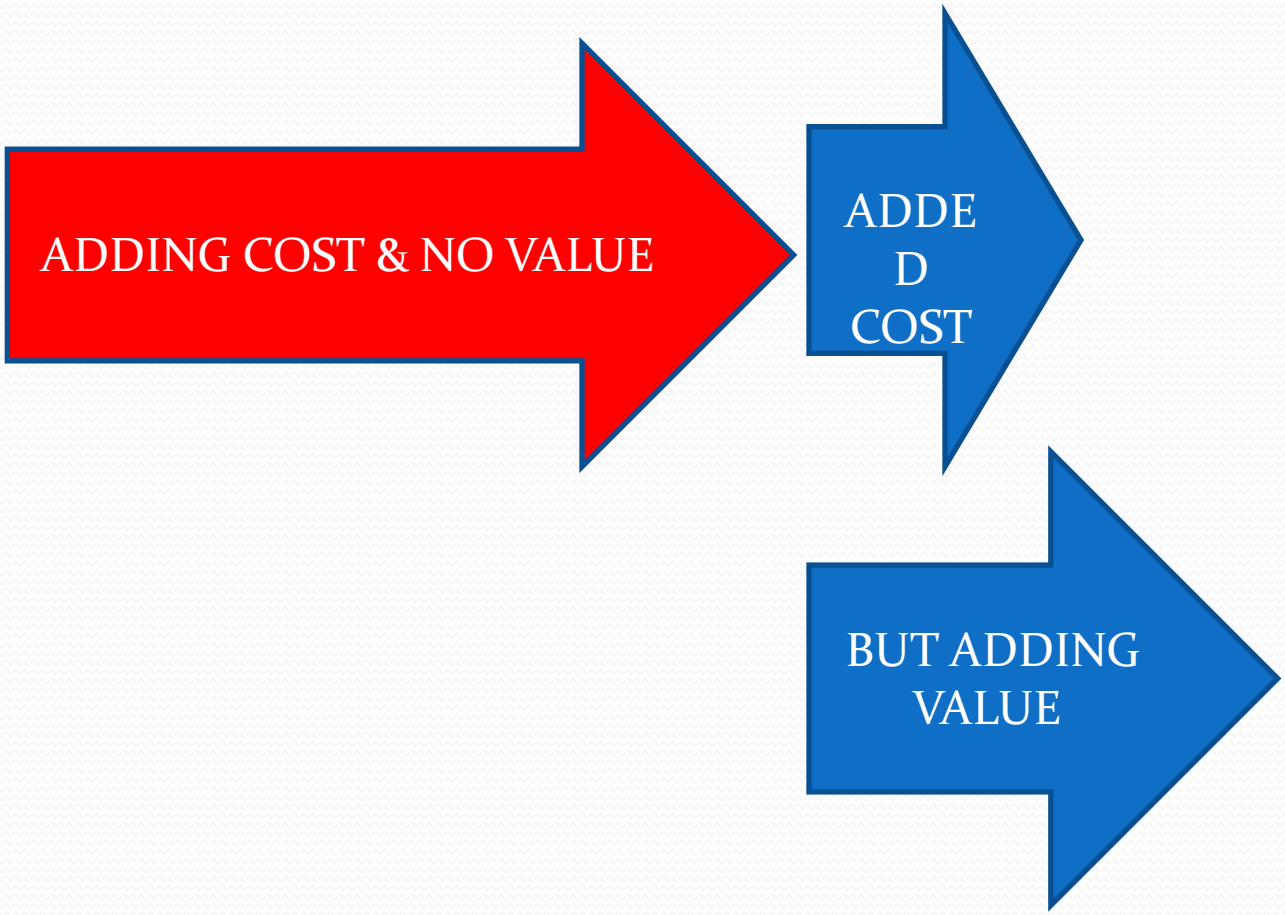
Are Business Buyers Different?



A Question of Value

	VALUE	DO NOT VALUE
You as a customer (consumer)		
You as a customer for your Company		
Your Internal Customer		

Activities Adding Value or Waste



Educating Budget Managers about Cost & Value

- How COSTs change
- COST Drivers
- Defining VALUE



- Making business cases including VALUE (With Evidence)

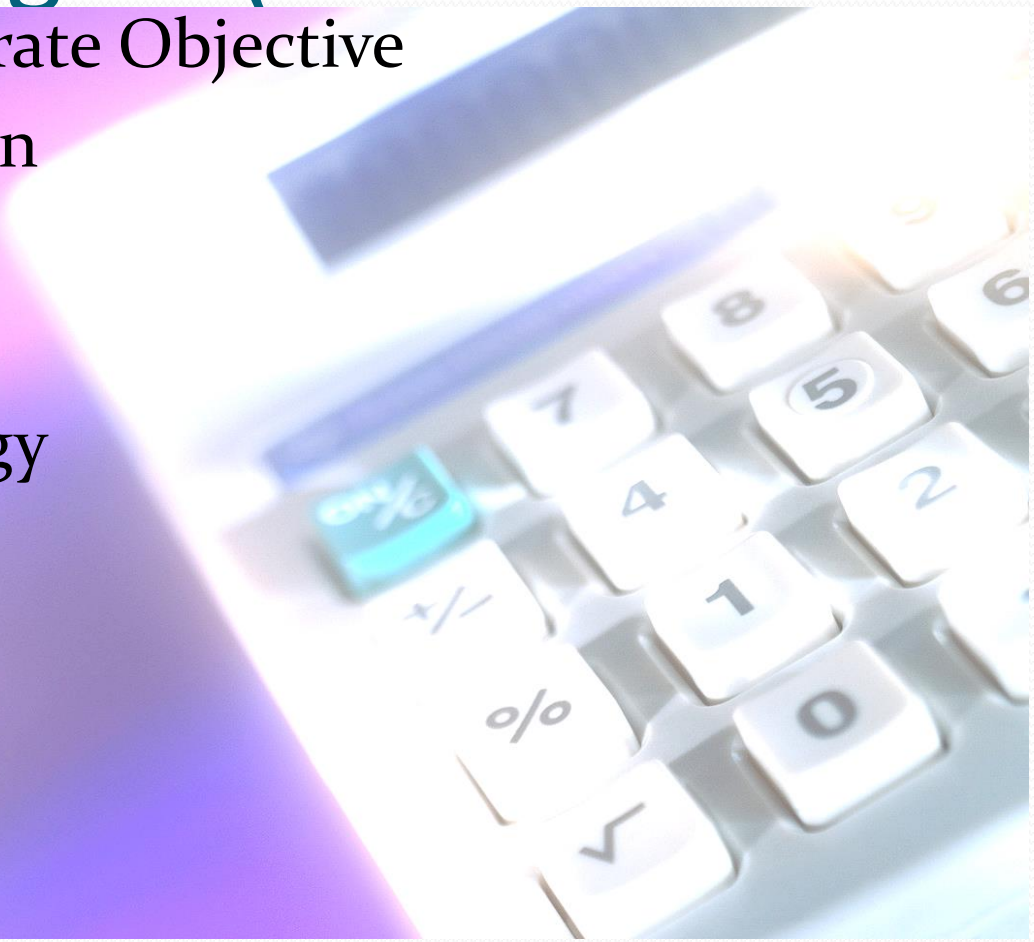
Educating Budget Managers / Non Accountants about Accounting

- Accruals Accounting
- Cash Accounting
- Commitment Accounting
- Cash v Accruals v Commitment



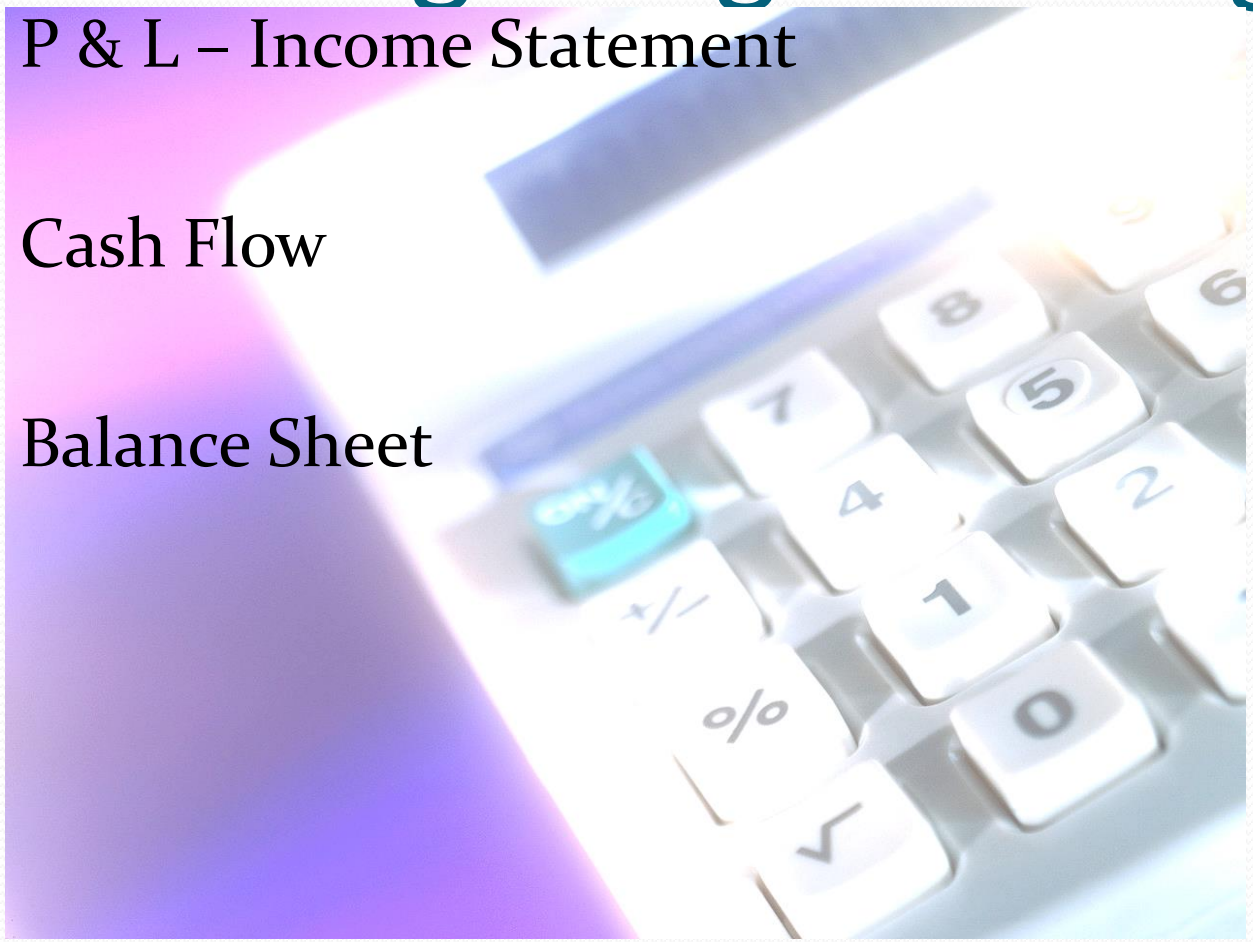
Educating / Communicating Budget Managers (& Shareholders?)

- Corporate Objective
- Mission
- Vision
- Values
- Strategy



Educating Budget Managers

- P & L – Income Statement
- Cash Flow
- Balance Sheet





SHELL OMAN
Change Location

- Environment & Society
- Innovation
- Products & Services
- About Shell
- Who we are
- Shell in Oman

You are here: Shell Oman Home > About Shell > Who we are > Shell in Oman > Shell General Business Principles >

Mission Statement & Vision

Mission Statement & Vision

Mission statement and Vision of shell oman marketing company

Our Mission Statement

"To enhance profitability through innovative management strategies while ensuring cost effectiveness and harnessing creative ideas."

Our Vision

"To be the market leader and deliver the best value to our stakeholders."





GLOBAL
Change Location

Environment & Society

Innovation

You are here: Home > About Shell > Who we are > **Our values**

Our values

As a global energy company we set high standards of performance and ethical behaviours. We are judged by how we act - our reputation is upheld by how we live up to our core values honesty, integrity and respect for people. The Shell General Business Principles, Code of Conduct and Code of Ethics help everyone at Shell act in line with these values and comply with all relevant legislation and regulations.

What we stand for

BP wants to be recognised as a great company – competitively successful and a force for progress. We have a fundamental belief that we can make a difference in the world.

We help the world meet its growing need for heat, light and mobility. We strive to do that by producing energy that is affordable, secure and doesn't damage the environment.

BP is progressive, responsible, innovative and performance driven.

Progressive

We believe in the principle of mutual advantage and build productive relationships with each other, our partners and our customers.

Responsible

We are committed to the safety and development of our people and the communities and societies in which we operate. We aim for no accidents, no harm to people and no damage to the environment.

Innovative

We push boundaries today and create tomorrow´s breakthroughs through our people and technology.

Performance driven

We deliver on our promises through continuous improvement and safe, reliable operations.

These values guide us in the conduct of our business. In all our business we expect high ethical standards and act in accordance with our Code of Conduct.

PTT GROUP VISION

PTT GROUP MISSION

To conduct integrated energy and petrochemical business as the national energy company with a balanced mission of stakeholder satisfaction through



To the country
Ensuring long-term energy security by providing sufficient, high-quality energy supply at fair prices to enhance economic growth

To community and society
Being a good corporate citizen by maximizing positive environmental contributions, minimizing negative impacts, and improving the quality of life for communities and society

To shareholders
Conducting profitable business leading to sustainable growth and providing appropriate returns

To customers
Ensuring customer satisfaction and engagement by delivering world-class quality products and services at fair prices

To business partners
Conducting fair business with partners of the same standard, building value, and cooperation to develop capability and maximize efficiency in long-term business partnership

To employees
Supporting capability building in professional conduct and ensuring employees' well-being in par with other leading companies to forge employee engagement

PTT GROUP VALUES

S P I R I T

Synergy
Innovation
Responsibility for Society
Integrity & Ethics
Trust & Respect

The way we work together

PTT STRATEGIC FRAMEWORK





Thai Premier Multinational Energy Company

BIG A world scale Company to be listed in Fortune 100 by 2020

LONG A company with sustainable growth to be listed in DJSI in 2013

STRONG Operational excellence to achieve Top Quartile Performance by 2020

Business Strategy

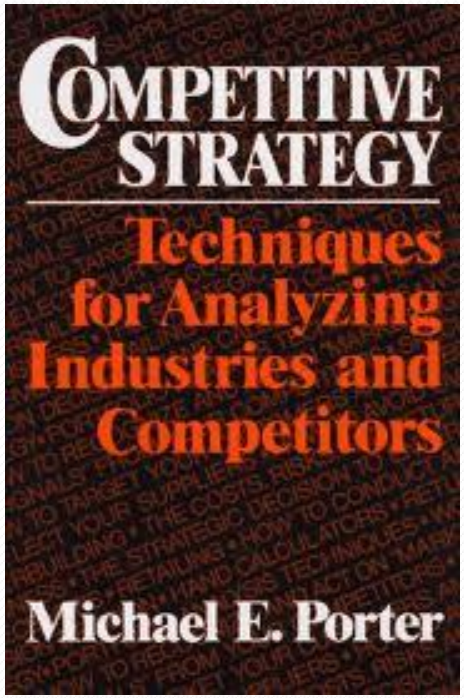
What is your business strategy?

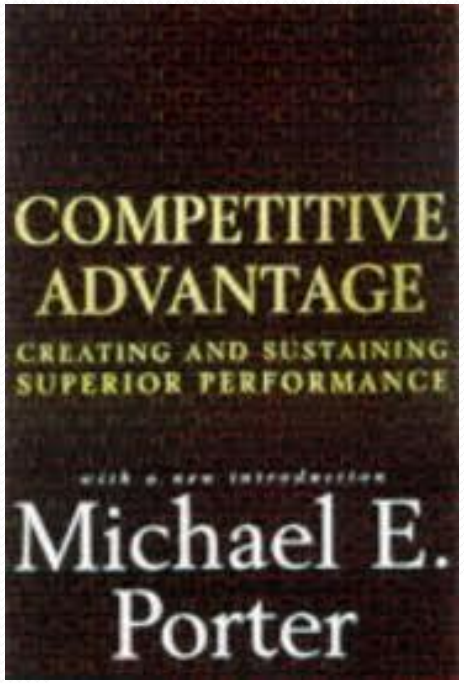
How do you beat your competitors by serving your customers better?

Describe your business's business strategy in less than three sentences

List out words that describe your business's business strategy, contrast this against your main competitors

Strategy – Michael Porter Harvard Business School



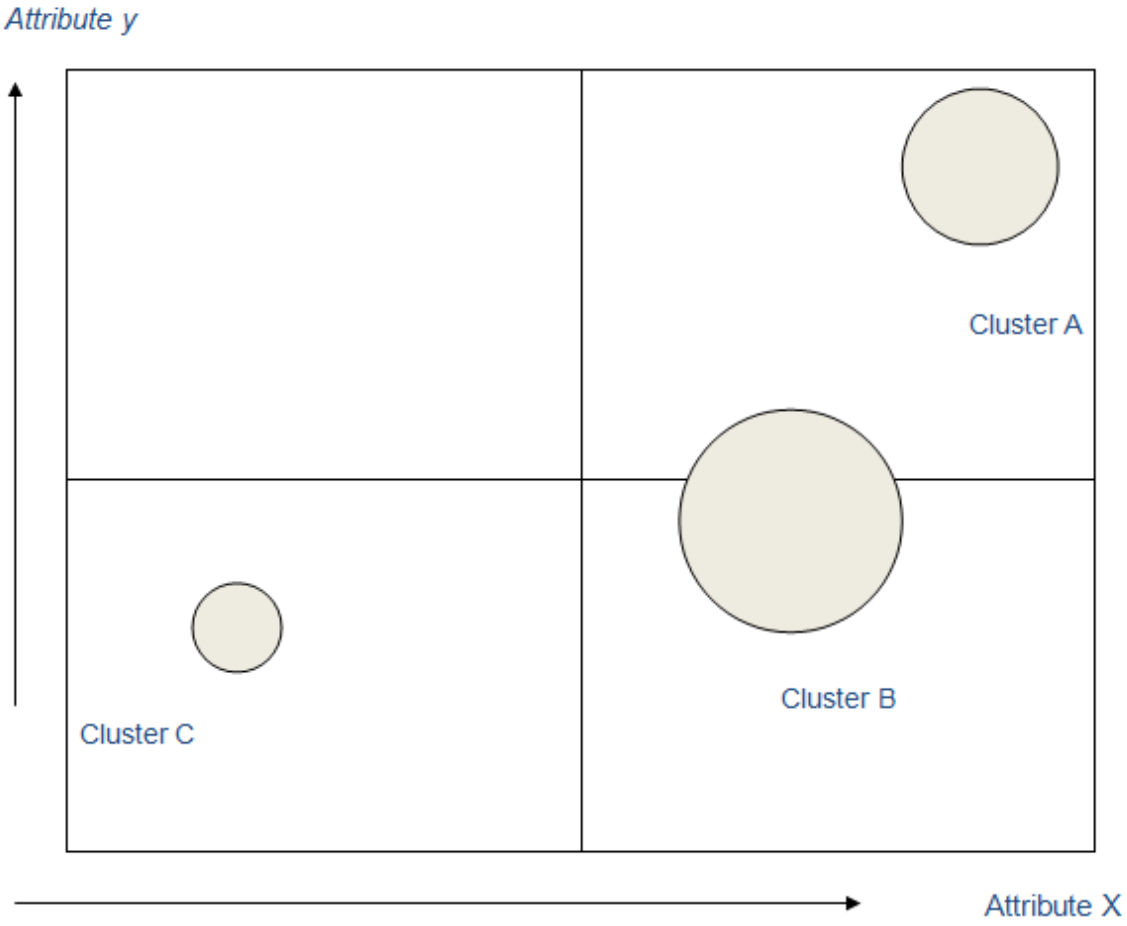




HARVARD BUSINESS

"Non Strategy" - "Stuck in the Middle"

	Lower Cost	**Differentiation**
Broad Target	1. Cost Leadership	2. Differentiation
Narrow Target	3a. Cost Focus	3b. Differentiation Focus



Mapping cluster of customer preferences against attributes

Preferences / needs may be

a. The same– No opportunity for segmentation
b. Diffused – No opportunity for segmentation
c. Clustered – segmentation opportunity

SWOT Analysis

INTERNAL	STRENGTHS	WEAKNESSES
EXTERNAL	OPPORTUNITIES	THREATS

Porter's Generic Strategies Exercise

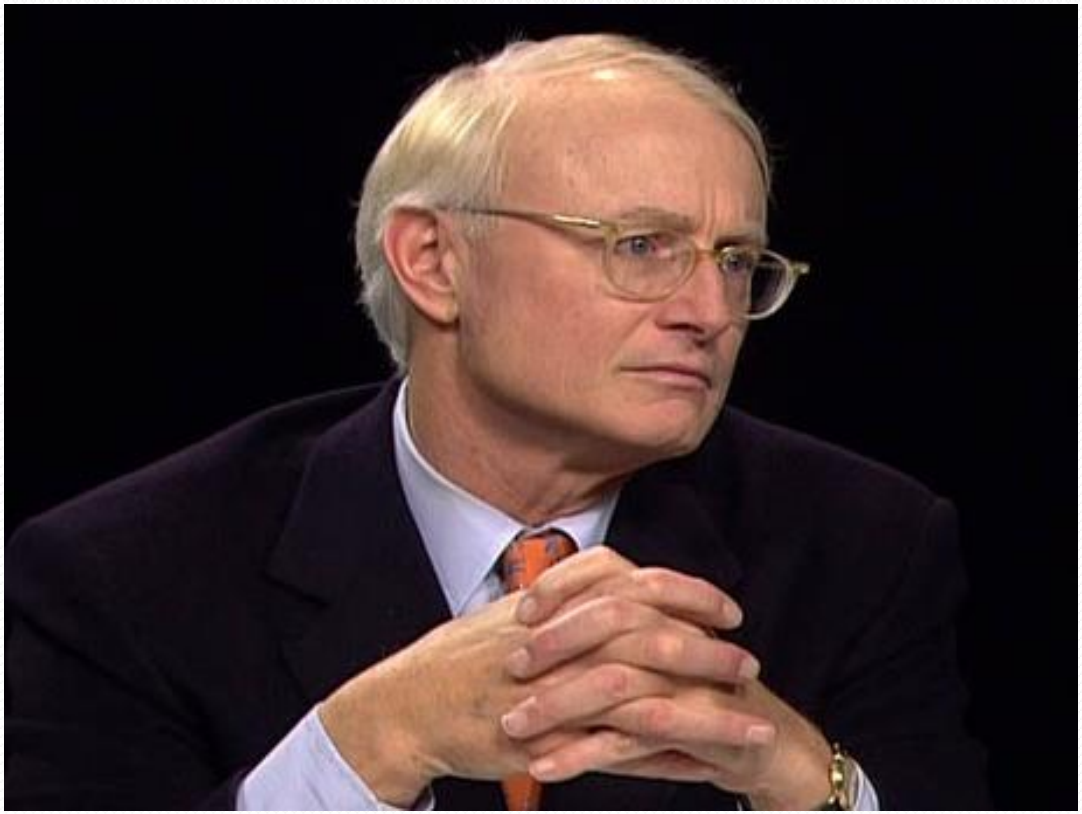
	Cost Leadership	Differentiation	Cost Focus	Differentiation Focus	"Stuck in the Middle"
Ford	X				
Land Rover				X	
BMW		X			
Saab					?
Lotus				X	
Smart				X	
Citroen	X				
Mercedes		X			
Dell					
Bang & Olufsen					
Your Business					

Your Company

SWOT Analysis

INTERNAL	**S**TRENGTHS	**W**EAKNESSES
EXTERNAL	**O**PPORTUNITIES	**T**HREATS

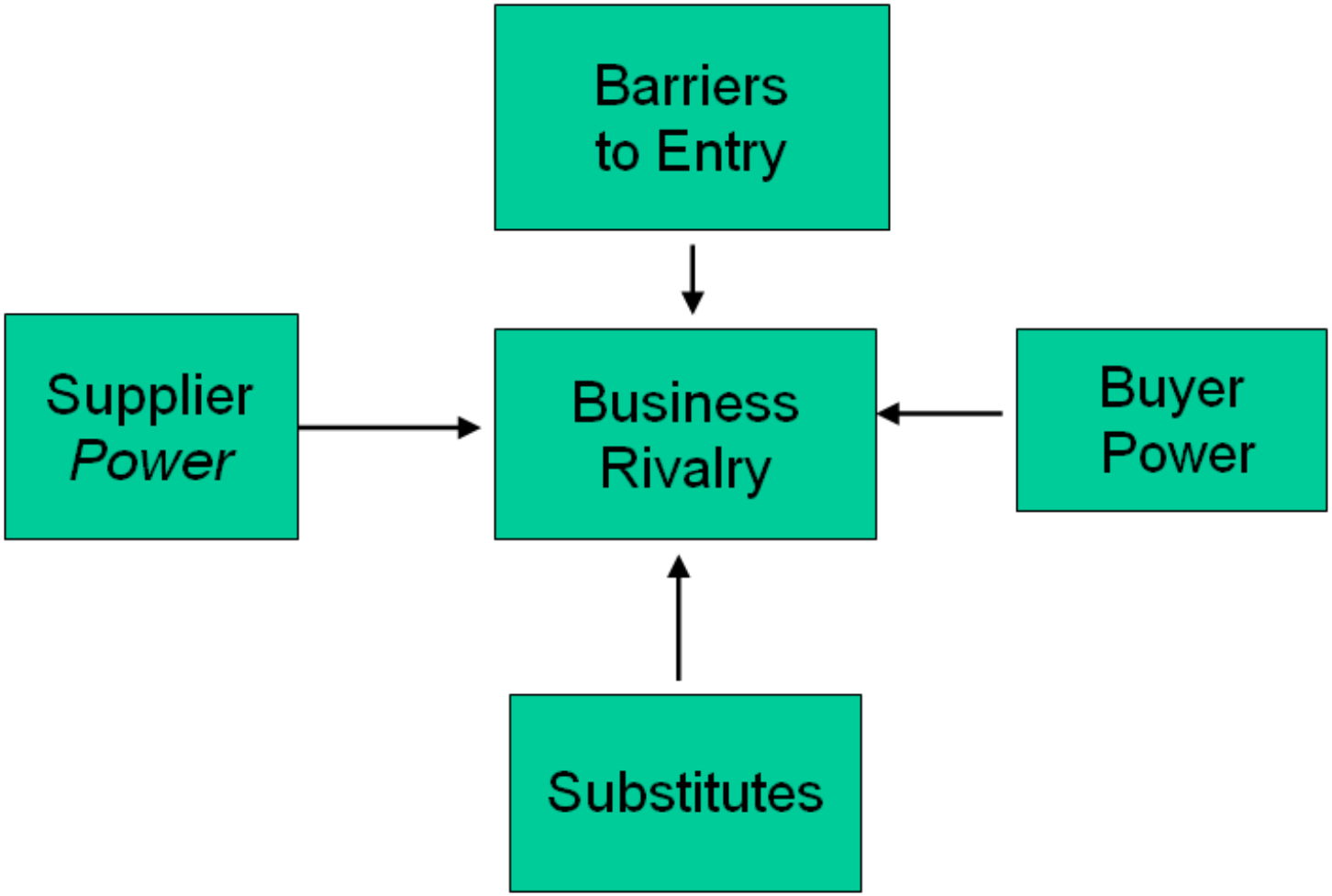
Michael Porter “SWOT”



SW - Value Chain
OT – Five Forces

Analysis of Threats & Opportunities

Porter's Five Forces

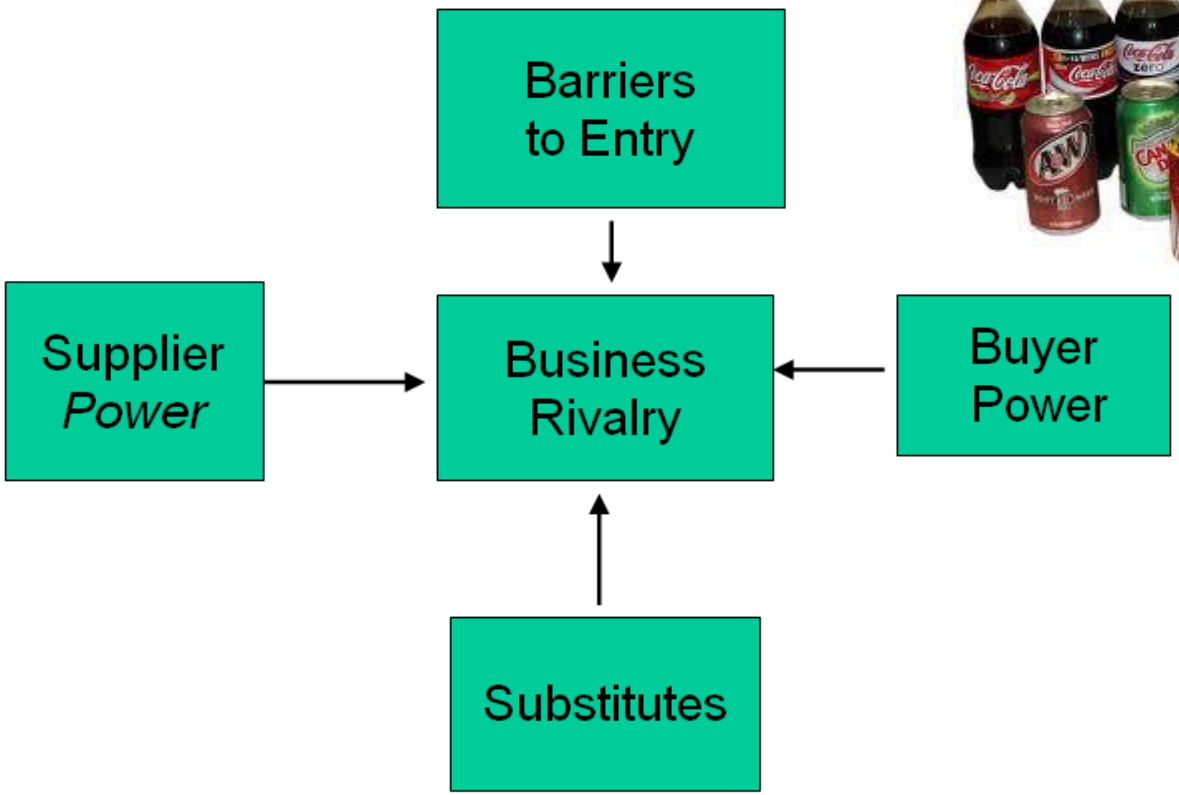


Five Star Industries – Soft Drinks

Analysis of Threats & Opportunities

Porter's Five Forces



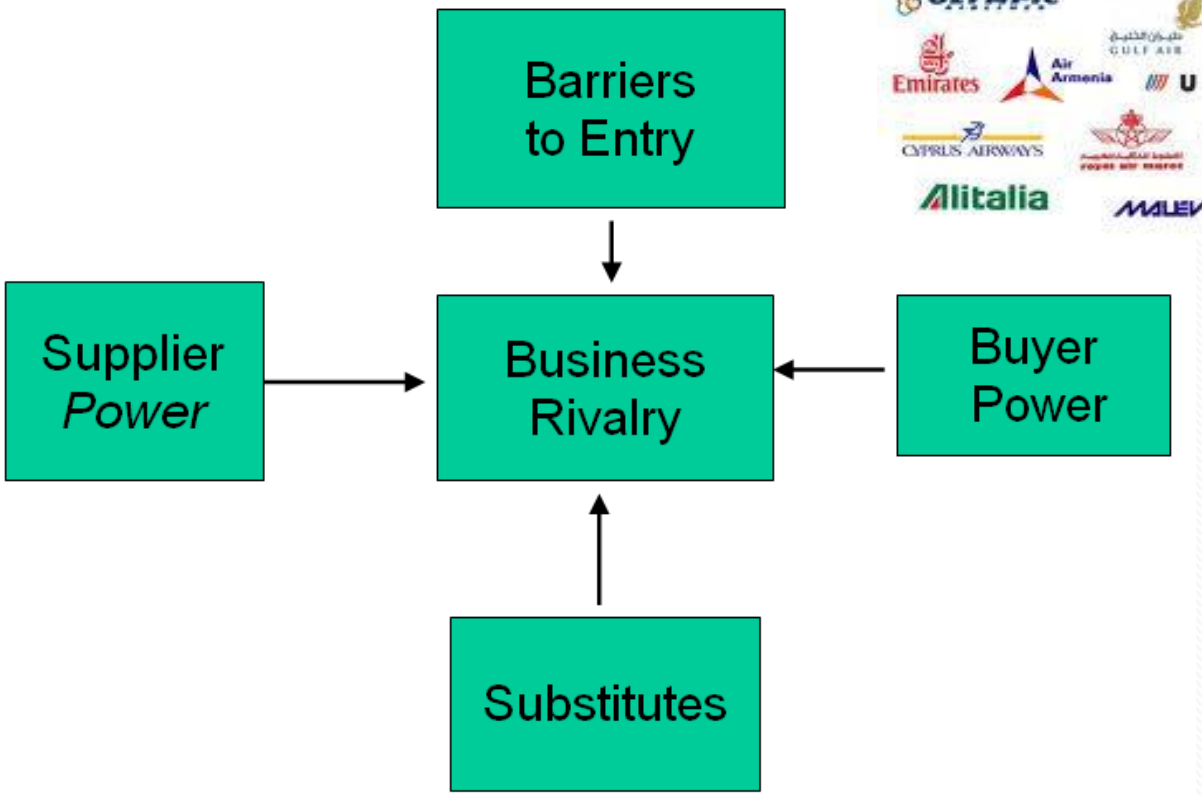


No Star Industries - Airlines

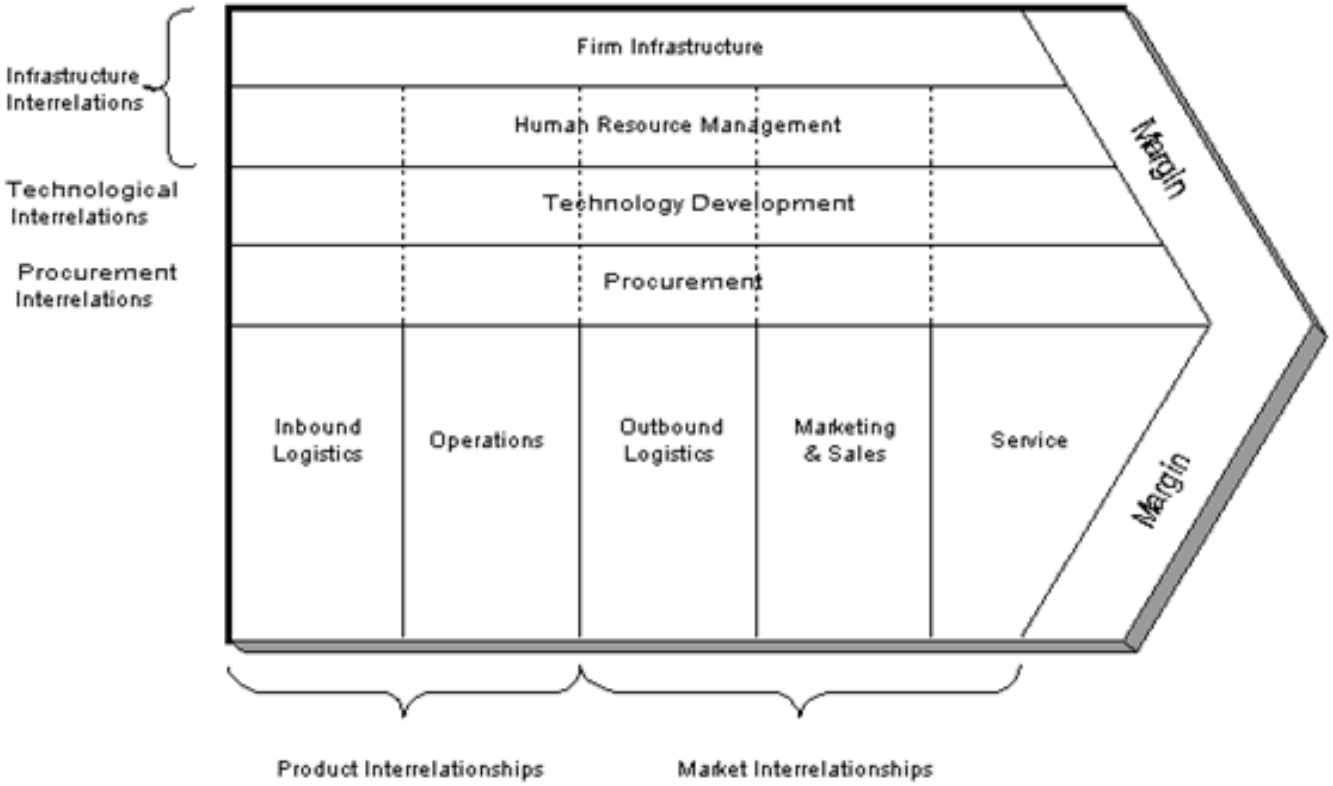


Analysis of Threats & Opportunities

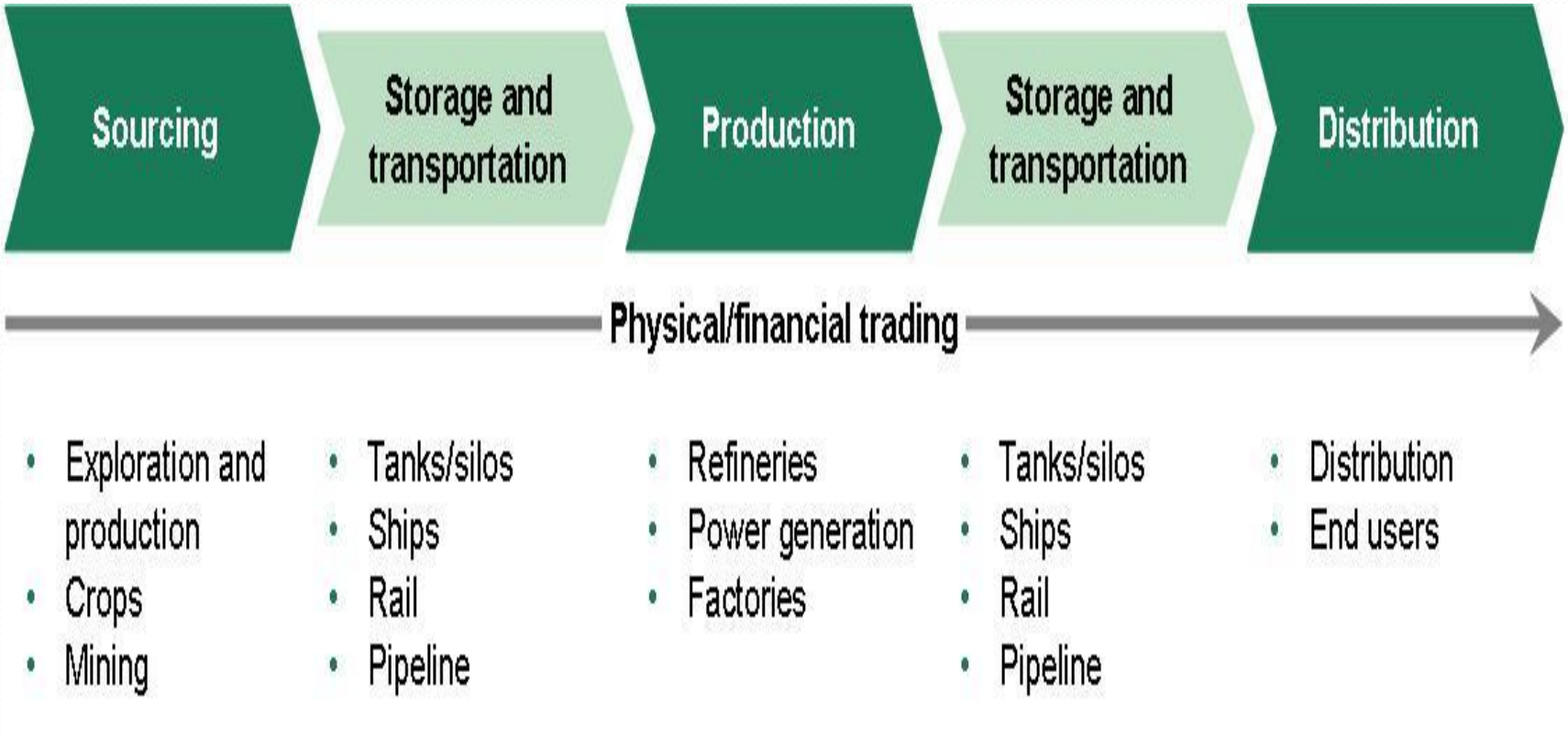
Porter's Five Forces

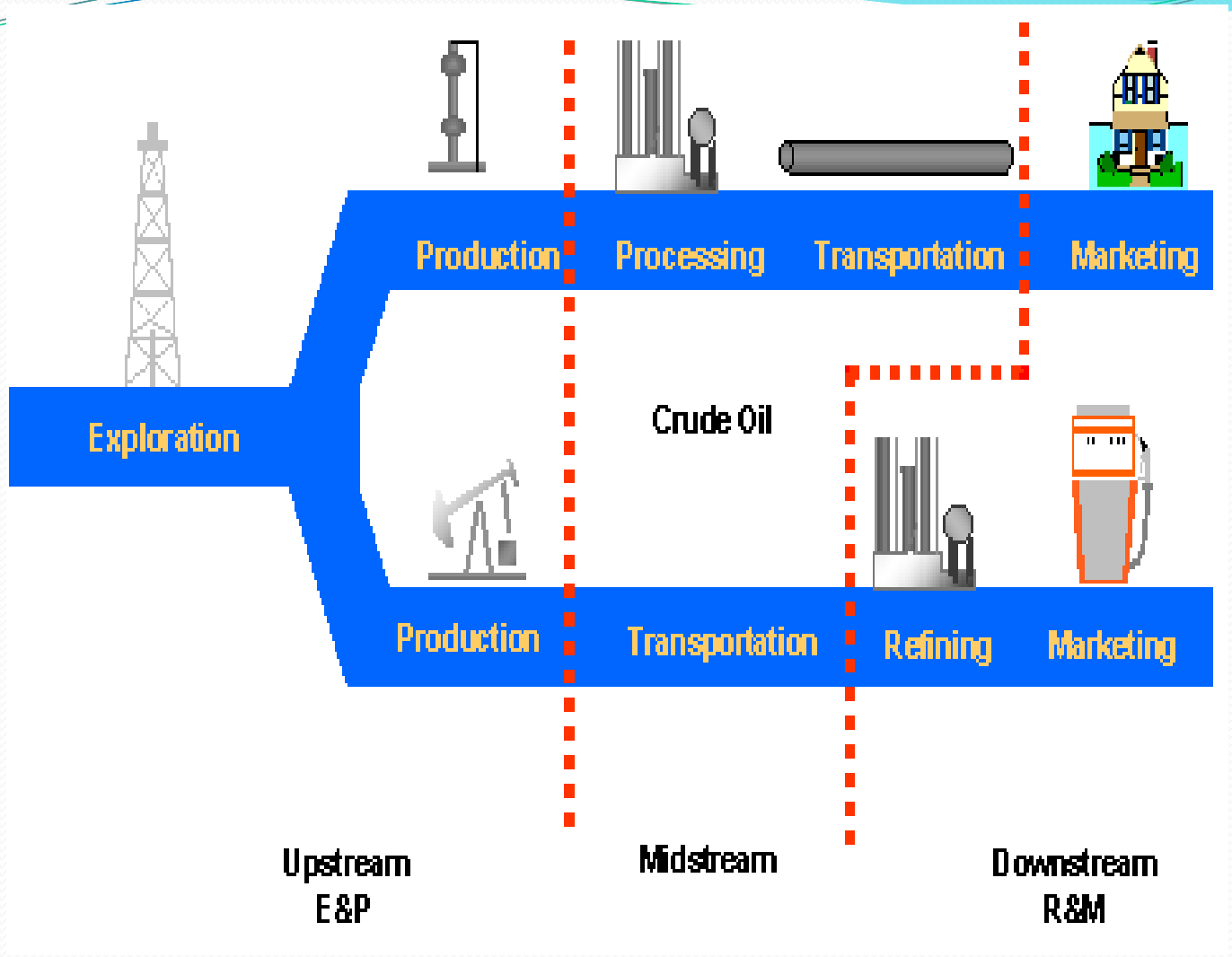


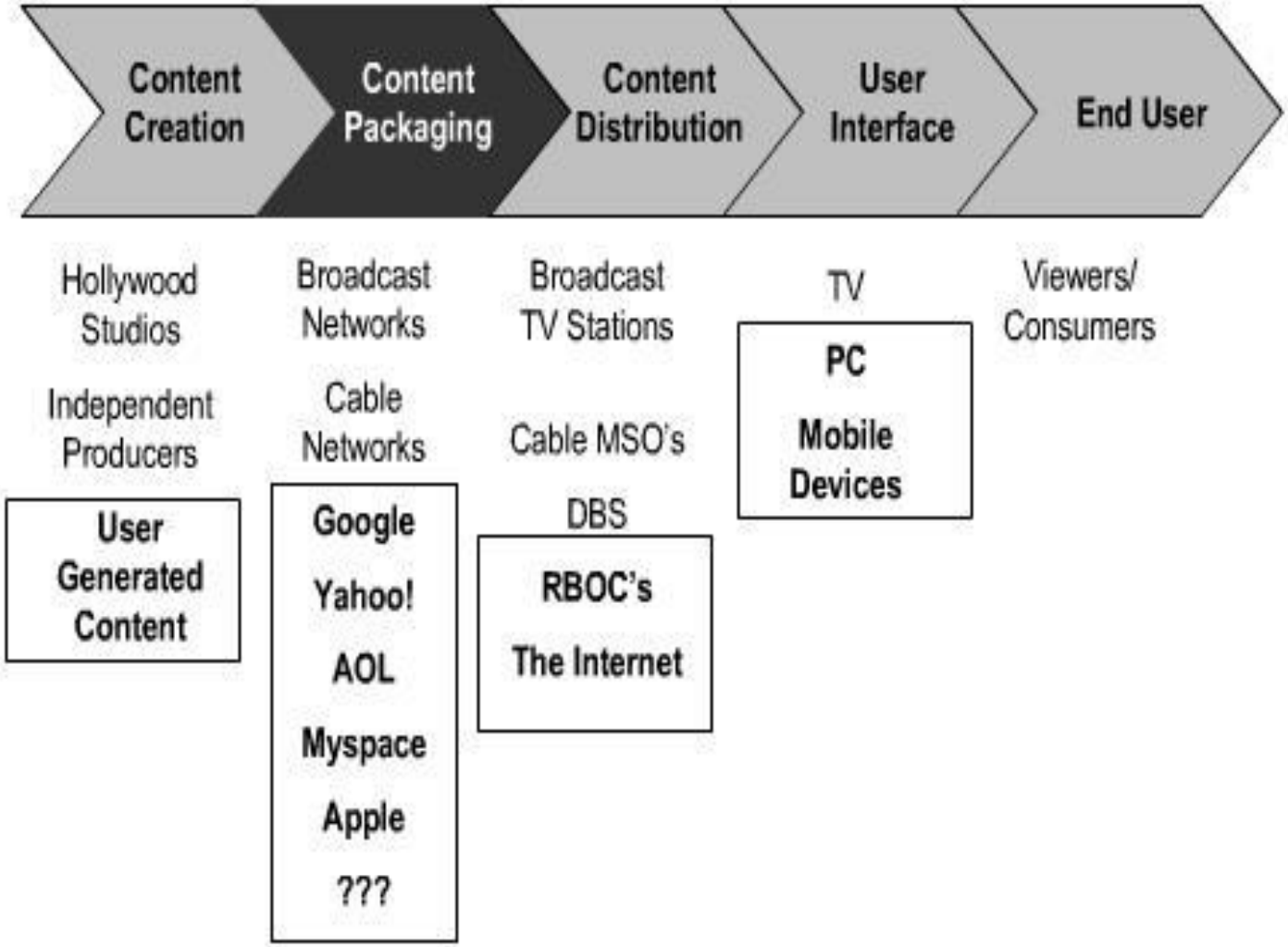
Porter's Value Chain – Strengths & Weaknesses



Generic Industry Value Chain




Production
Processing
Transportation
Marketing
Exploration
Crude Oil
Production
Transportation
Refining
Marketing
Upstream
E&P
Midstream
Downstream
R&M


Content Creation
Content Packaging
Content Distribution
User Interface
End User
Hollywood Studios
Independent Producers
User Generated Content
Broadcast Networks
Cable Networks
Google
Yahoo!
AOL
Myspace
Apple
???
Broadcast TV Stations
Cable MSO's
DBS
RBOC's
The Internet
TV
PC
Mobile Devices
Viewers/ Consumers

The Routes to Competitive Advantage

3 types of Business Systems

1. Operational Excellence
    a. MacDonalds
    b. EasyJet

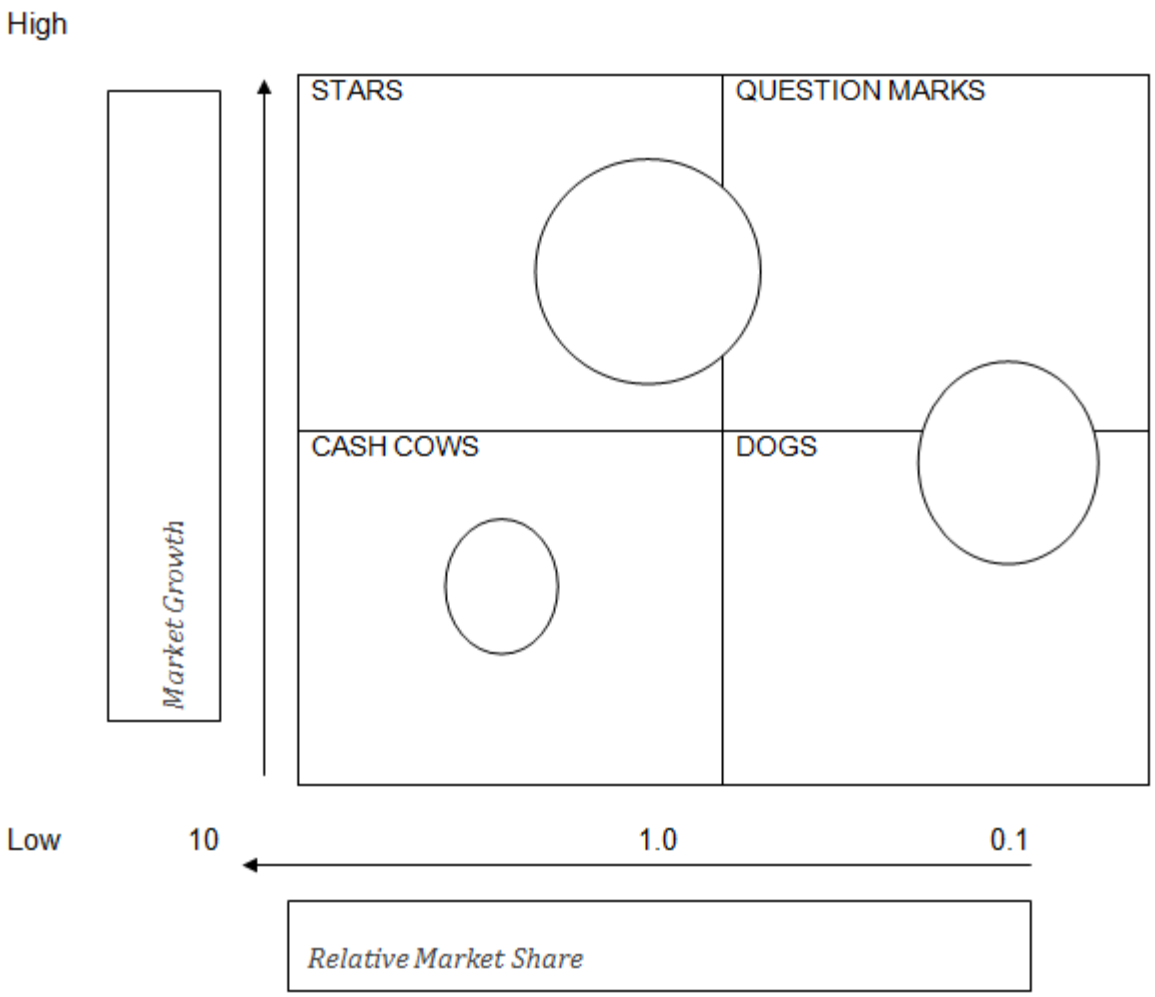
2. Product Leadership
    a. Microsoft
    b. Apple

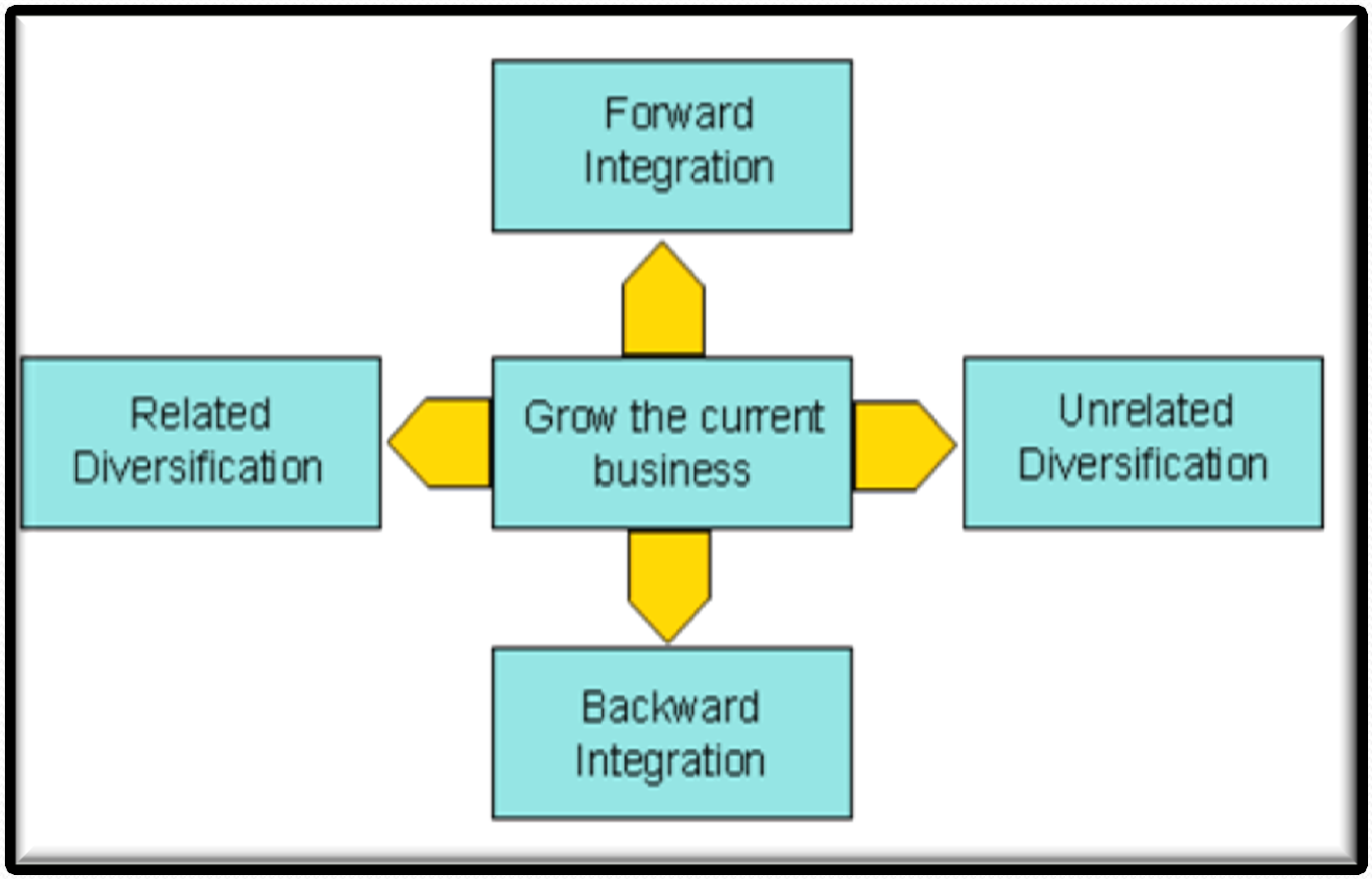
3. Customer Intimacy
    a. Rolls Royce cars
    b. Banks (in theory)

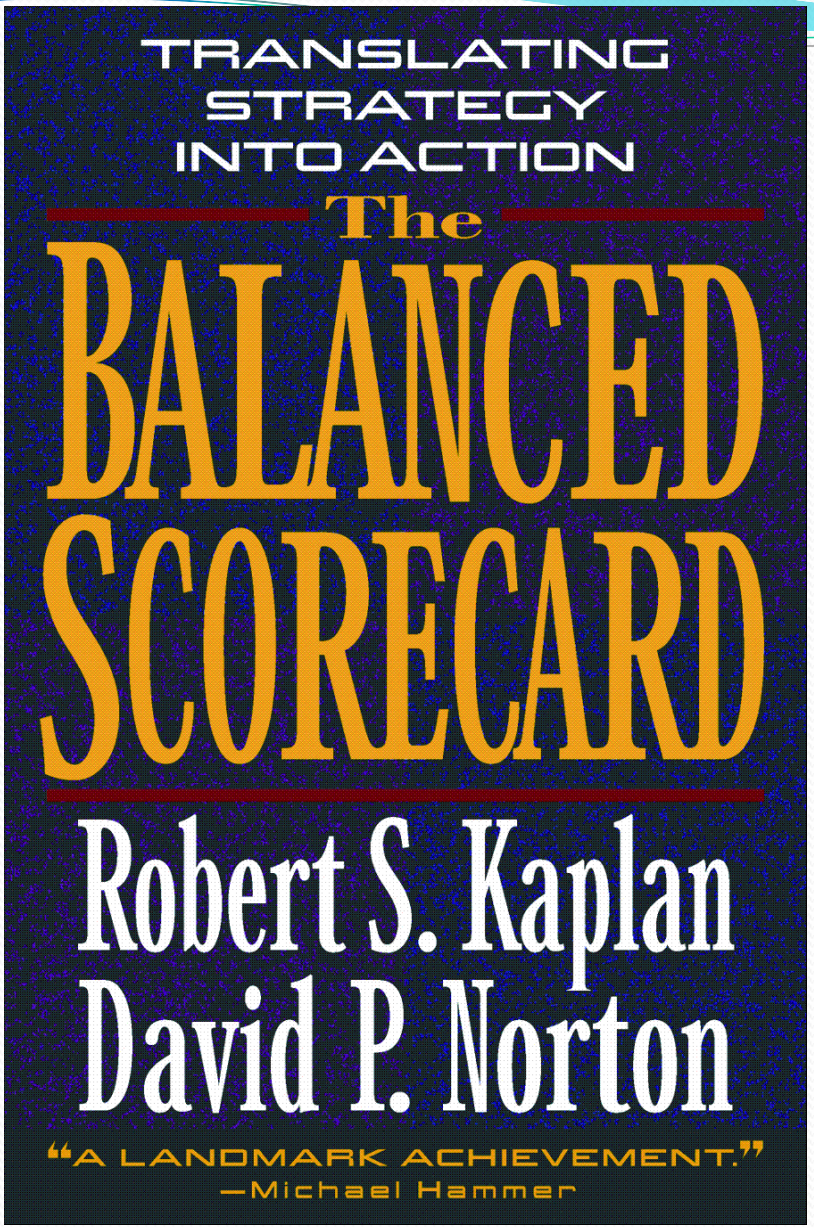
Source: 'The Discipline of Market Leaders' by Treacy & Wiersema

1. Other Business Strategy Models
"Box Inflation"

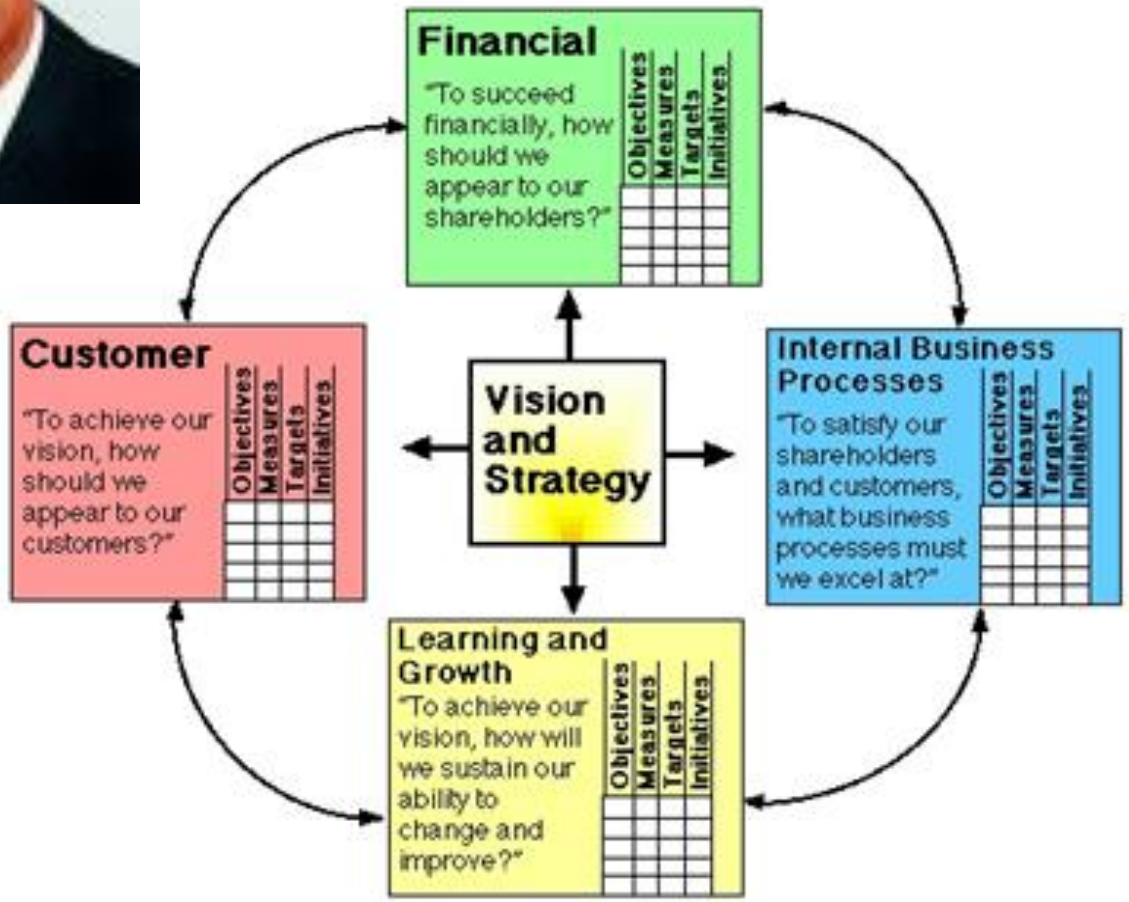
Boston Consulting Group Growth Share Matrix – "Boston Box" – 4 Box Model




Forward Integration
Related Diversification
Grow the current business
Unrelated Diversification
Backward Integration

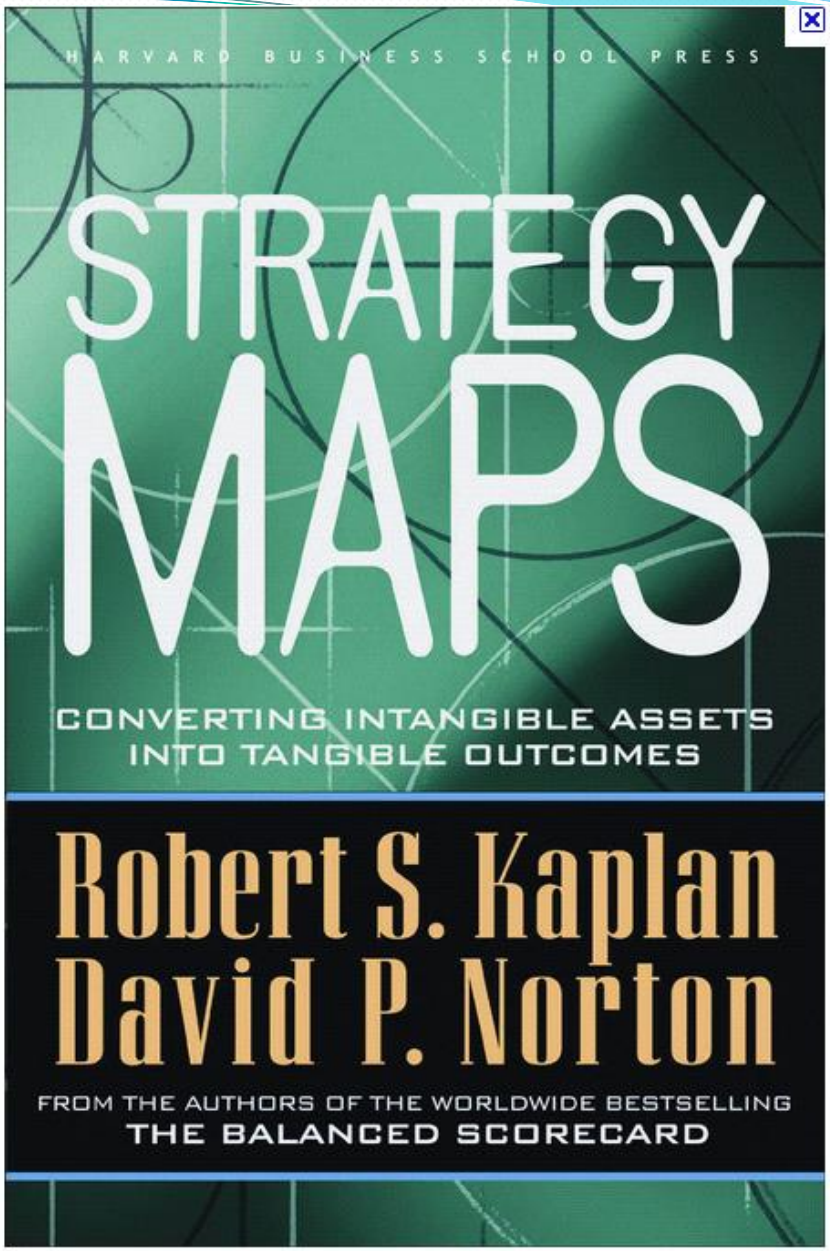

TRANSLATING
STRATEGY
INTO ACTION
The
BALANCED
SCORECARD
Robert S. Kaplan
David P. Norton
"A LANDMARK ACHIEVEMENT."
—Michael Hammer

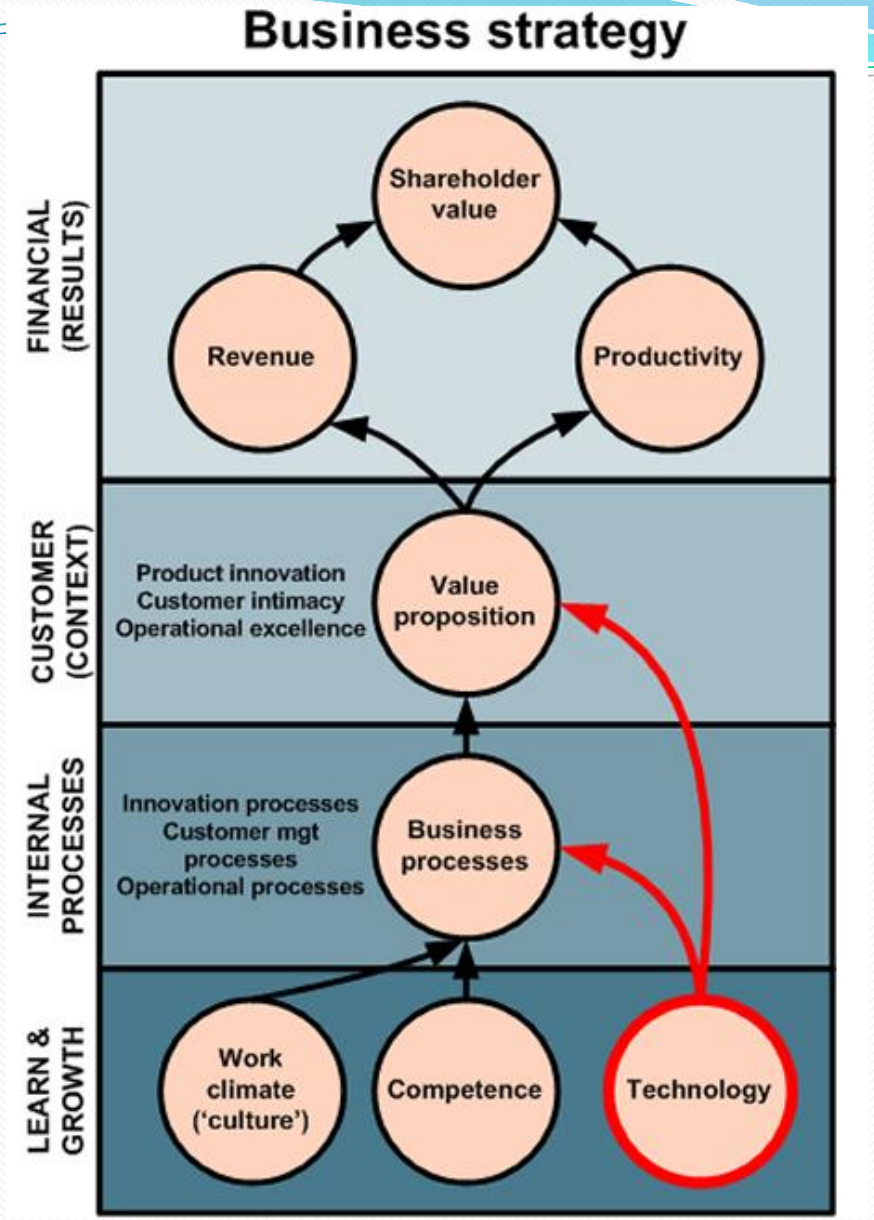




Adapted from Robert S. Kaplan and David P. Norton, "Using the Balanced Scorecard as a Strategic Management System," Harvard Business Review (January-February 1996): 76.


COMMUNITY
ACTIVELY SUPPORTING LOCAL COMMUNITIES
BUYING AND SELLING OUR PRODUCTS RESPONSIBLY
CARING FOR THE ENVIRONMENT
GIVING CUSTOMERS HEALTHY CHOICES
CREATING GOOD JOBS AND CAREERS
CUSTOMER
FINANCE
PEOPLE
OPERATIONS
Every little helps

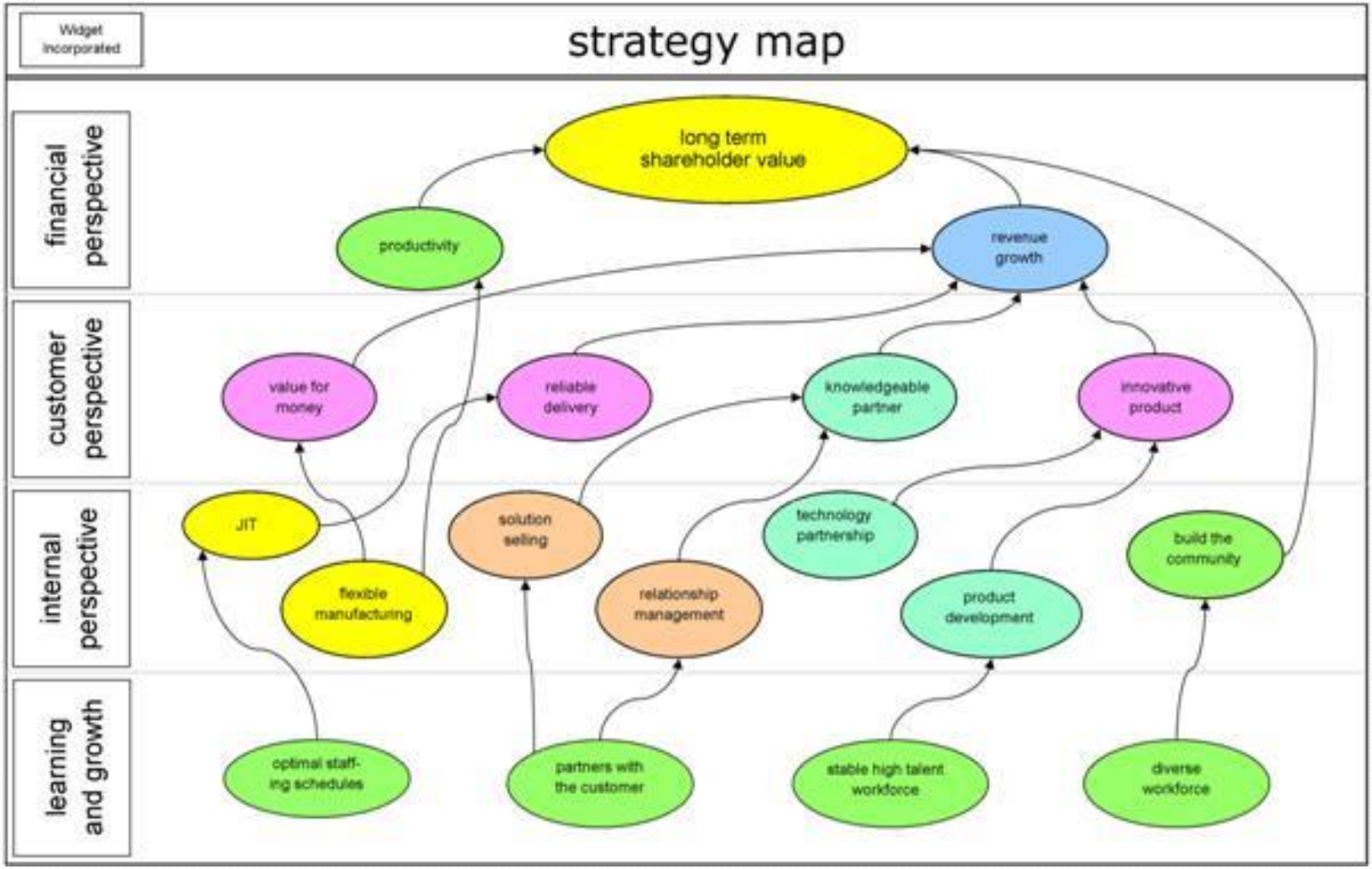

HARVARD BUSINESS SCHOOL PRESS
STRATEGY MAPS
CONVERTING INTANGIBLE ASSETS INTO TANGIBLE OUTCOMES
Robert S. Kaplan
David P. Norton
FROM THE AUTHORS OF THE WORLDWIDE BESTSELLING
THE BALANCED SCORECARD


Business strategy
FINANCIAL (RESULTS)
Shareholder value
Revenue
Productivity
CUSTOMER (CONTEXT)
Product innovation
Customer intimacy
Operational excellence
Value proposition
INTERNAL PROCESSES
Innovation processes
Customer mgt processes
Operational processes
Business processes
LEARN & GROWTH
Work climate ('culture')
Competence
Technology

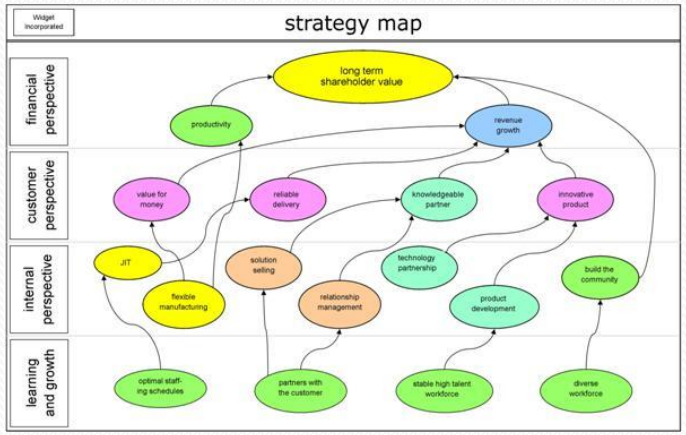
CAUSE & EFFECT Diagram

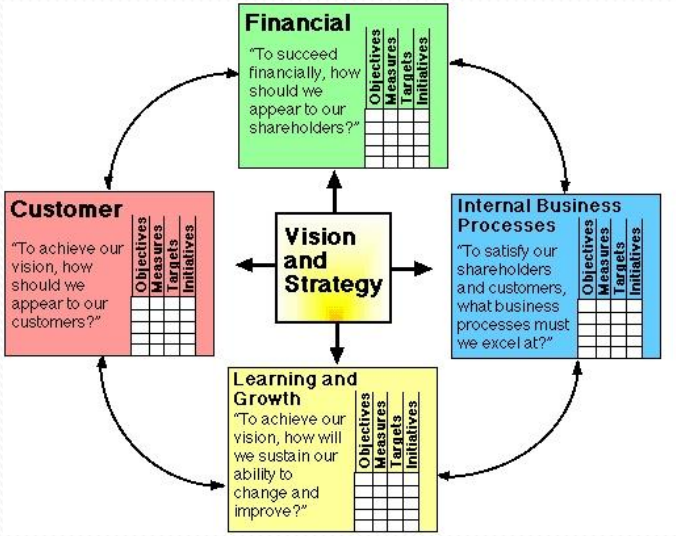
- What we need to deliver in one “perspective” to effect another “perspective” to deliver..
- Ultimate to deliver our corporate objectives – Shareholder Value?
- Underpinned by our values, driven by our mission and vision

The strategy map – a ‘picture’ of the strategy’



Managing the business using a BSC approach

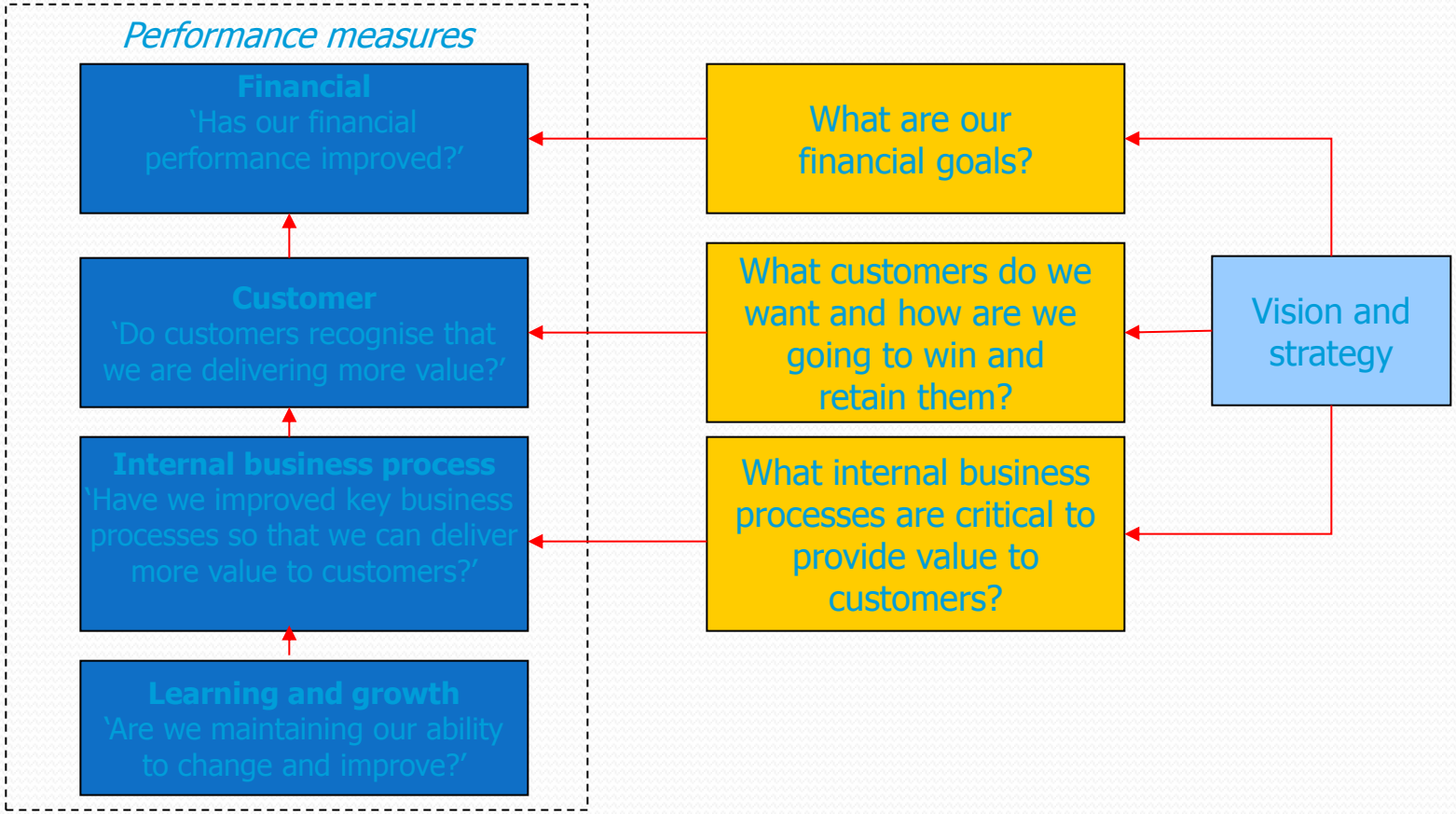




'Describe the strategy'

'Measure the strategy

Designing the Scorecard - from Strategy to Performance Measurement



Balanced Scorecard
Top 10 Implementation issues

1. No executive sponsorship
2. Lack of education and training
3. No strategy
4. No clear objectives for programme
5. Timing
6. Inconsistent management practices
7. No new measures – mainly focused on finance / process
8. Terminology
9. Lack of effective cascading
10. Poor understanding of cause and effect

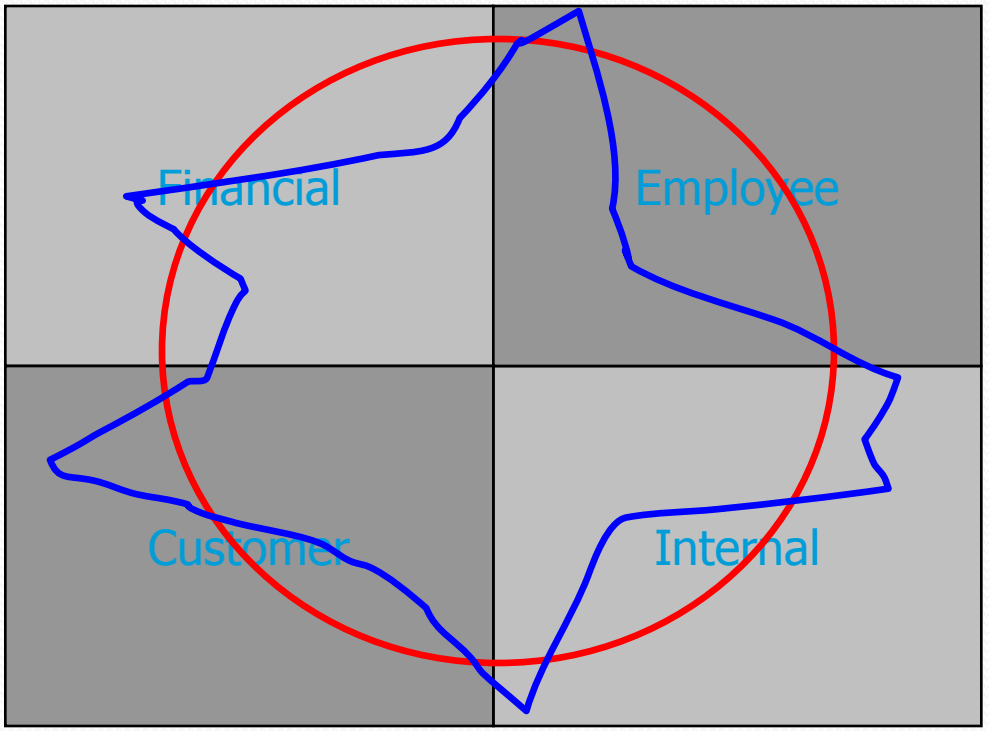
Balanced Scorecard – The Benefits

- Translating Strategy into Action
- Improved Resource Allocation
- Enhances Management Strategic Feedback & Learning
- Clear communication of Strategy may highlight divergent views on strategy
- Can result in a re-design / simplification of the Budget Process

Presentation
KPI wheel & RAG Status Traffic Lights

Actual

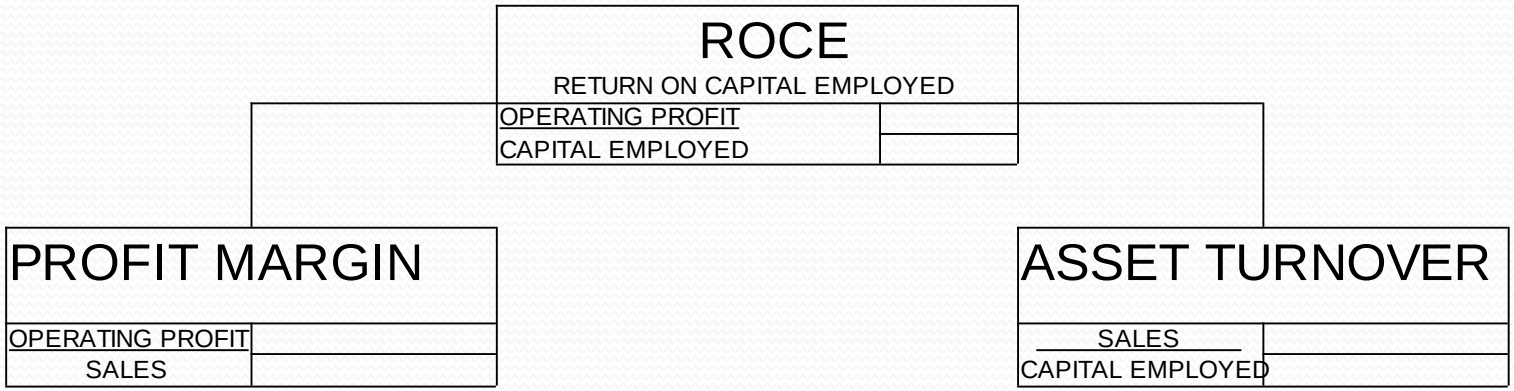
Target





Traditional View of Performance

A HIERARCHY OF FINANCIAL RATIOS - DUPONT ANALYSIS



CAPITAL EMPLOYED = FIXED ASSETS + WORKING CAPITAL

FIXED ASSETS
WORKING CAPITAL

EVA – Economic Value Added



NOPLAT – Capital Charge

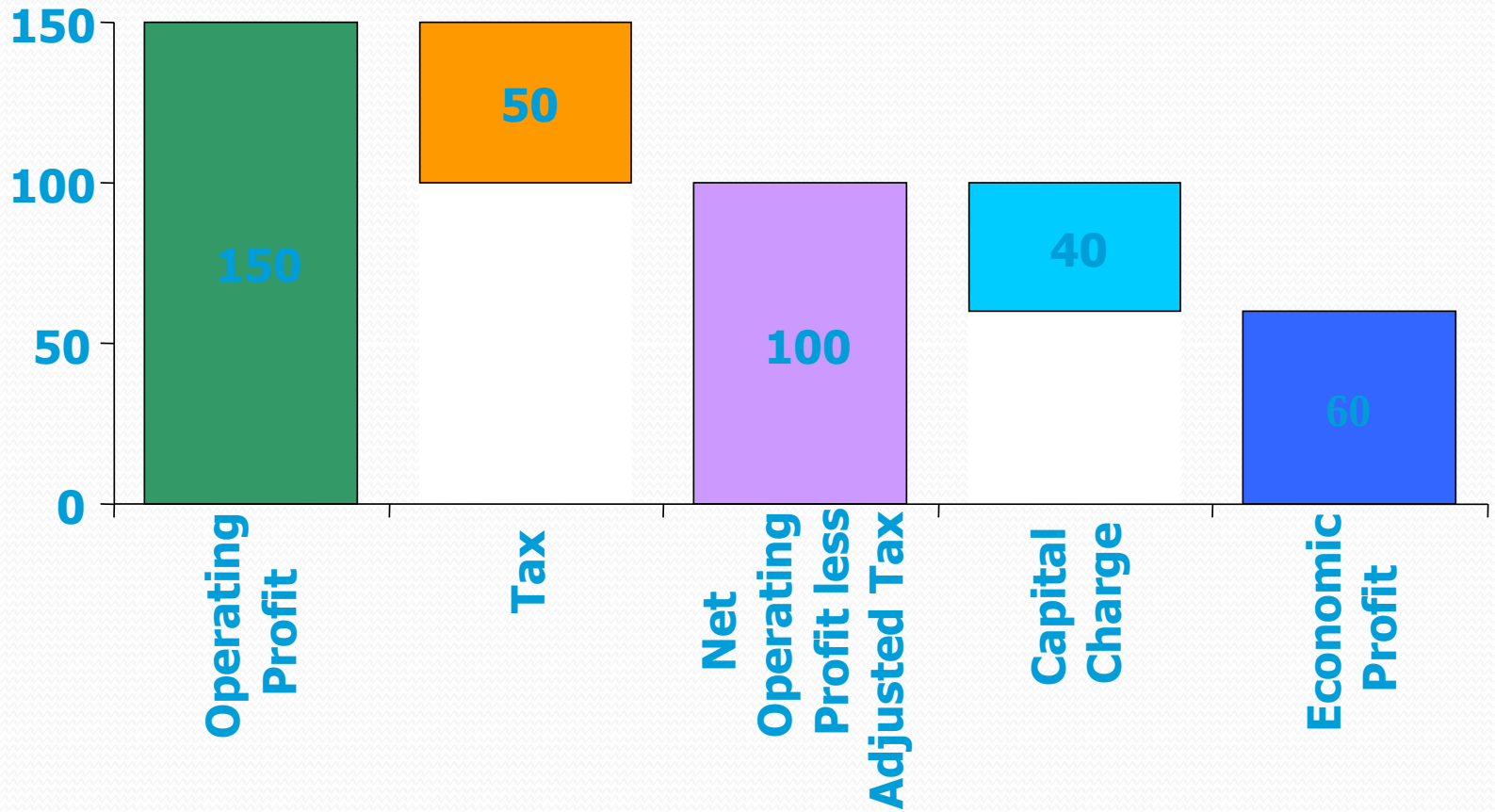
NOPLAT = Net Operating Profit After Tax (Calculated with adjustments)

System goes beyond measurement also includes rewards

Economic profit

- Re-branding of 'residual income'
- Surplus operating profit after tax & after deducting a charge for capital employed
- EVA® = EP with up to 164 adjustments (trademarked by Stern Stewart & Co.)
- Diageo & Siemens

Economic profit



Economic profit illustration: Royal Mail Holdings plc year ending March 2004

	£m
Operating profit	51
Tax on operating profit at 30%	(15)
NOPLAT	36
Capital Charge (£1,165m x 9.5%)	(111)
Economic Profit	(75)

Source: Shareholder Executive Annual Report 2004/5

Economic profit – the interpretation

- Although successful from an accounting profit perspective, the cost of using investors' funds is ignored by just focusing on operating profit
- Once the full cost of investors' funds is included (the capital charge) then we have a true indication of the underlying economic profit of an entity

Economic profit – the inputs

- Operating profit – excluding gains and losses arising from non-operating assets
- Capital charge, being:
  - Invested capital – being equity plus net debt, multiplied by…
  - Cost of capital – calculated using quoted comparables from relevant sectors

Economic profit insights – lessons from Diageo

Scotch Whisky	
Revenues	£100m
Costs	£50m
Invested capital	£400m
Cost of capital	10%

Vodka	
Revenues	£90m
Costs	£60m
Invested capital	£100m
Cost of capital	10%

Economic profit insights – lessons from Diageo

Scotch Whisky	
Operating profit	
Margin	
Economic profit	

Vodka	
Operating profit	
Margin	
Economic profit	

As a result of analysis like this, the business switched funds from lower value-added brands (whisky) to the higher ones (vodka) and diverted advertising expenditure accordingly

Cascading the measures

- The ultimate objective
- The stock market measure used at corporate level
- The internal short-term performance measure
- Generic financial value drivers
- Operational measures

- Maximise shareholder value
- Total Shareholder Returns (TSR)
- Economic profit
- Growth, margins, efficiency, cost of capital
- Financial and non-financial kpi's

Financial ratios	A	B	C	D	E
Performance					
ROCE	42.69%	18.96%	7.67%	8.96%	8.66%
Profit Margin	33.62%	5.07%	3.40%	15.32%	5.59%
Asset Turnover	1.27	3.74	2.26	0.58	1.55
Working Capital (expressed as 'days of sales')					
Stock	38	47	11	3	47
Trade Debtors	68	76	2	8	46
Trade Creditors	-14	-58	-29	-29	-41
(Finance from) / Invested in WC	93	66	-16	-17	52
Financial status					
Liquidity - Current ratio	1.51	1.74	0.41	0.59	1.43
Gearing - Debt / Equity	25.39%	47.51%	19.66%	84.85%	46.92%
Employee ratios					
Per employee (£000)					
Sales	228	316	106	45	101
Cost	54	31	13	14	31
Operating Profit	77	16	4	7	6
Employment costs to sales	24%	10%	12%	32%	31%

Stock market Ratios & Terms

1. EPS – Earnings Per share $\frac{\text{Profits Attributable to ordinary Shareholders}}{\text{Number of Ordinary Shares}}$

2. P/E ratio $\frac{\text{Share Market Price}}{\text{EPS}}$

3. Dividend Yield $\frac{\text{Dividend}}{\text{Share price}}$

4. Total Shareholder Return (TSR) $\frac{\text{Price Inncrease + Dividend}}{\text{Price (Start)}}$

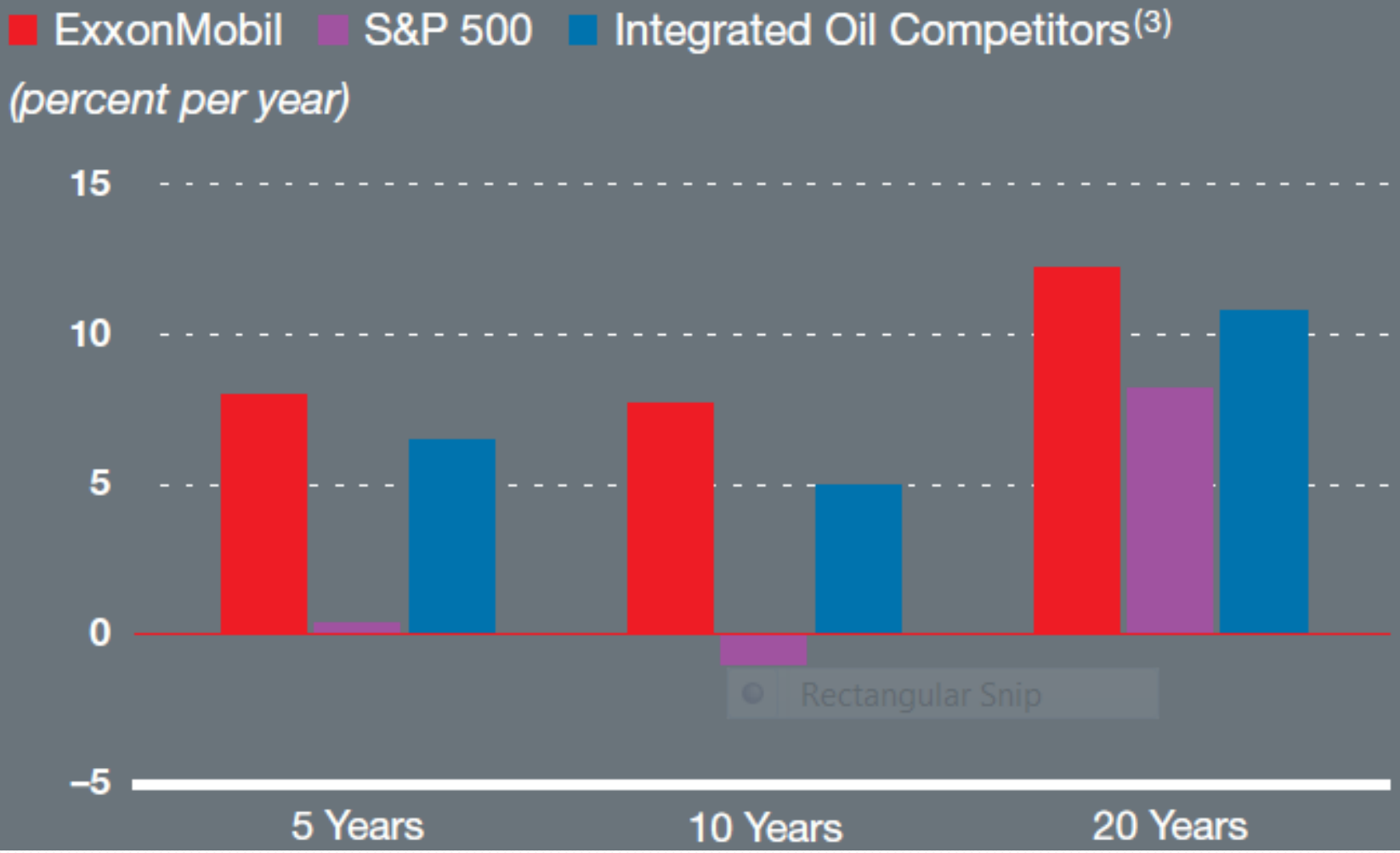
5. Market Capital = Market value (Share Price x Number of Shares)

6. Enterprise Value = market capitalization plus debt, minority interest and preferred shares, minus total cash and cash equivalents.

Share Prices & Ratios – Times Monday 7th January 2008

Company	Market Cap (£M)	Share Price	Yield %	P/E Ratio
Marks & Spencer	**8, 719.60**	**518**	**3.9**	**13.2**
Next	2,986.50	1464	3.5	10.0
Tesco	35,758.00	456	2.2	19.3
BP	118,736.0	627.5	3.3	11.7
GSK	70,287.10	1276	4.0	13.4
AstraZeneca	30,742.70	2110	4.2	12.4
Smith & Nephew	5,167.30	577	1.0	14.4
BSkyB	10,150.10	576.5	2.7	20.3
ITV	3,037.40	78	4.0	14.2

Total Shareholder Returns[2]



Top Tip

- Strive for more relative measures rather than internally focused measures
- Focus on Customers and Customer Value to Deliver Shareholder or Stakeholder Value
- "Beat the Competition" not the internal measure

- How do these ideas apply to you? / What can you do now?

Cost control and reduction

Cost behaviour and modelling

Cost Models for Management Decision Making

Activity Based Cost management

"Lean" and Cost management

Managing and costing constraints - what holds back your organisation? What do these constraints cost you and how could they be overcome?

Mini Case Study / Exercise – The Nature of Costs

Exercise / Toolbox 3 – Reducing Complexity and Variety to reduce needless cost

Understanding & working with costs

Cost	v	Value
Relevant	v	Irrelevant
Controllable	v	Uncontrollable
Capital	v	Revenue
Planned	v	Unplanned
Essential	v	Discretionary
Direct	v	Indirect/overhead
Fixed	v	Variable

Standard Cost

Opportunity Costs (Cost of Lost Opportunity)

Sunk Costs (Irrecoverable Costs)

Failure Costs (Cost of errors)

Activity Costs (Costing Complexity & Variety)

Activity Analysis (*Time is money* – What are our people spending our time or cost on? Is it the best use of their time?)

Resource costing and comparison

Benchmarking

Resource Substitution

Resource Sharing – Strategic Alliances

Value Based Pricing v Cost Plus Based Pricing

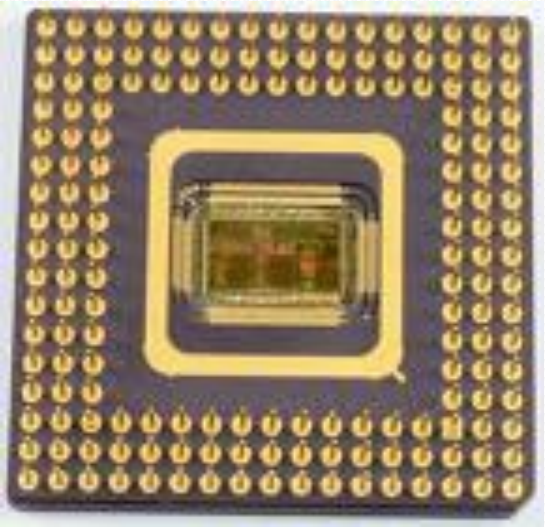
Cost Based	Value Based
Internal Focus	Customer / Market Focus
Inputs	Results
	Target Costing?

Price, Cost & Value

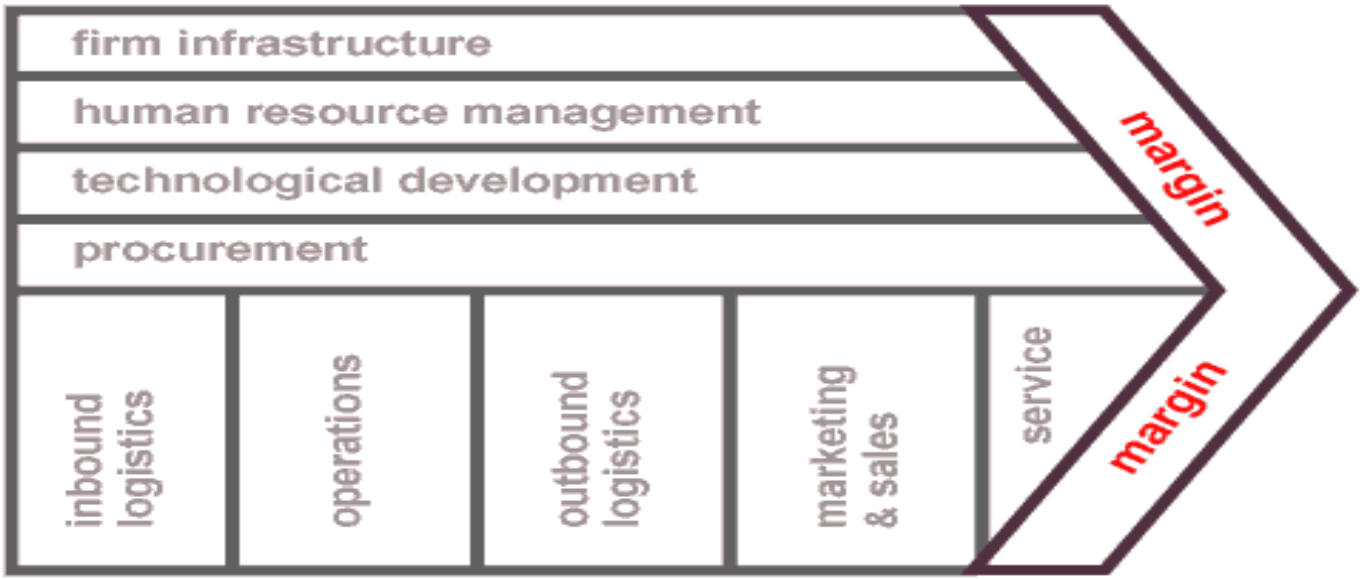
Coffee & Chips

- Cost is not Value
- Price can be used to gauge value
- Pricing can influence perceived “Value”





Value Chain – Michael Porter



Value Analysis / Engineering

Taking out cost without destroying value.

"Discovered" by GE in WWII – when searching for substitute materials



The purpose of planning and budgeting in business

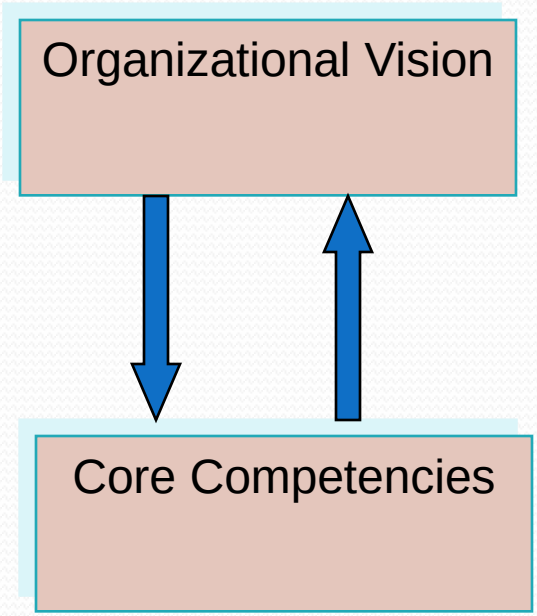
Q1: Organizational Vision and Core Competencies

- The organizational vision is the core purpose and ideology of the organization.

- Determining the organizational vision precedes all other management decision making.

- Management must also isolate the organization's core competencies – its strengths relative to competitors.

Q1: Organizational Vision and Core Competencies



The organizational vision and the core competencies are closely related.

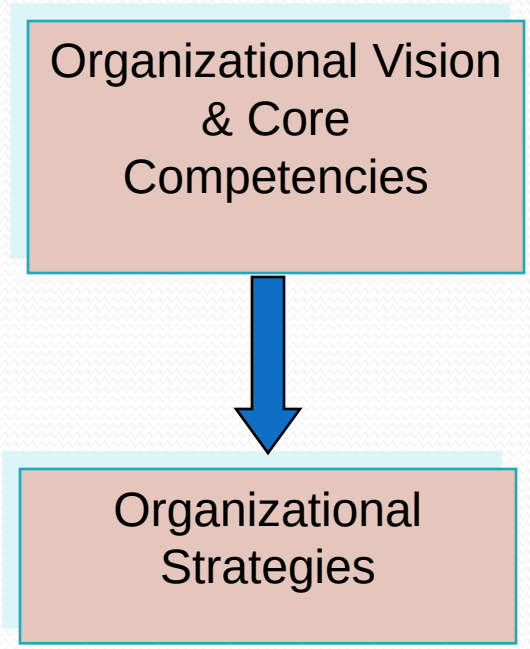
The organization's strengths should help shape the vision.

The vision should help locate the organization's strengths.

If you were starting an accounting practice, what would be your organizational vision?

What do you think would be your core competencies?

Q1: Organizational Strategies



Organizational strategies are the tactics that managers use to work toward the organizational vision while taking advantage of the core competencies.

These strategies are long-term in nature.

Examples include organization structure, financial structure, and long-term resource allocation strategies.

If you were starting an accounting practice, what would be some of your organizational strategies?

How do these work toward your organizational vision?

How do they take advantage of your core competencies?

Q1: Operating Plans



Operating plans are the short-term implementations of the organizational strategies.

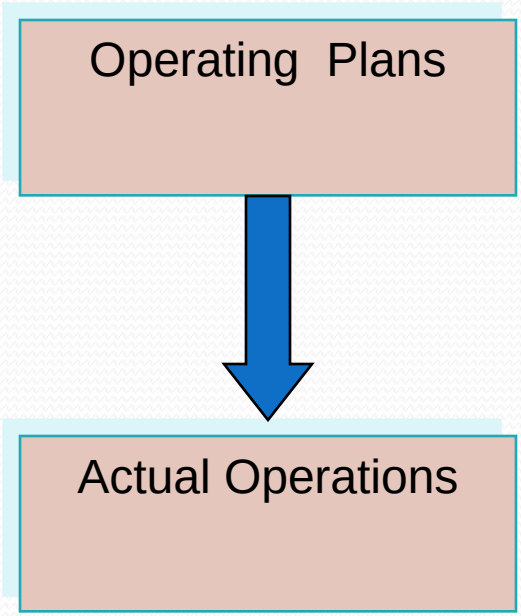
Operating plans usually include budgeted goals for revenues and expenses.

Examples include schedules for employees and procedures for daily relationship management decisions with suppliers.

If you were starting an accounting practice, what would be some of your operating plans?

How do these relate to your organizational strategies?

Q1: Actual Operations



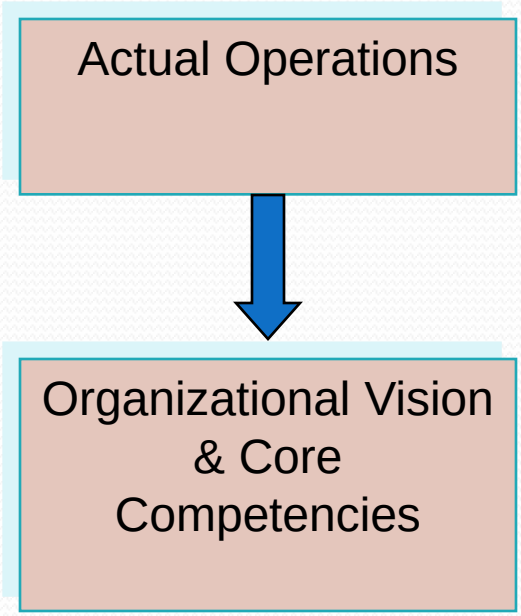
Actual operations are the actions taken and the results achieved.

The organization's information system measures the results of actual operations.

Examples include number of units sold, advertising expense, and the wage expense for the period.

If you had an accounting practice, what information would you want to collect about the results of your actual operations?

Q1: Monitoring and Motivating Performance



Managers use the results of actual operations to monitor performance and ensure that it is in line with the organizational vision.

Managers may find that the results of actual operations make them re-think the organizational vision or their view of the organization's core competencies.

If you had an accounting practice, can you think of an example of a measure of actual operations and how you would use it to motivate performance?

Can you think of an example of a measure of actual operations that might make you redefine your organizational vision or your view of your core competencies?

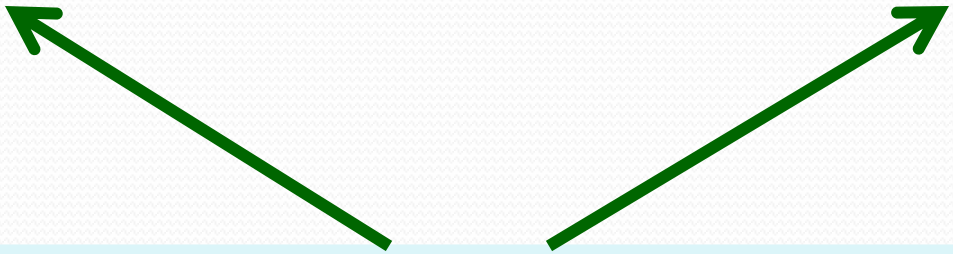
Q2: Management Control Systems

- Belief Systems
  - Vision, Mission, Core Values Statements
- Boundary Systems
  - Code of Conduct, Procedure Manuals, Compliance Actions
- Diagnostic Control Systems
  - Measure, monitor, and motivate employees against preset goals
- Interactive Control Systems
  - Recurring information and reports to evaluate performance and direct actions

Q3: Financial, Managerial, and Cost Accounting

Financial accounting prepares reports most frequently used by decision makers external to the organization.

Managerial accounting prepares reports most frequently used by decision makers internal to the organization.



Cost accounting includes both financial and nonfinancial information and is used for both financial and managerial accounting.

Defining the strategic approach to business planning

Q3: Strategic Cost Management

- Strategic cost management is an approach to reducing costs while strengthening the organization's strategic position.
- The balanced scorecard can be used to formalize strategic cost management efforts by detailing financial and nonfinancial benchmarks for all segments of the organization.
- Examples of such benchmarks include:
  - Personnel can reduce costs by completing all hiring within 20 days of initial interview.
  - Production can reduce costs and improve quality if Engineering can reduce the number of processes in the production process.

Q4: What Information is Relevantfor Decision Making?

- Information is relevant if:
  - *Differs* across the alternatives, and
  - Is about the *future*.
- Relevant information can be quantitative or qualitative
- Information is irrelevant if:
  - *Does not vary* with the option chosen or action taken

Irrelevant information is NOT useful in decision making!

- Relevant cash flows are future cash flows that differ across the alternatives.
  - also called incremental cash flows
  - also called avoidable cash flows
- Irrelevant cash flows are:
  - non-incremental and unavoidable cash flows
  - do not vary among alternatives
- Must look at the cash flow relevance to the decision being made
  - Electricity costs *are relevant* to the decision to open a business or not
  - Electricity costs *are not relevant* in the decision to lease or buy a building for your business

Q4: What Information is Relevant for Decision Making?

You have a small computer repair company and are deciding whether to replace your old copy machine or repair it. In the list of information below, identify which data are relevant to this decision and which are irrelevant.

- The purchase price of the copy machine was $1200.
- The repair costs are $320.
- The copy machine can make 20 copies per minute.
- If you repair it, the machine will use less toner than it does now.
- You make approximately 1000 copies per month.
- The repair won't fix the broken stapler.
- The repair carries a one-year warranty.
- The copy machine was a gift from your spouse.

Q4: Relevance of Income Statement Information

- Income Statements include:
  - Period costs
  - Product costs (recorded as cost of goods sold)
- Many business decisions require the incremental cost to produce a unit
- Cost per unit on the income statement includes both fixed and variable costs
- Including fixed costs does not represent the true incremental cost of a unit

Defining strategic assumptions

Assumptions

- Like all assumptions they need to be reasonable and tested.
- Risk management assists in this area.

Q5: Impact of Business Risk on Decision Making

- Business Risk is the possibility an event will occur and interfere with the organization's strategic goals



- The existence of business risk can cloud management's decision making process

Q6: Uncertainties, Biases, and Decision Quality

- Uncertainties are issues and information about which there is doubt.
- Biases are preconceived notions adopted without careful thought.
- Decision quality refers to the characteristics of a decision that affect the likelihood of achieving a positive outcome.
- Both uncertainty and bias reduce decision quality.

Q6: Uncertainties and Biases in Information

- Uncertainties come from many sources and can be exogenous or endogenous.
  - The future is always uncertain.
  - Managers may be uncertain that the right information was captured in a report.

- Biases can come from many sources.
  - The decision maker may be biased towards or against a particular alternative (predisposition bias)
  - The methods used to collect information could have introduced bias (information bias)
  - The decision maker may exercise an error in judgment or processing information (cognitive bias)

Q6: Motorola's Iridium Project

- How did uncertainties and bias effect Motorola's decision making process?

Q6: Uncertainties, Biases, and Decision Quality

Lori loves to sew and has always made her own clothes. People often tell her that she is the best-dressed person they've ever met. She can design and sew a lovely outfit in under 2 days. She is considering opening a store that could sell her home-made fashions. Then she could combine her work with her hobby.

Can you identify some of the uncertainties Lori faces? Can you think of any way she can reduce some of these uncertainties?

Can you identify any possible personal biases that Lori may have? How could these affect her decision making process?

Building the strategic planning model using financial data

Building The Model

- Building the model can be done once all the data has been collected and assumptions made.
- The model has to start with the Vision, Mission and Objectives of the organisation.

Various strategic and tactical approaches to business planning

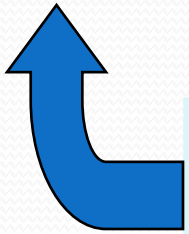
Approaches

- There are many ways to skin a cat as they say.
- The approaches taken will be affected by the culture of the organisation and the style of management.

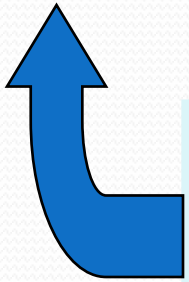
Defining the Decision-Support model: Assumptions/Goals and Key Success Factors

Q7: Characteristics of Higher-Quality Decisions

Higher quality decisions come from a higher quality decision making process. Such a process is thorough, unbiased, focused, strategic, creative, and visionary.

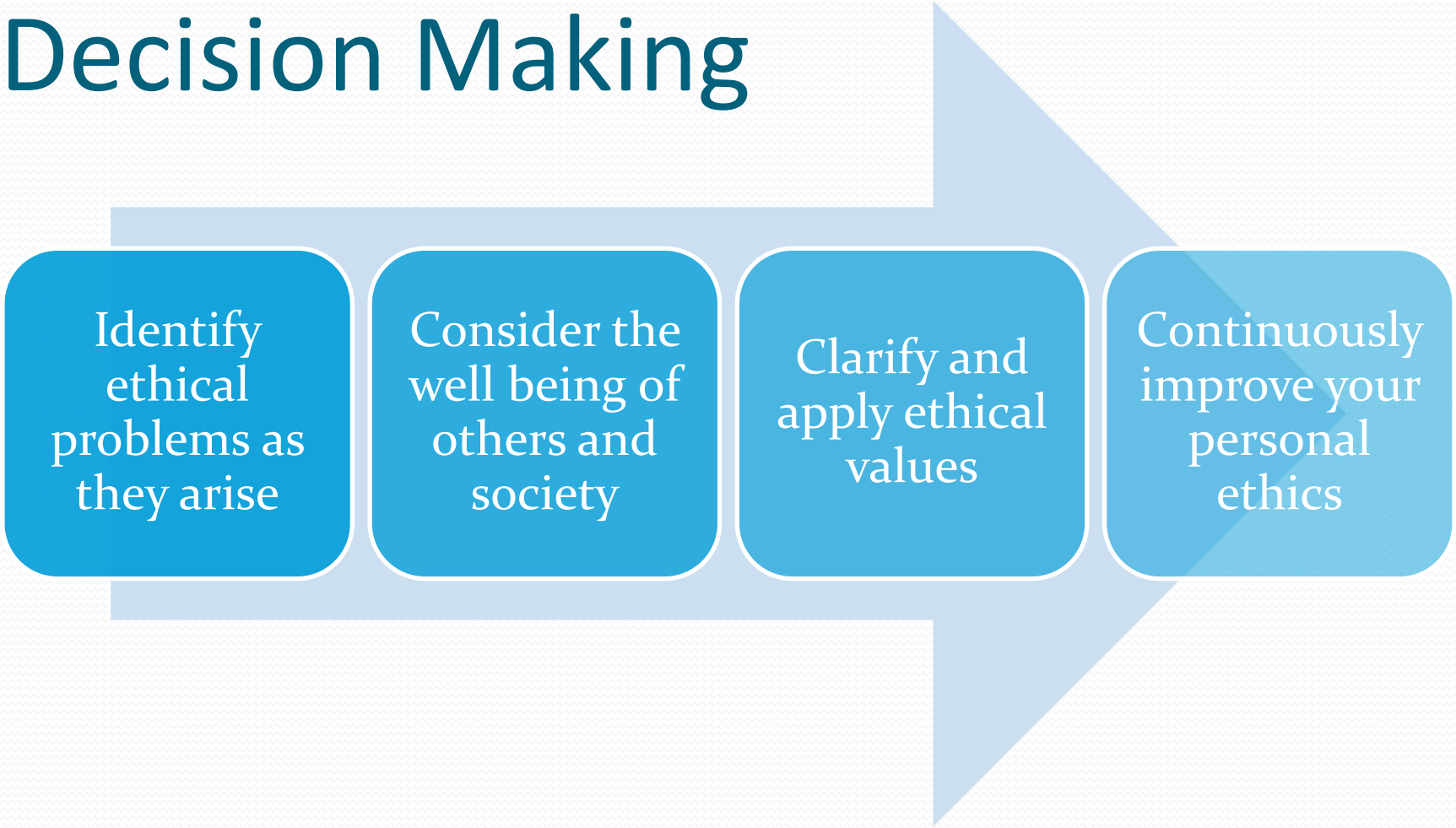


This process requires reports that are relevant, understandable, and available.



These reports must contain information that is more certain, complete, relevant, timely and valuable.

Q8: Components of Ethical Decision Making



- The Institute of Management Accountants (IMA) has a Code of Ethics that states that IMA members have a responsibility to:
  - maintain an appropriate level of professional competence and perform their professional duties in accordance with laws, regulations, and standards;
  - refrain from disclosing confidential information (unless legally obligated), or using (or even appearing to use) confidential information to illegal advantage;
  - avoid actual and apparent conflicts of interest; and
  - communicate information fairly and objectively, and disclose all relevant information to decision makers.

Q8: Ethical Decision Making

Suppose you work for the Lee K. Fawcett Plumbing Company as Mr. Fawcett's administrative assistant. Recently Mr. Fawcett asked you to type some financial statements from his hand-written notes so that he can take them to the bank as part of a loan application.

This exercise seems odd to you because the company's CPA recently delivered the monthly financial statements that she prepares.

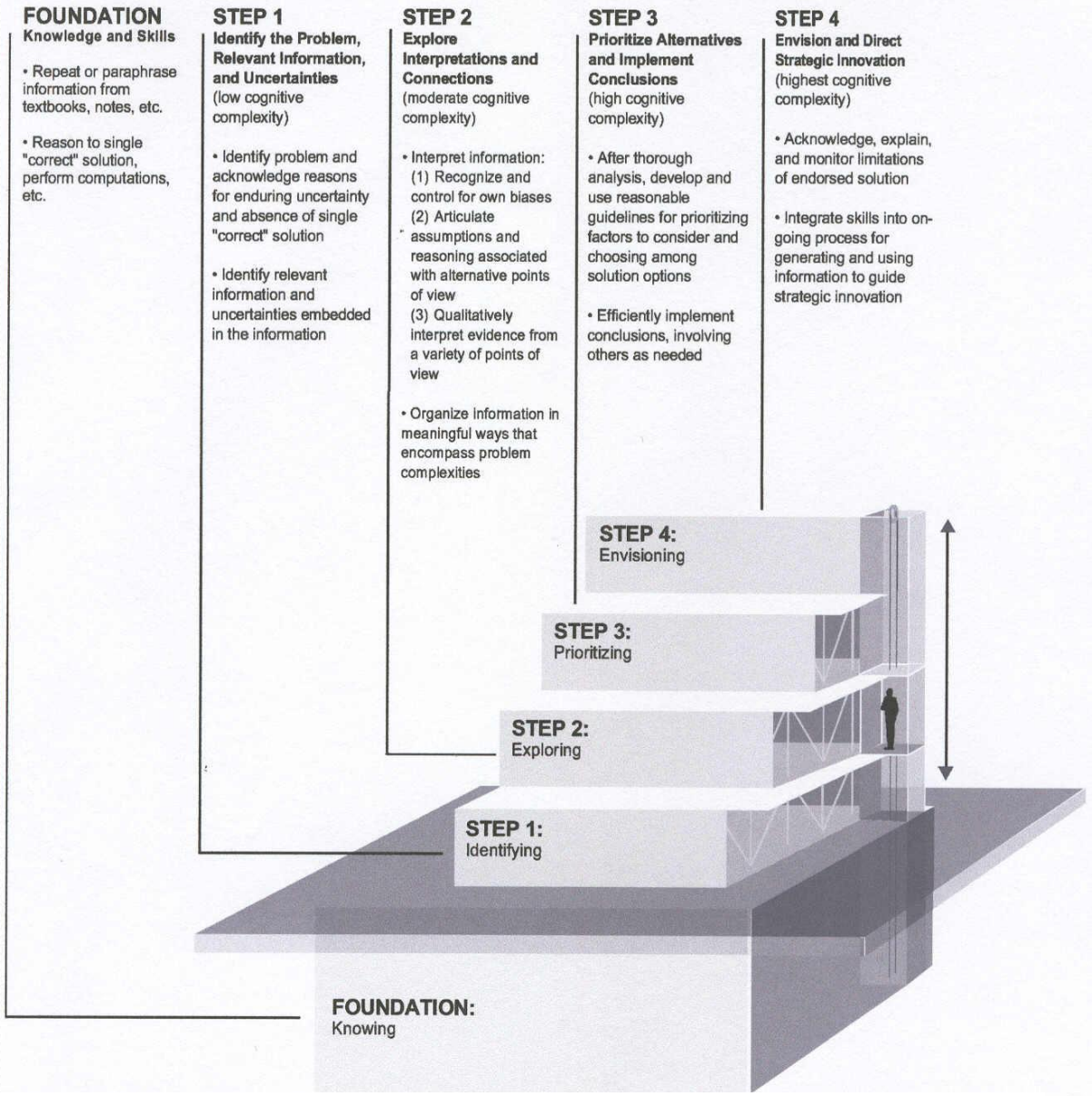
While typing the financial statements you notice that the building the company rents is listed as an asset. Also, you write checks each month for the monthly payments on two car loans, and these are not listed as liabilities.

Do you have an ethical dilemma? Discuss your approach to handling this situation.

Steps for Better Thinking

Steps for Better Thinking is a process to help address open-ended questions.

Open-ended questions have no single correct solution; managers must seek the *best* solution.



Source: (c) 2002. C. L. Lynch, S. K. Wolcott, and G. E. Huber, "Steps for Better Thinking: A Developmental Problem-Solving Process" (August 5, 2002).

Steps for Better Thinking – Foundation (Knowing)

- Foundation level skills include a knowledge of the terminology and basic concepts that are relevant to the decision at hand.
- An individual with Foundation level skills can:
  - perform calculations to arrive at correct answer
  - define terms in his/her own words
  - describe a concept
  - list the elements contained in a concept or process

Steps for Better Thinking - Identifying

- Step 1 skills include the ability to identify relevant information and uncertainties.

- An individual with Step 1 skills can:
  - create a list of issues related to the decision
  - sort information that is relevant
  - identify the reasons for the underlying uncertainties
  - perform research to obtain input into the decision

Steps for Better Thinking - Exploring

- Step 2 skills include the ability to explore interpretations of the information and connections between alternative solutions approaches.
- An individual with Step 2 skills can:
  - recognize and control for his/her own biases
  - articulate assumptions and reasoning associated with alternative points of view
  - organize information in meaningful ways to encompass problem complexities
  - compare and contrast different approaches to a problem's solutions

Steps for Better Thinking - Prioritizing

- Step 3 skills include the ability to prioritize alternatives, come to a decision, and implement the decision.
- An individual with Step 3 skills can:
  - develop guidelines for prioritizing alternatives
  - prioritize alternatives after objective analysis
  - communicate findings in a manner appropriate to the audience
  - describe how the solution or decision might change if priorities change

Steps for Better Thinking - Envisioning

- Step 4 skills include the ability to monitor the decision and innovate new strategies to modify the decision when circumstances change.
- An individual with Step 4 skills can:
  - explain the limitations of the decision made
  - establish a plan for monitoring the performance of the decision
  - explain how conditions may change in the future and how this may change the decision

DAY 2

Analysing the Historical Data Using Excel®

- Recognizing the Basic Patterns Inherent in Historical Data
- Using the Exploratory Data Analysis Tools Available in Excel®
- Development of Time Series Models using histograms, moving averages, exponential smoothing and regression analysis
- Using Regression Analysis as a predictor and estimator
- Mastering the use of Exponential Smoothing as a Data Analysis tool
- Single Regression vs. Multiple Regression
- Validation of Time Series Analysis

Recognizing the Basic Patterns Inherent in Historical Data

Recognizing the Basic Patterns Inherent in Historical Data

- Historic data has to be collected so that patterns can be established.
- There are a number of tools that can be used for this process.

Using the Exploratory Data Analysis Tools Available in Excel®

Using the Exploratory Data Analysis Tools Available in Excel®

- Excel exercises and examples

Development of Time Series Models using histograms, moving averages, exponential smoothing and regression analysis

Development of Time Series Models using histograms, moving averages, exponential smoothing and regression analysis

- It takes time to develop the models.
- These following tools help to establish the forecast patterns.

Financial Forecasting and Planning

Break-even, Costing and Pricing, Cashflow, Balance Sheet

Contents

- Financial Forecasting and Planning
- Objectives
- Break-even analysis
- Costing and pricing
  - Costs
  - Price
  - Pricing Strategies
- Financial Forecasts
  - Three Steps to Forecasting
- Preparing Cashflow Forecast
- Balance Sheet
- Sensitivity Analysis
- Welcome to the Shell LiveWIRE Business Library

Financial Forecasting and Planning

Preparing forecasts will help you to assess your likely sales income, costs, external financing needs and profitability. Financial forecasts are essential if you need to raise money from a third party, such as a bank.

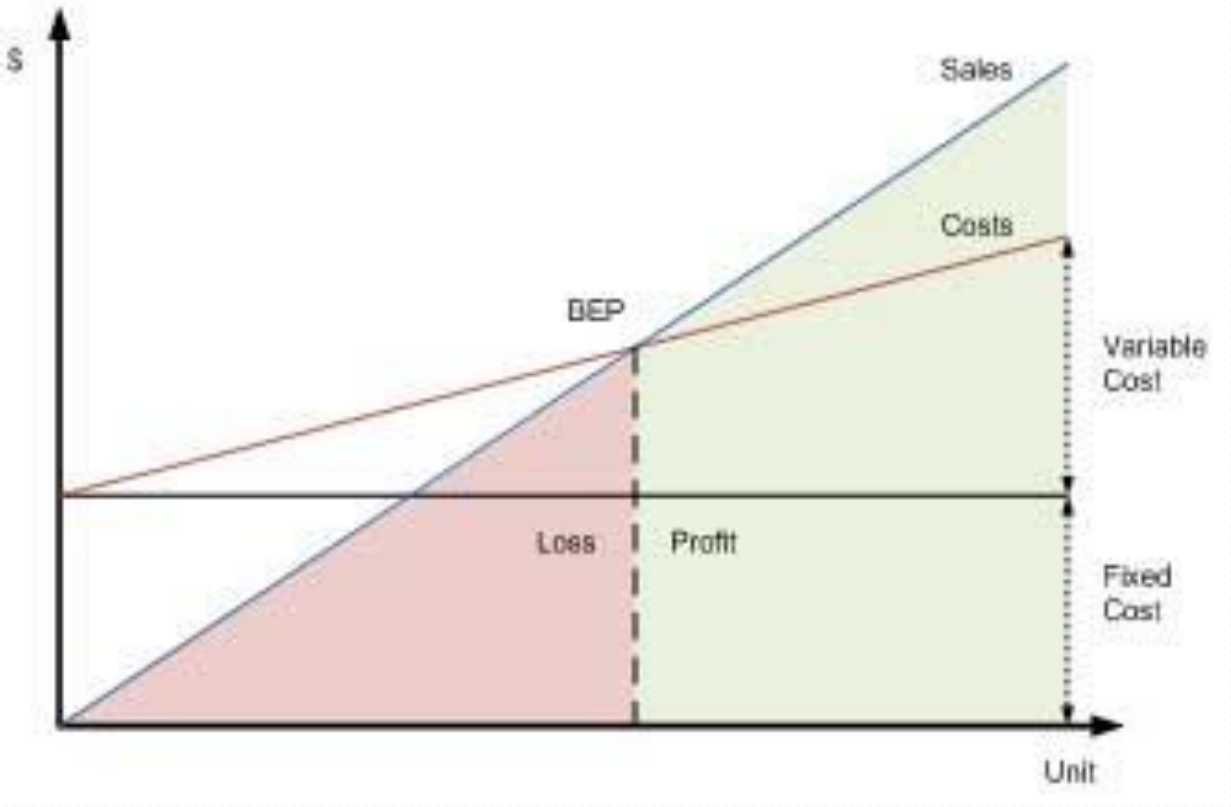
But they also provide you with the means to monitor performance on, say, a monthly basis and thereby exercise effective financial control - arguably the second most important management function in running a business.

Objectives

The aim of this presentation is to help you to prepare financial forecasts. It will enable you to:

- understand costing and pricing;
- use break-even analysis as a way of setting sales targets;
- understand financial forecasting; and,
- assess working capital requirements.

Break-even analysis



- Calculating Break Even Analysis with MS Excel Template
- Templates

Break-even analysis

Break-even analysis identifies the point at which your business starts to make a profit. You can work out the break-even point using any timescale, e.g. weekly, monthly, yearly, etc.

To calculate the break-even point you need to know the following:

- the total fixed costs of your business - these include rent and rates, your drawings, loan repayments, etc;
- the total variable costs for producing your product - these include labour, materials and packaging; and
- the selling price of your product.

Break-even analysis

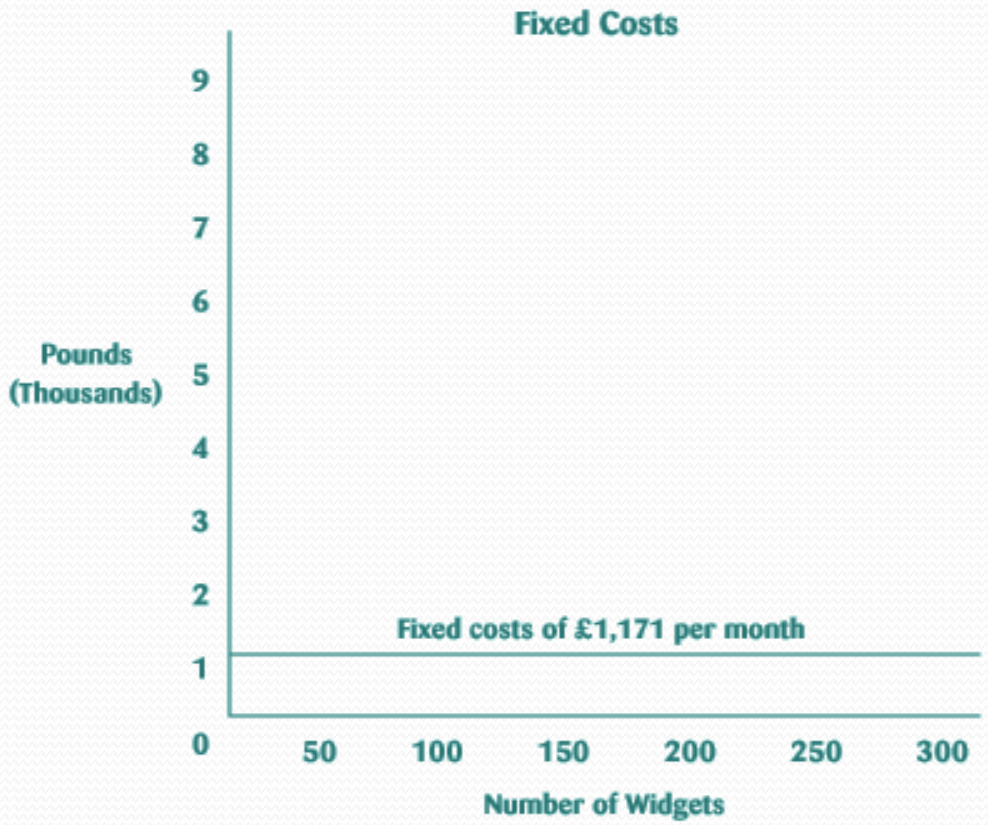
Once you have these figures, you can work out your break-even point using four simple calculations and plotting the findings on a graph.

Example
Ron from Widgets 'R' Us wants to work out how many widgets he needs to sell in order to break-even every month. He works his fixed costs out as follows:

- Rent - £167 per month
- Salary - £834 per month
- Rates - £70 per month
- Loan repayment - £100 per month
- Total - £1,171

Break-even analysis

This figure can be plotted as follows:

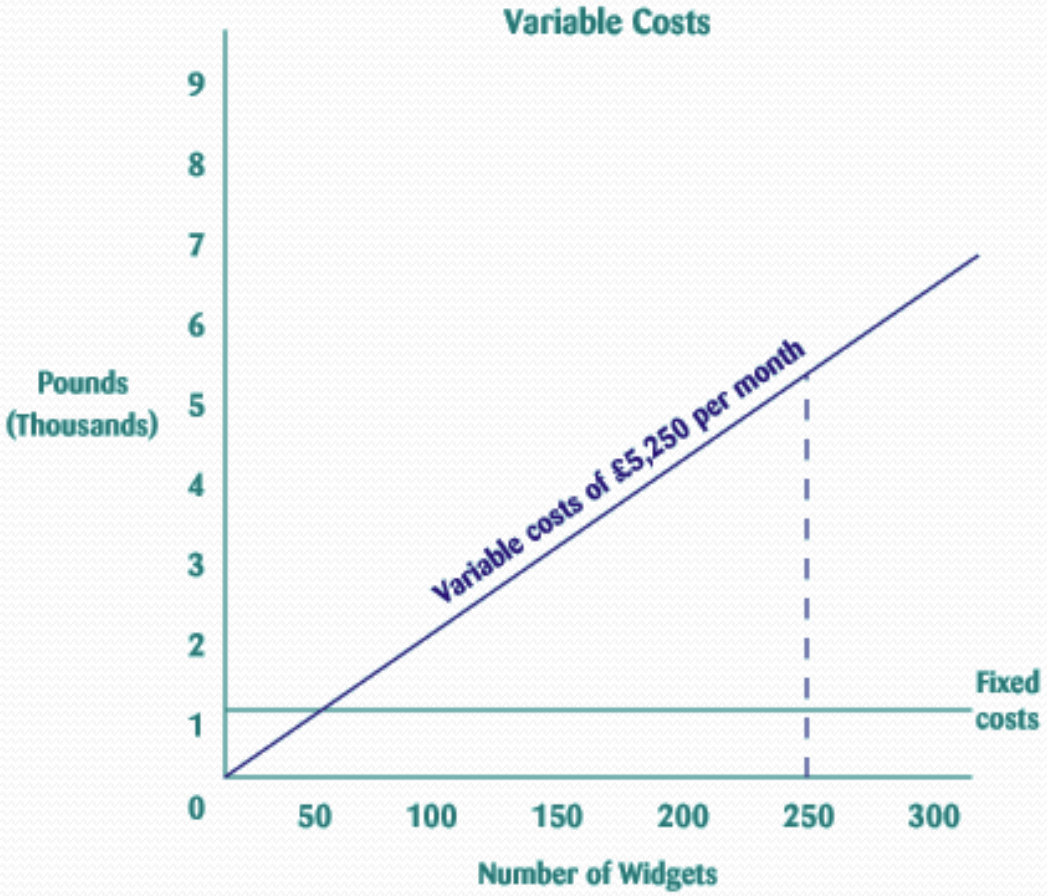


Ron then works out his variable costs for the production of each widget:

Materials - £9.00
Packaging - £1.00
Labour - £11.00
Total cost - £21.00 per widget

Break-even analysis

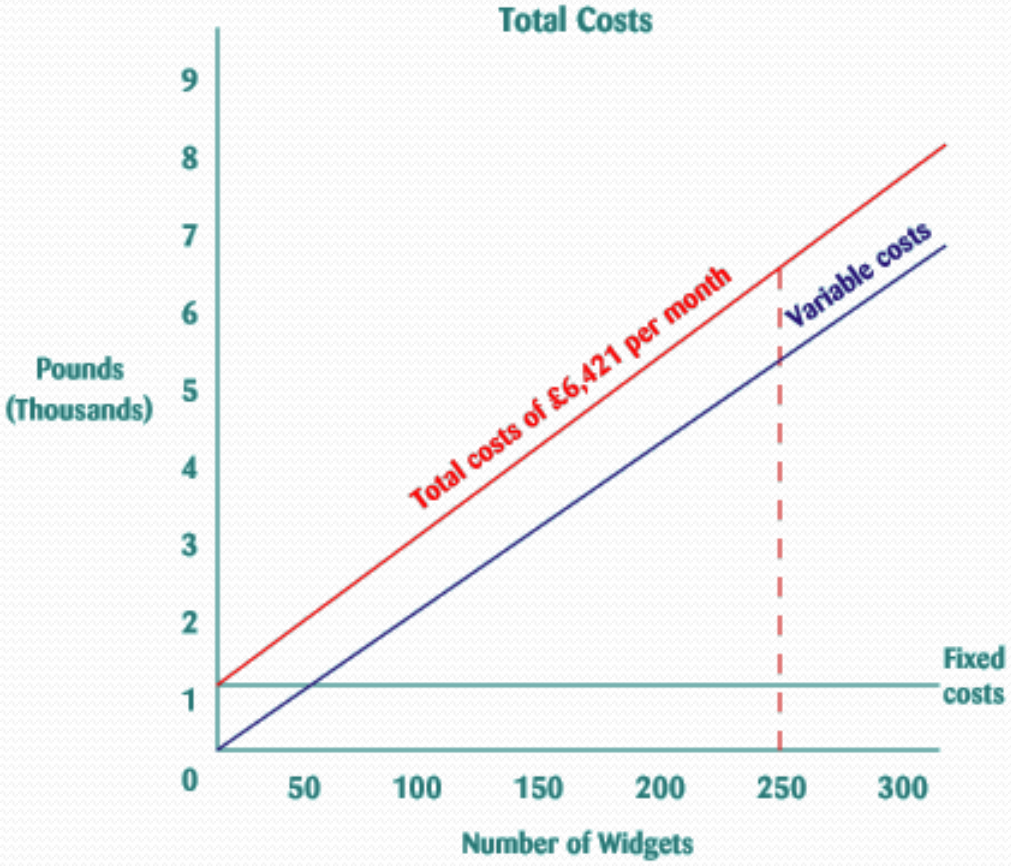
Ron plots this figure on the graph and draws a straight line from it to zero.



He selects a value on the 'number of widgets' axis (in this case, 250) and does the following calculation:

250 widgets x £21.00 per widget = £5,250

Break-even analysis

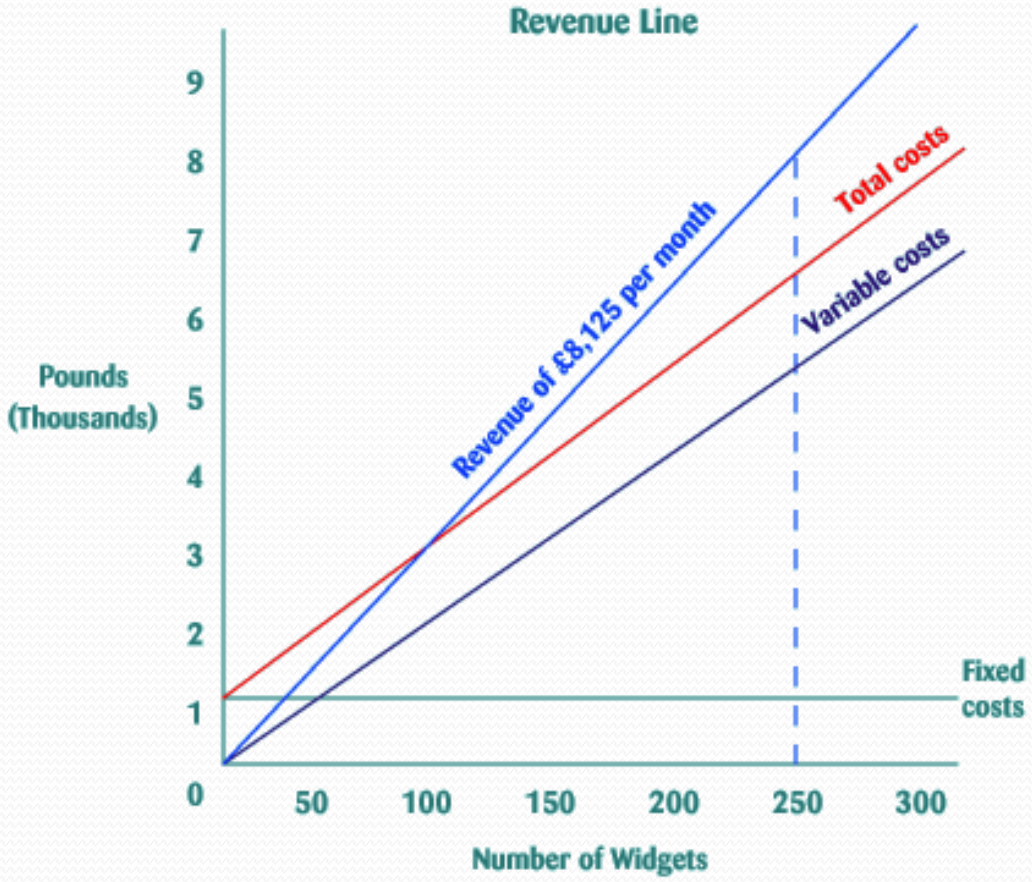


The next step is for Ron to work out his total costs. To do this, he adds his fixed costs to his variable costs:

£1,171 + £5,250 = £6,421

He plots this figure on the graph and draws a straight line from it to £1,171 on the 'Pounds' axis.

Break-even analysis

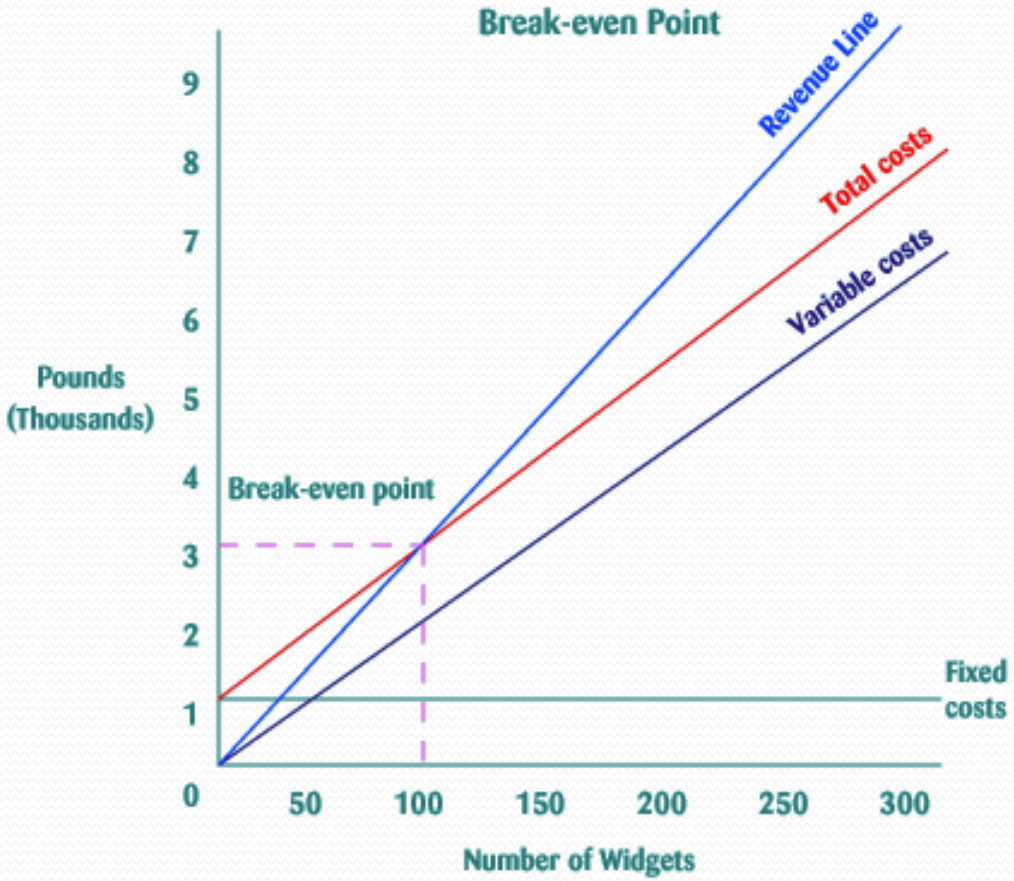


Ron now needs to work out his revenue line. To do this, he simply multiplies his products' selling price by the example number of widgets he chose earlier (250):

£32.50 x 250 = £8,125

He then plots this figure on the graph and draws a straight line from it to zero.

Break-even analysis



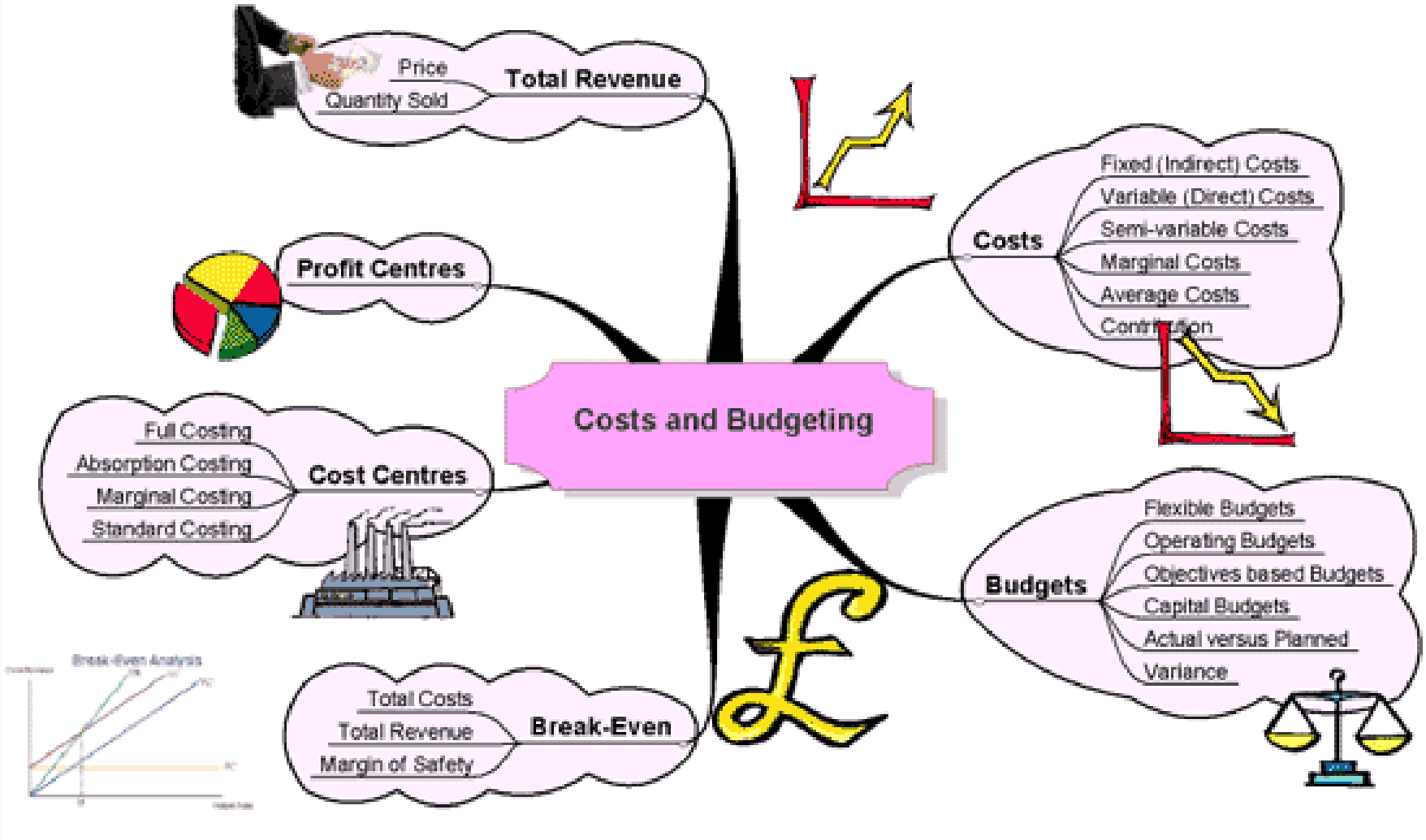
Ron can now find his break-even point simply by locating the exact point where the revenue line dissects the total costs line.

Related Websites:

- 02. Profit and loss account (P&L)
- Finance Action Planner (FAP)

In this case, Ron must sell 100 widgets each month if his business is to break-even. If he sells more than 100, he makes a profit; if he sells less he makes a loss.

Costing and pricing



Costs

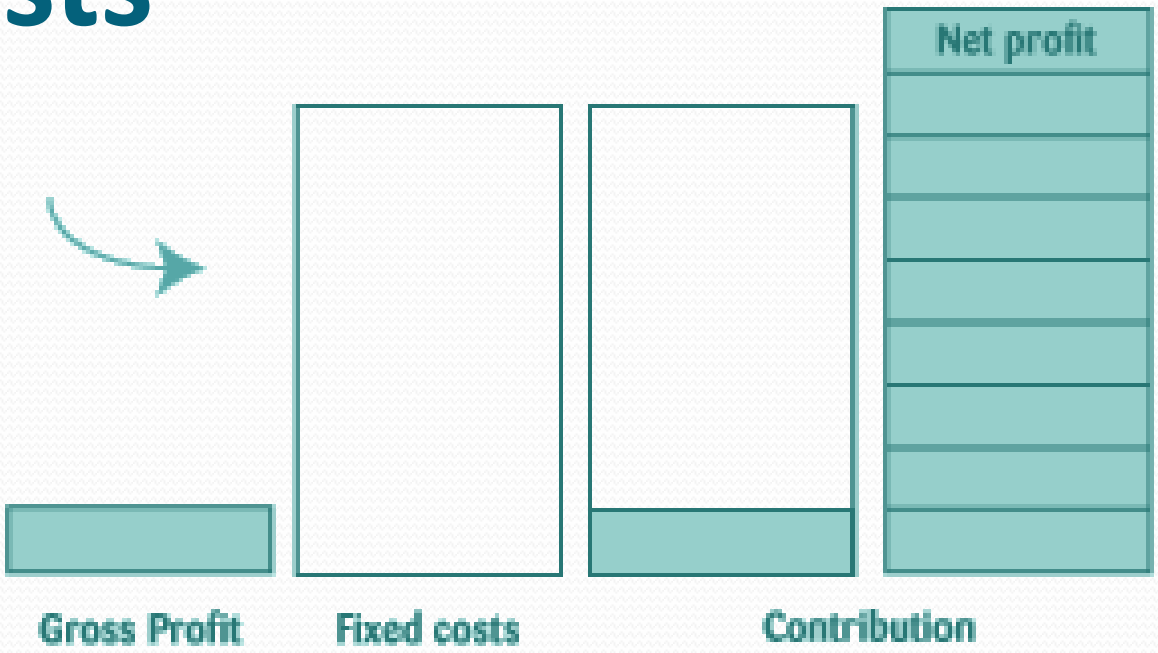


Although accountants define costs in several different ways, there are, effectively, just two types of cost. The first cost is that which is directly attributable to the product or service.

Direct costs include raw materials and sub-contract work. If you make desks, for example, the cost of wood will be a direct cost. Within reason, the cost will be the same for each desk, no matter how many desks you make.

When you make a sale the income first has to cover the direct costs relating to that sale. Whatever is left is called gross profit or contribution.

Costs



All other costs are **overheads**, e.g. staff salaries, marketing, rent, rates and insurance.

They also include depreciation; that is, an allowance for wear and tear on capital equipment.

Overheads are often called fixed costs because, generally, they are fixed for the business. Interest is often regarded as a deduction from net profit rather than an overhead cost. You need to include it as an overhead in your costing calculations, even though it varies with the size of your overdraft or loan.

If you are self-employed, you will take drawings from the business. Whilst, strictly speaking, drawings are an advance against profit, include them (and an allowance for income tax) as an overhead when calculating total costs.

Costs

The contribution is so-called because it contributes towards covering the overhead costs.

Each sale generates a contribution. When enough contributions have been made, and all the overhead costs are covered, they start to contribute to net profit.

Price

The price at which you sell your product or service clearly needs to exceed the total costs of providing it.

But the price should also reflect what the market can stand. If you are selling a differentiated product or have adopted a strategy of market focus then you may also be able to charge a premium price.

If you are pursuing a cost leadership strategy you will need to be ruthless in keeping your costs down and under control.

Price

In calculating your price you will need to follow a number of steps:

- estimate your likely sales for a period, say, one year;
- calculate the total direct costs and divide by the sales volume to give direct costs per unit (say per product or per hour of service);
- calculate your total overhead costs and divide by the sales volume to give overhead costs per unit;
- add direct costs per unit and overhead costs per unit to give total cost per unit; and,
- add a further profit margin (to allow for re-investment, etc).

  If necessary, add VAT as well.

Price

You now have a first stab price. How does that compare with your competitors? Will customers buy at that price? Do you need to reduce costs? Can you achieve a higher profit margin?

What happens if you fail to achieve sales at the determined price? Remember that the overhead costs are fixed, so if sales fall the overheads will be spread over fewer items and the unit cost effectively increases.

Price

The converse is also true. Increasing the volume of sales means that the overheads are spread over more units, so the unit cost falls.

This means that you can, if you choose, reduce the price. And reducing the price might increase your level of sales. It's a fine balancing act.

Pricing strategies

The greatest danger when setting a price for the first time is to pitch it too low.

Raising a price is always more difficult than lowering one, yet there are great temptations to undercut the competition. It is clearly important to compare your prices to your competitors', but it is essential that your price covers all your costs.

There are a number of possible pricing strategies from which you might choose

Pricing strategies

These include:

- **Cost based pricing** - total costs are calculated and a mark up is added to give the required profit.
- **Skimming** - you charge a relatively high price to recover set up costs quickly if the product is good or new. As more competitors enter the market, you lower the price.
- **Individual** - you negotiate prices individually with customers based on how much they are prepared to buy.

Pricing strategies

- **Loss leaders** - if you wish to sell to a particular market then you might sell one product or service cheaper to gain market entry. You balance this by selling other products or services at a higher price. This can be risky as the danger is that everything becomes a loss leader.

- **Expected price** - what does the customer expect to pay? If you are selling a quality product, do not underprice. Often the customer expects to pay a lot as the product or service has a certain 'snob' value and this may be diminished if you underprice.

Pricing strategies

- **Differential pricing** - you charge different segments of your market different prices for the same service. For example, offering discounts to certain people like pensioners or the unemployed, or charging lower rates for quiet periods.

If, after working out your costs, the price you charge is much greater than your competitors' then you will have to look at ways of reducing costs.

Financial forecasts

Once you have an idea of your likely costs and an idea of how much you need to sell to make a profit you are in a position to prepare financial forecasts.

There are three basic financial statements (**the profit and loss account** (P&L); **the cashflow statement**; and the **balance sheet**) that describe the activities and financial state of any business.

These can be prepared on a historical basis - to show how a business performed during a defined period - or as forecasts - as estimates of how the business will perform in the future.

Three steps to forecasting

- Businesses often start by forecasting their cashflow and then aim to derive other forecasts from it. It makes more sense, however, to start by forecasting the income and expenditure of the business, which will indicate whether you will make a profit, then worry about when money will be received or paid out - to discover if you will have enough cash when it is needed. Income and expenditure is summarized in a profit and loss account.

- You will also need to look at your likely sales for, say, the year ahead. This needs to relate back to your market research and, if you are already in business, to previous performance. The direct costs can then be estimated (usually as a percentage of sales) to give gross profit.

- The next step is to estimate the likely overheads. Deducting these gives an operating profit forecast. If the net profit is too low you will either need to assess whether you can achieve higher sales or whether you can reduce the overheads.

Three steps to forecasting

When preparing your forecasts, remember to allow for increased costs, for instance, due to inflation or future pay awards. If you do need a loan, then you will also need to allow an amount for loan interest. If you use equipment, remember to allow for depreciation. Whilst depreciation is not included in the P&L, you may need to allow for the replacement or repairs of machinery, so you may wish to include a contingency.

The P&L forecast will show whether you are likely to achieve your first key financial requirement: making a profit.

Preparing cashflow forecasts

- In preparing your forecasts, you will need to think carefully about all your costs, about your price and likely sales at that price, and about the timing of both receipts and payments.

- As mentioned above, the first forecast that you set out should ideally be a P&L, summarizing income and expenditure for, say, the year ahead. You might do this monthly or annually.

  The P&L is important for demonstrating profitability; over the very short-term, however, the key requirement is to generate cash and know the business' working capital requirements. This can best be done by preparing a cashflow forecast which should set out all the information, month by month, regarding cash inflows and outflows.

Preparing cashflow forecasts

The cashflow forecast should include:

- receipts of cash from customers;
- payments for raw materials;
- payments for all other expenses;
- drawings and wages;
- capital expenditure;
- capital, loans or grants introduced;
- loan repayments;
- VAT receipts and payments (if VAT registered); and,
- tax payments.

Preparing cashflow forecasts

All of these items should normally be shown separately and in the month into which the money will be received, or paid by, your business.

For businesses with a modest turnover and that demonstrate profitability in the year, it is normal only to forecast one year ahead, with a monthly cashflow.

Larger businesses, especially those seeking equity investments and/or which do not show profitability in the year, may need to prepare forecasts for two or three years. The first year cashflow is usually shown monthly, the second year quarterly and the third year just a single annual figure.

Preparing cashflow forecasts

It is often helpful when preparing cashflow forecasts initially to ignore any finance that is available from the bank or other lenders.

The cashflow forecast then shows the true position of the business. It can then be used to decide if the budget is viable and can be adjusted to reflect the true position and to assess the total funding requirement.

Preparing cashflow forecasts

CASHFLOW FORECAST							
	Jan	Feb	Mar	etc..	Dec	TOTAL	Accruals
SALES							
Chairs	10,000	11,000	12,000		10,000	178,000	
RECEIPTS							
Debtors	2,000	4,200	7,600		17,250	152,000	26,000
Owners 5,000	5,000						
Loans	15,000					15,000	
VAT	350	735	1,330		3,019	26,600	
TOTAL	22,350	4,935	8,930		20,269	198,600	
PAYMENTS							
Raw materials	3,000	3,300	3,600		3,000	53,400	
Wages and NI	2,500	2,500	2,500		2,500	30,000	
Rent	500	500	500		500	6,000	
Rates	200	200	200		200	2,400	
HLP	100	100	100		100	1,200	
Telephone	500					2,000	
Insurance	1,000					1,000	
Advertising	1,500		1,500			9,000	
Stationery	500					500	
Travel, etc	100	100	100		100	1,200	
Bank Charges			100		100	400	
Loan repayments	500	500	500		500	5,500	
Interest	140	140	140		140	1,540	
Professional fees	1,000					1,000	
Repairs						0	
Drawings	1,000	1,000	1,000		1,000	12,000	
Tax						0	
Equipment	12,000					12,000	
VAT	3,255	595	910		543	13,843	
VAT to C and E 0							6,510
TOTAL	27,155	8,935			8,683	159,493	
BALANCE	(4,805)	(4,000)	(2,220)		11,586	39,108	6,248
CUM BALANCE	(4,805)	(8,805)	(11,025)		39,108		

Preparing cashflow forecasts

If you do not have sufficient money of your own, then you will need to seek loan finance or an equity investor. Most small businesses simply look for loan finance. Aim to match the term of the loan to the life of the asset for which it is required.

It would be normal to look for a short-term loan, for example, to purchase equipment, or a long-term loan to purchase premises. You will also need to buy stock and pay overheads whilst awaiting payment from your customers.

The money required is called working capital and is typically funded by an overdraft.

Preparing cashflow forecasts

When preparing your cashflow forecast, you may like initially only to include personal investment or loan finance for fixed assets and to ignore funds for working capital.

The worst cumulative deficit will then give an indication of your total working capital requirement.

Of course, the amount that you need to borrow can be reduced if you have more available to invest yourself.

Preparing cashflow forecasts

If you have a term loan, the capital repayments will not figure in your profit and loss account - they are not a business expense - although the interest portion of the repayments will be charged as an expense.

However, the repayments do need to be included in your cashflow forecast.

Balance sheet

The money in a business can only come from three sources:

capital introduced by the owner(s);

loans (whether from the bank or, effectively, from creditors); and,

retained earnings; that is, profit which has been generated by, and retained within, the business.

That money is used to finance the fixed and current assets of the business.

Balance sheet

Current liabilities include:

- creditors;
- overdrafts;
- loans due within one year;
- money owed under hire purchase agreements; and,
- any amounts owed in VAT or tax, etc.

Balance sheet

In larger businesses, loans falling due in more than one year are usually shown separately. You will, however, have a better idea of your business' performance if you show all loans as current liabilities.

Current assets less current liabilities shows your working capital requirement. Since the balance sheet is merely a snapshot, however, it may be better to deduce your working capital requirement from the cashflow forecast.

The net assets are always equal to the capital introduced plus reserves; that is, the net finance, sometimes known as net worth or the equity of the business.

Balance sheet

The net finance, together with any long-term loans, is called the capital employed. All borrowing should be included when calculating capital employed.[1]

[1] A number of key ratios can be derived from the balance sheet and can assist in exercising effective financial control.

Sensitivity analysis

It is important to know how sensitive your forecast is to changes. Sensitivity analysis looks at 'what if?' scenarios. What happens to your cash position, for example, if sales fall by 10%?

What happens if your main supplier increases raw material prices by 12%? Sensitivity analysis is particularly used by financial institutions when considering propositions for a loan.

Sensitivity analysis

If your business is particularly susceptible to small changes, then you probably do not have a sufficiently large profit margin. You will thus be less likely to receive the loan required. You may find it difficult to cut costs.

You may not be able simply to increase prices to improve your margins - that might deter customers.

Sensitivity analysis

Are there other ways in which you can push up the margins, e.g. by increasing output?

Having undertaken your sensitivity analysis, you may need to review elements of your forecast. Sensitivity analysis can help in making decisions.

Sensitivity analysis

You may want to consider, for example, the effect of increased raw material, labour or overhead costs; of reducing prices, with constant volumes, to counteract competitors; or reducing volumes, with constant prices, due to over optimistic forecasts.

Furthermore, if you are about to spend a large sum of money on equipment, you may want to look ahead several years, if at all possible.

Including a sensitivity analysis in your business plan will demonstrate that you have thought about some of the potential risks - and that is half way to avoiding them.

Cashflow Forecasting

Preparing a Cashflow Forecast

Contents

- Types of cashflow forecasting
- Preparing a cashflow forecast

	Last Year 1995	This Year 1996	Next Year 1997
Beginning Cash Balance	2,500	7,131	9,602
Cash Receipts	8,500	15,000	21,000
Collection of Receivables			
Interest Income	0	0	0
Total Cash Receipts	11,000	22,131	30,602
Cash Disbursements			
Accounts	2,264	6,475	12,000
Payments of Other Expenses	1,867	2,300	3,200
Income Tax Payments	0	3,254	7,200
Total Cash Disbursements	4,131	12,029	22,400
Net Cash from (Used for Operations)	1,131	10,102	8,202
Sale of Stock	N/A	N/A	N/A
Purchase of Equipment	0	500	0
Decrease (Increase in Funds Invested)	0	0	0
Short-term Borrowings (Repayments)	0	0	0
Ending Cash Balance	7,131	9,602	8,202

Types of Cashflow Forecasting

There are two types of cash flow statement that you will come across, these are:

- Actual cashflow statements - these show an historic view, showing the actual flows of cash into and out of a business that have occurred over a previous trading period, e.g. 6 months, or 1 year.

- Forecast cashflow statements - these show the expected flows of cash into and out of a business over a trading period in the immediate future, e.g. next 6 months or year.

Types of Cashflow Forecasting

When looking at preparing a business plan, it is obviously the second of these that we will be doing, and generally businesses are more concerned about forecasting cash- flow, as this helps them to see the need for any short-term financing.

Preparing a cashflow forecast

The cash flow forecast essentially has three separate parts to it. They are:

- Projected revenue
- Projected expenses
- Balance

Preparing a cashflow forecast

- When planning your business, you will need to draw up figures for each of these items, so think carefully about how many you think you will sell and when and what all your possible expenses will be and when they will need to be paid.
- Remember the cash flow shows **when the cash is actually paid or received** - this is not necessarily at the same time as the sale or purchase is made.

Preparing a cashflow forecast

Let's look at an example. Let's say you have forecast the following, and the business will be starting on January 1st next year:

- Sales will be £950 per month, but with one month credit given, so the cash is received one month after the sale is made.

Preparing a cashflow forecast

- Expenses will be:
  - Rent - £200 per month - payable immediately
  - Raw materials - £100 per month - but with one month credit given
  - Wages - £250 per month - payable each month
  - Rates - £400 per quarter - payable every three months (first payment in January)
  - Electricity - £55 per quarter - first payment in March
  - Travelling - £75 per month - payable immediately
- The opening business bank balance will be £250

Preparing a cashflow forecast

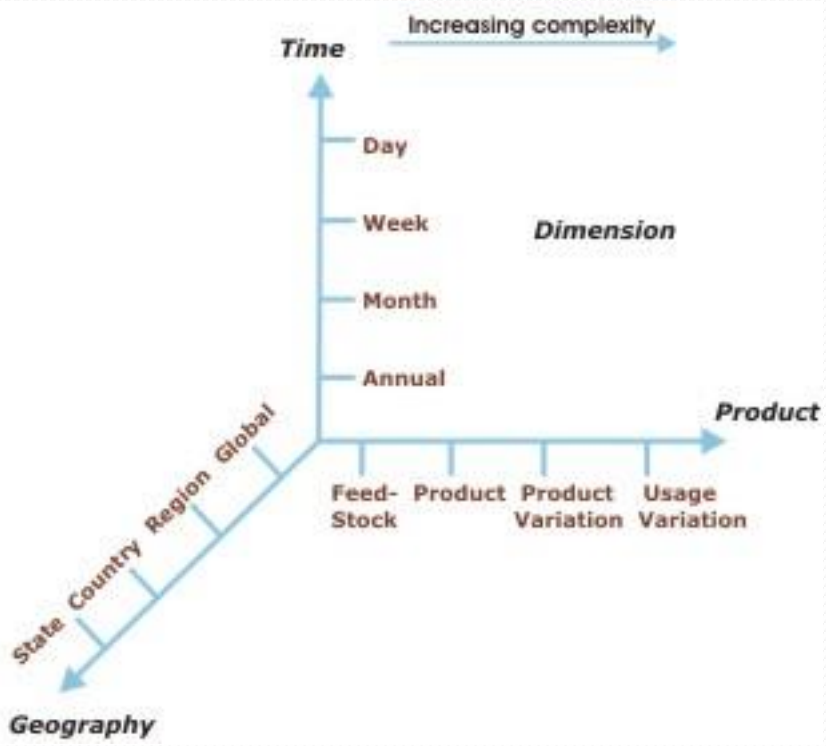
From this information we can prepare a cash flow statement for the first 6 months of the business. Have a look at the table on your handout and check you could reproduce this.

Forecasting

Costs, Benefits and Methods

Cost, Benefits and Methods

- Costs
- Benefits



Developing Forecasting Models

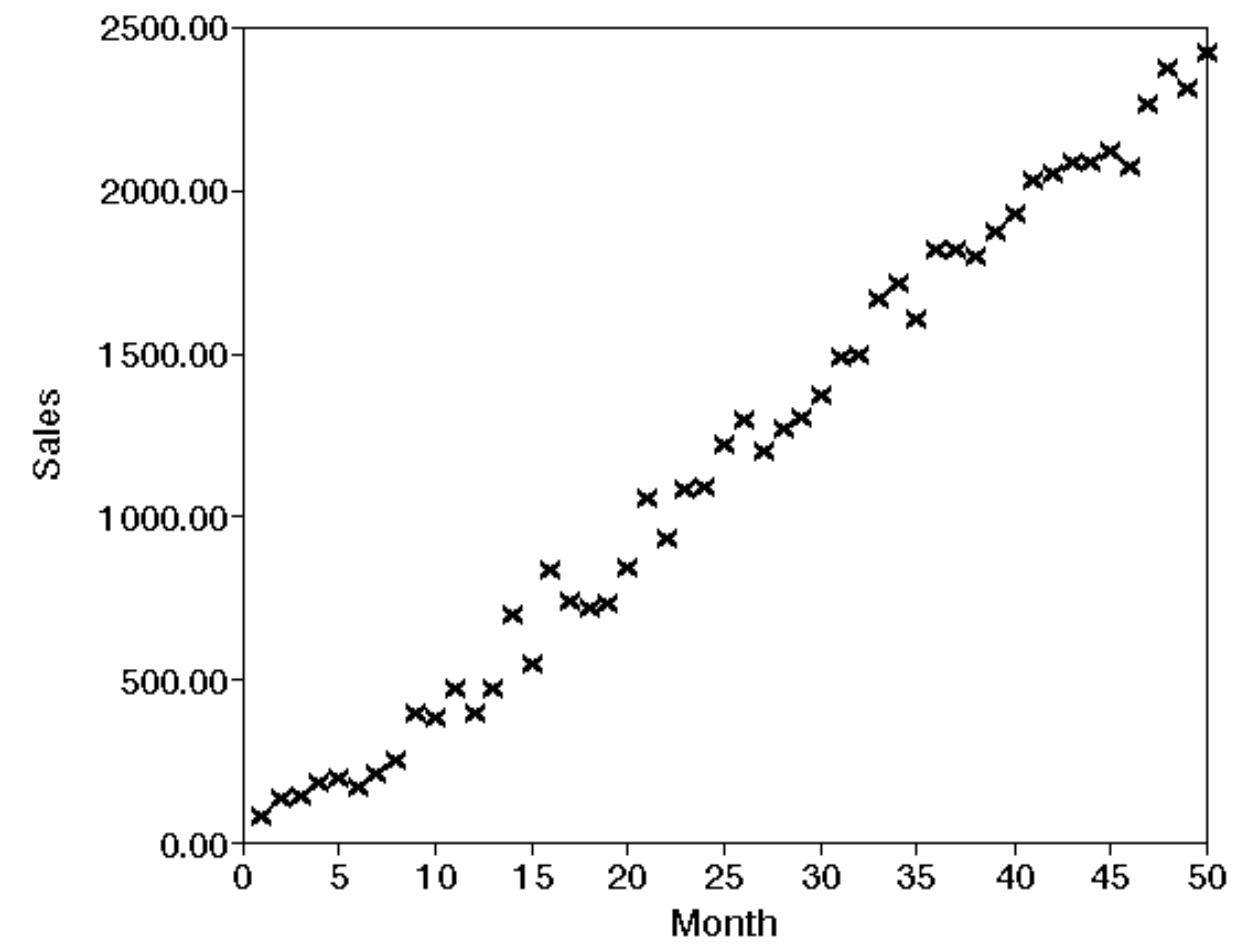
Costs

- Cannot predict the future with any certainty
- The past not a guide to the future
- Qualitative - how reliable? (Peer pressure)
- Change in business objectives can make forecasts redundant
- External factors cannot be predicted with any certainty

Benefits

- Can inform decision-making
- Quality of data vital
- Enables businesses to plan for resource allocation

Methods



Operations research

Forecasting

Forecasting tutorial question

Forecasting tutorial solution

OR-Notes are a series of introductory notes on topics that fall under the broad heading of the field of operations research (OR). They were originally used by me in an introductory OR course I give at Imperial College. They are now available for use by any students and teachers interested in OR subject to the following conditions.

Quantitative

- Where statistical data is available
  - Moving Averages
  - Trends
  - Cyclical variations
  - Random variations
  - Seasonal variations
- Extrapolation

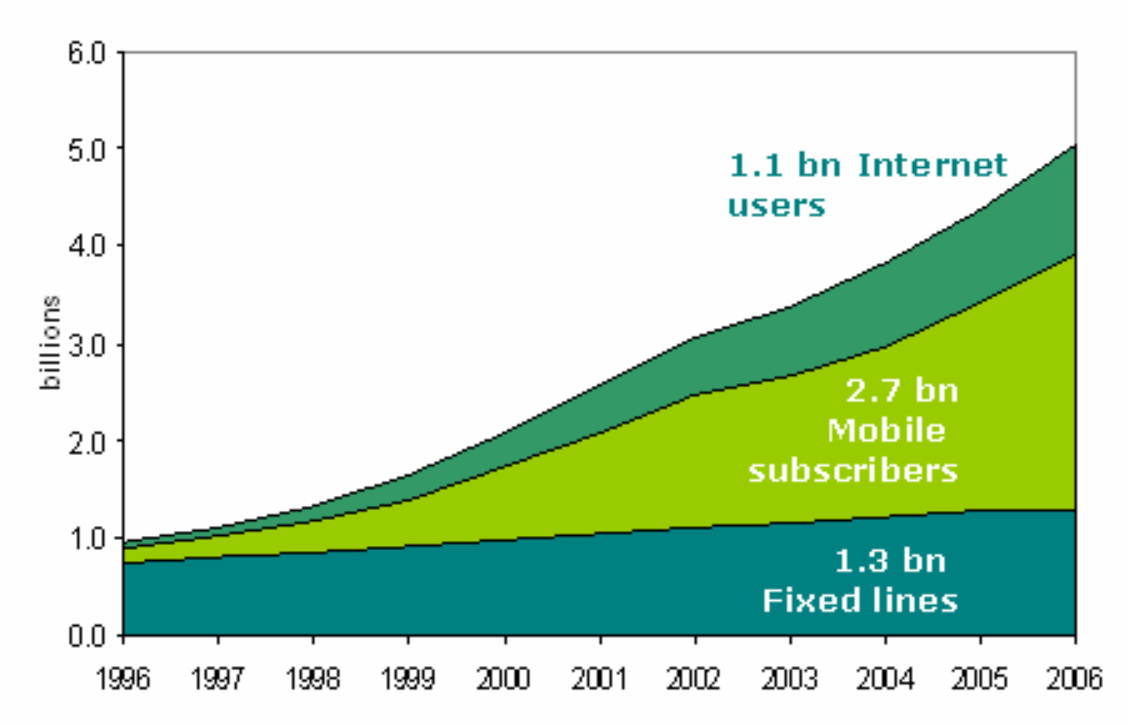
Moving averages



A moving average is simply a way to smooth out price action over time. By "moving average", I mean that you are taking the average closing price of a currency for the last 'X' number of periods.

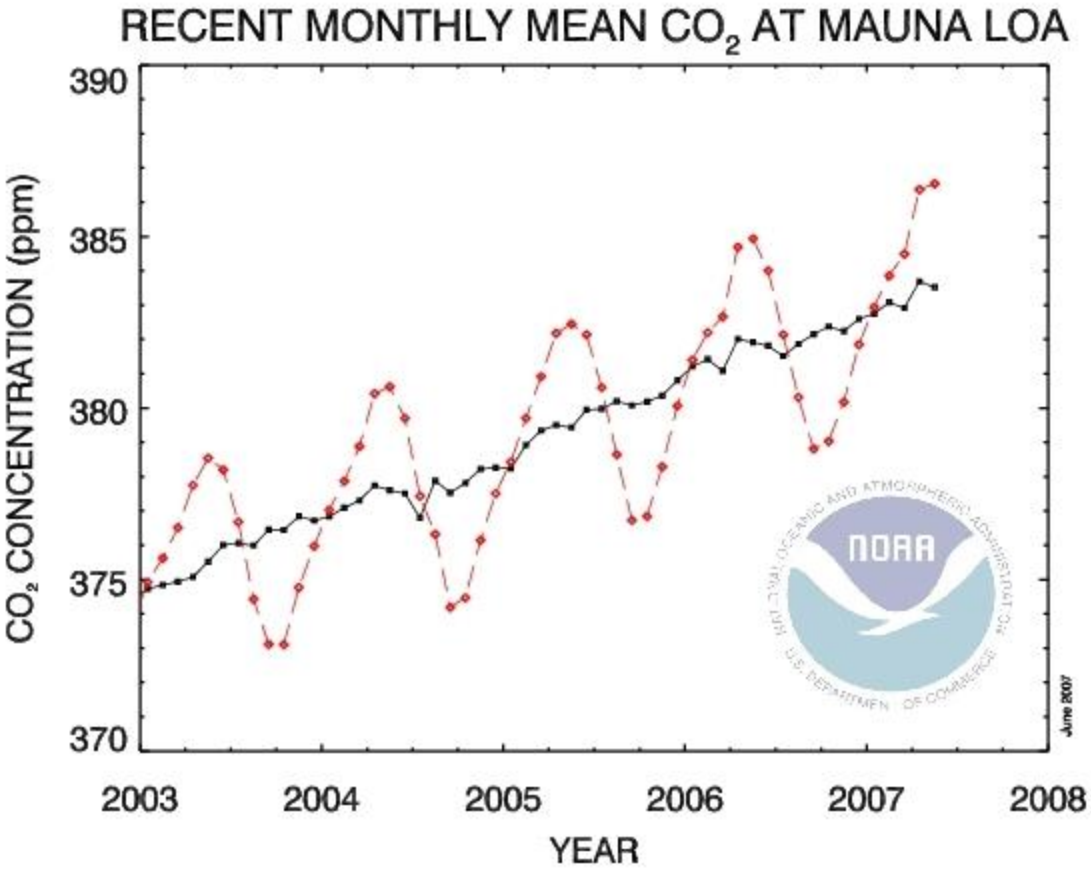
Like every indicator, it is used to help us forecast future prices. By looking at the slope of the moving average you can make general predictions as to where the price will go.

Trends



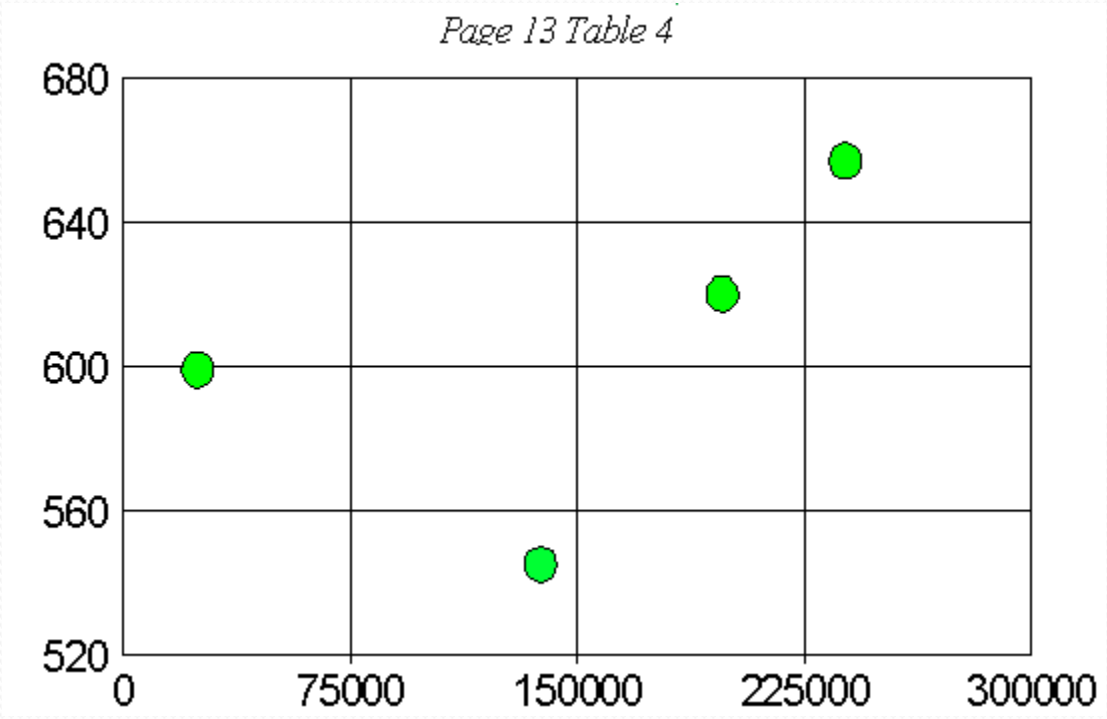
This report explores the move to NGN, its technology, fixed-mobile convergence, interconnection, international Internet interconnection, universal access, QoS and consumer protection and the creation of an NGN-enabling environment. Global ICT market and regulatory trends are also discussed and an overview of the NGN regulatory framework is provided.

Cyclical Variation



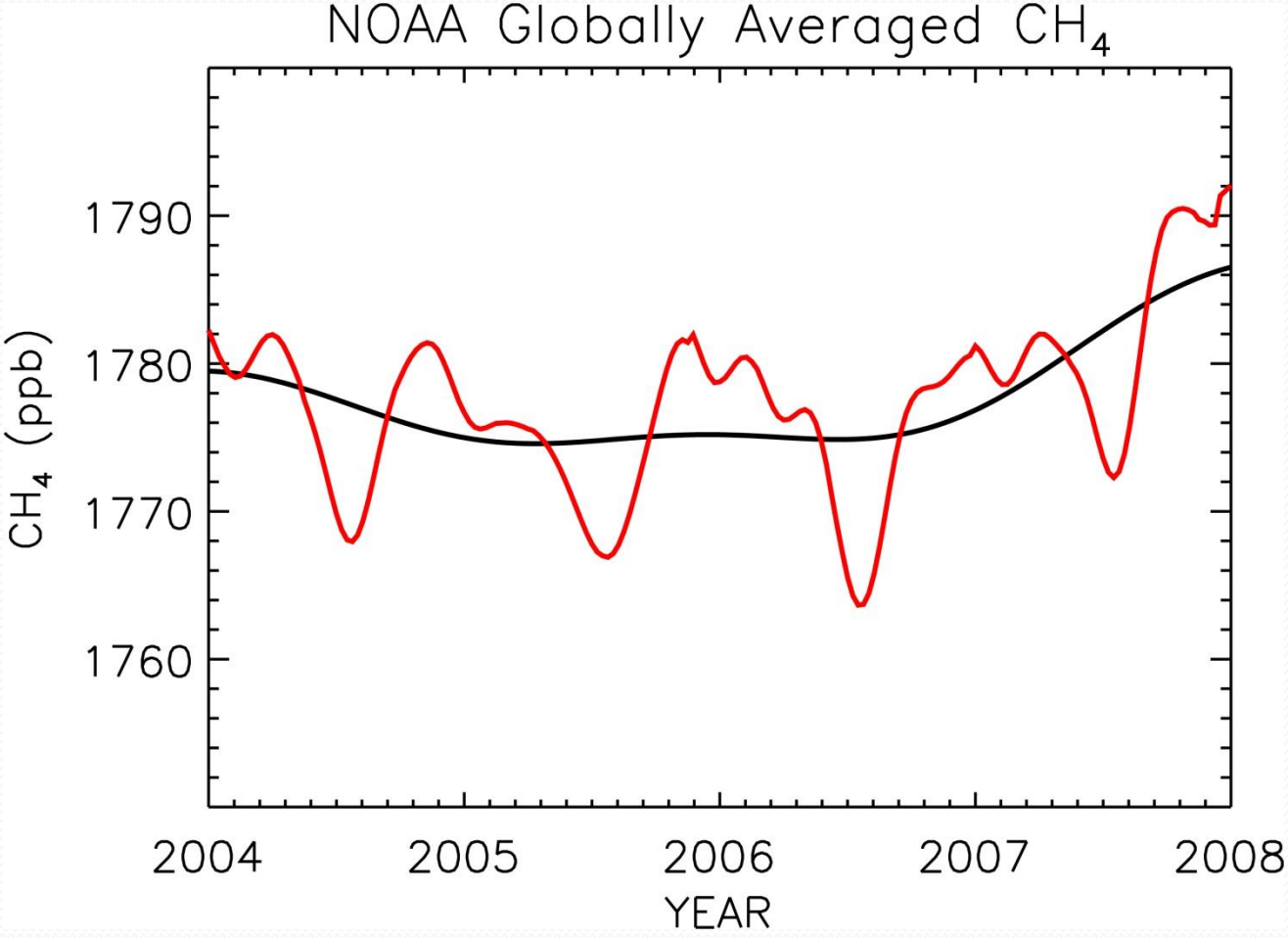
This cyclic variation can be taken out to give an adjusted curve with an apparently random component with an root mean square value of about 0.3ppm. This is the maximum meaningful accuracy to quote

Random Variation



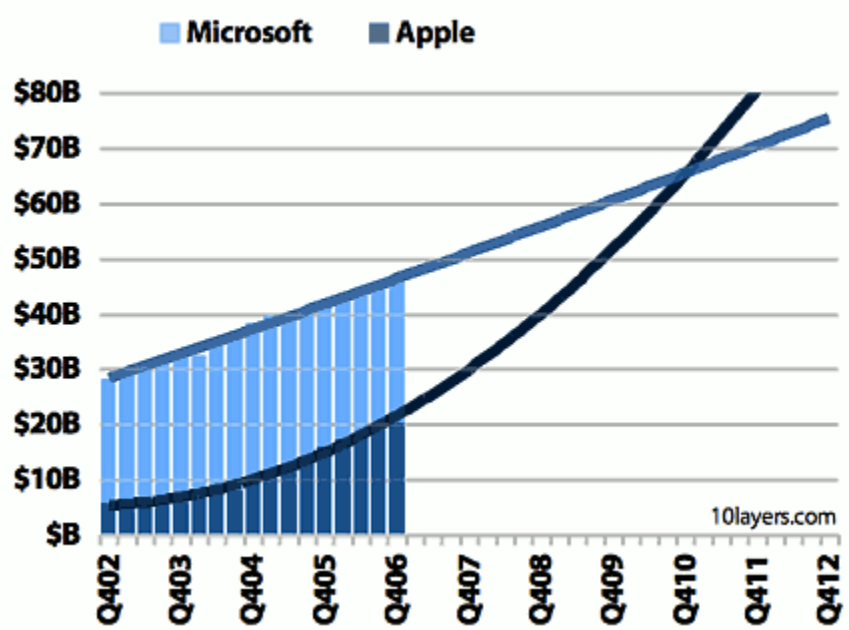
Columbia's data plotted above show relatively large random variations. These variations, which are not a function of file size, show an experimental error of more than 20 per cent.

Seasonal variations



Global methane (CH_4) concentrations rose in 2007. The red line shows the trend together with seasonal variations.

Extrapolation

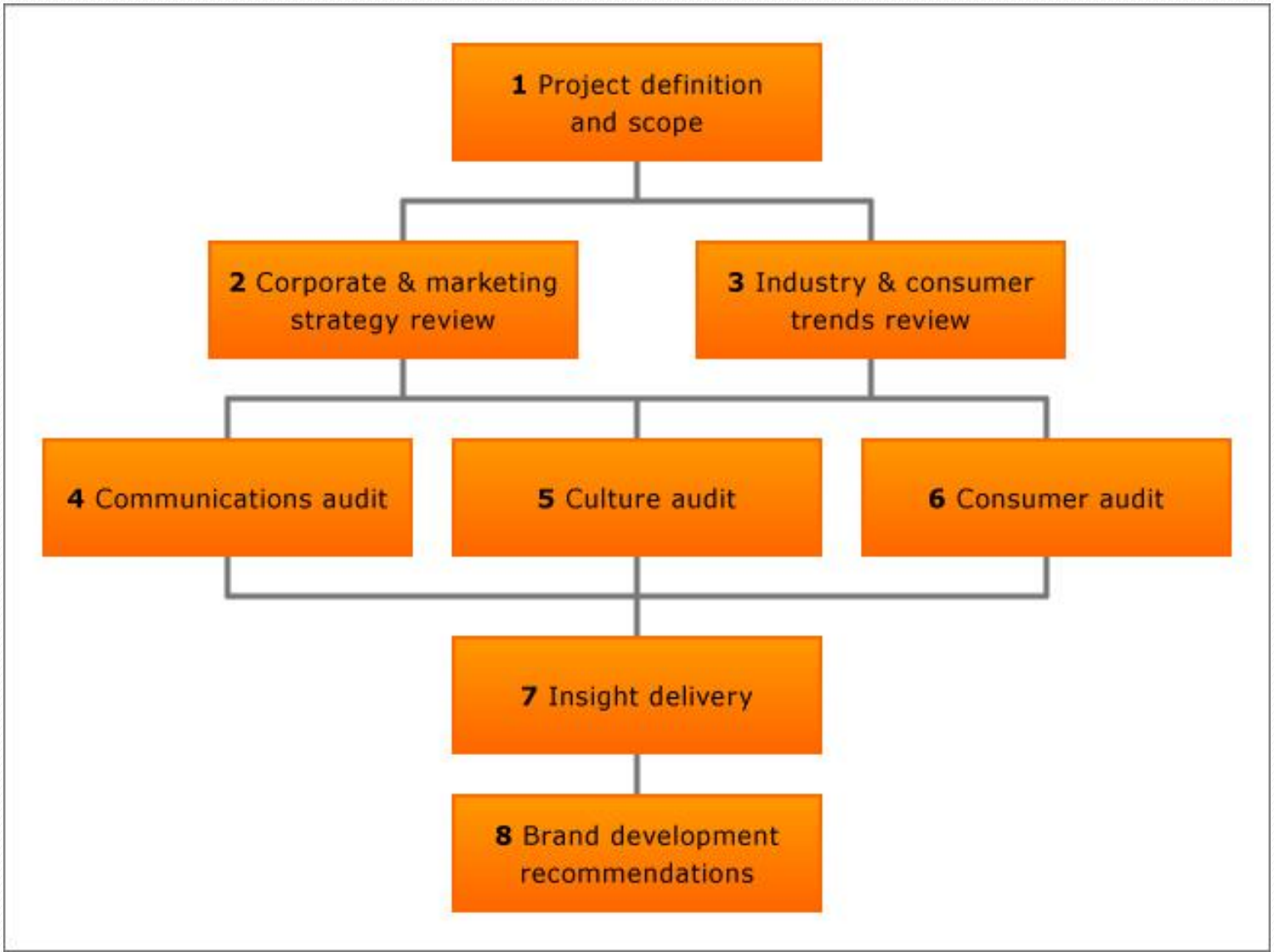


Apple Inc. has a decent shot of outgrowing Microsoft Corp. within the next five years if it can keep churning out hit wonders, an extrapolation of revenue data from the two industry heavyweights has revealed.

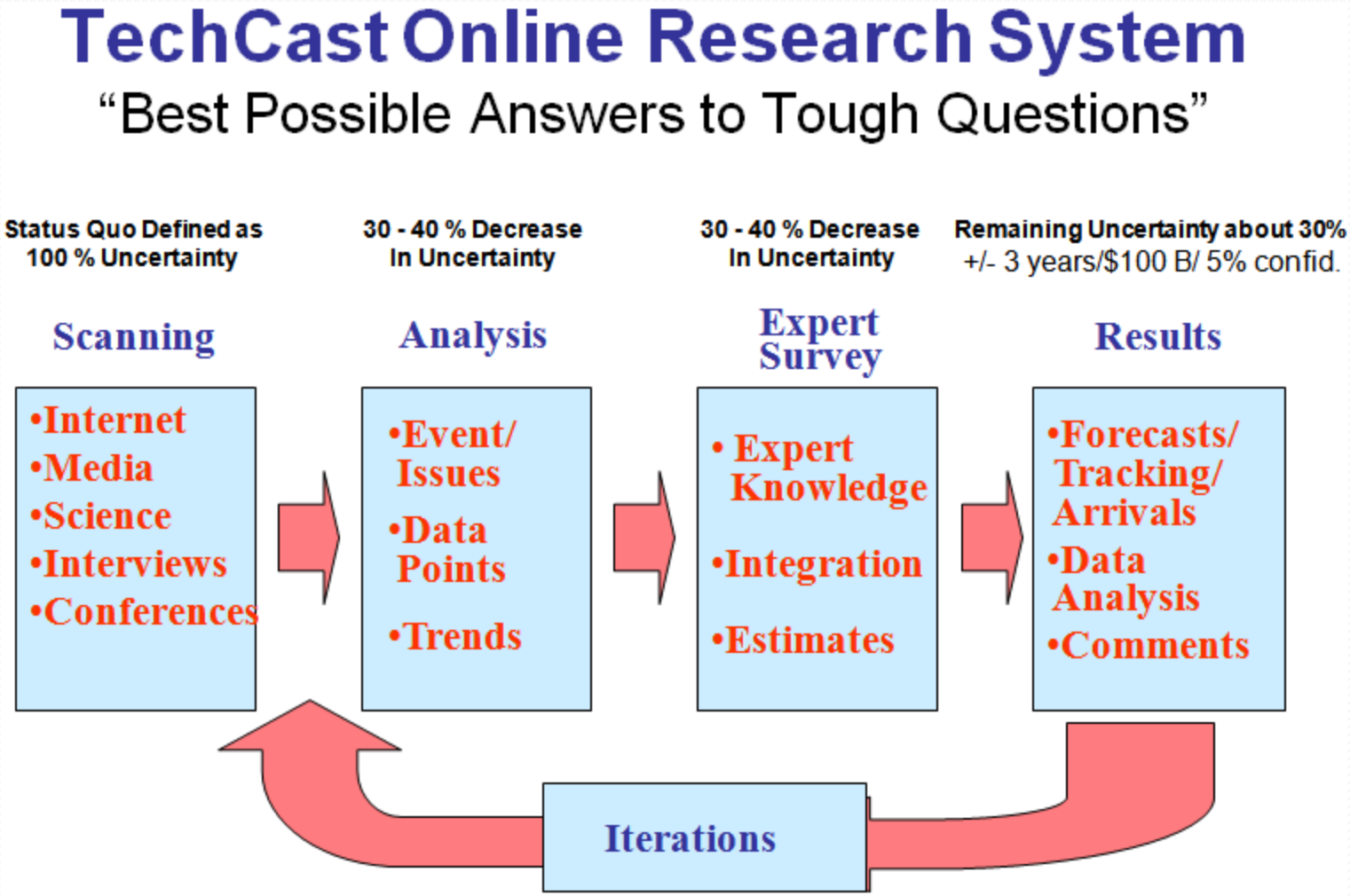
Qualitative

- Assesses opinion
- Delphi Technique
- Consumer Panels
- Focus Groups
- User Groups
- In - house Judgments

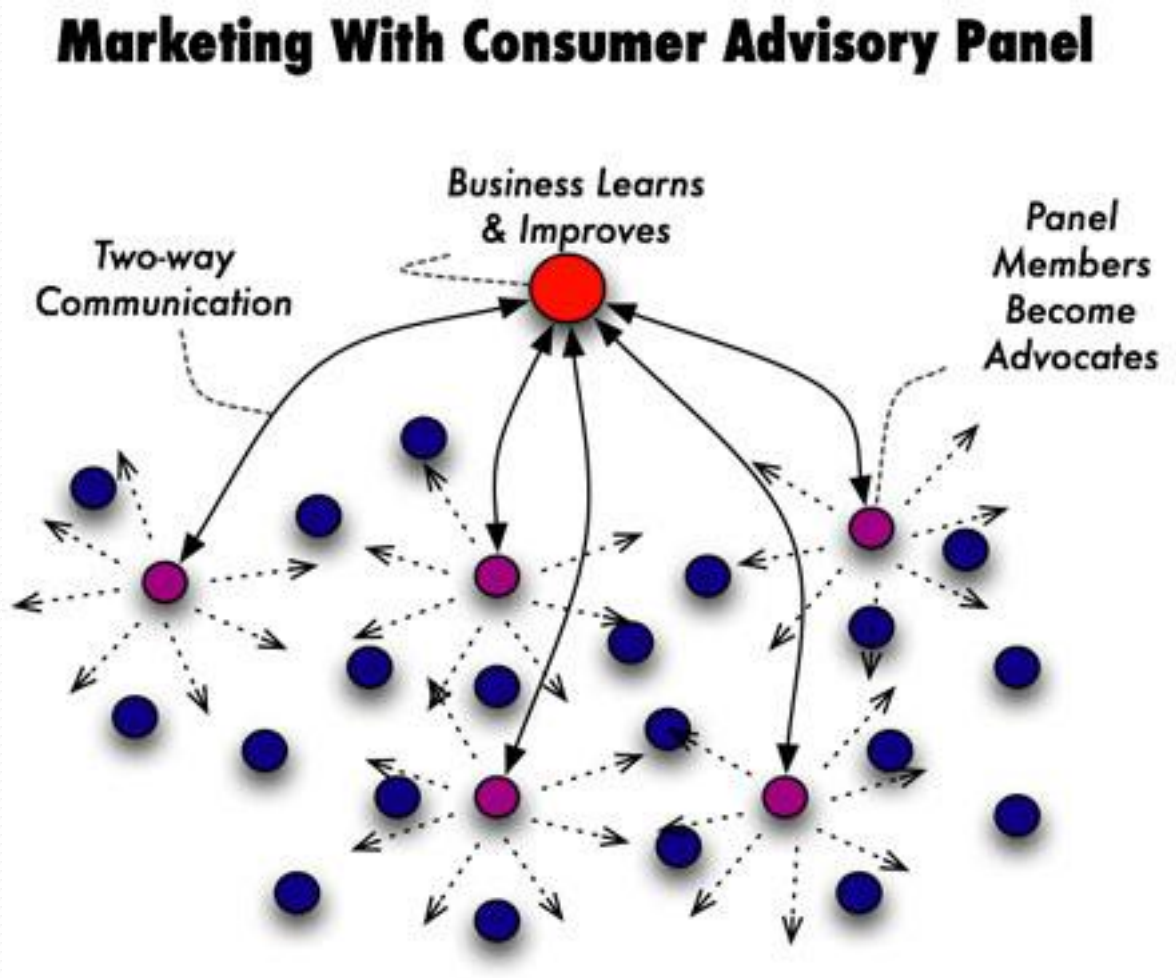
Assess Opinions



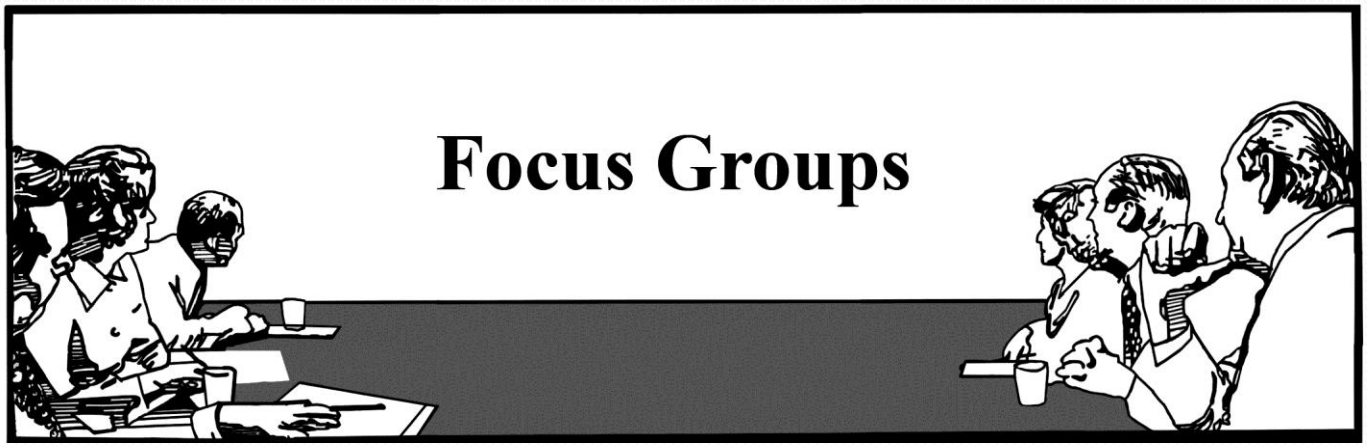
Delphi Technique



Consumer Panels

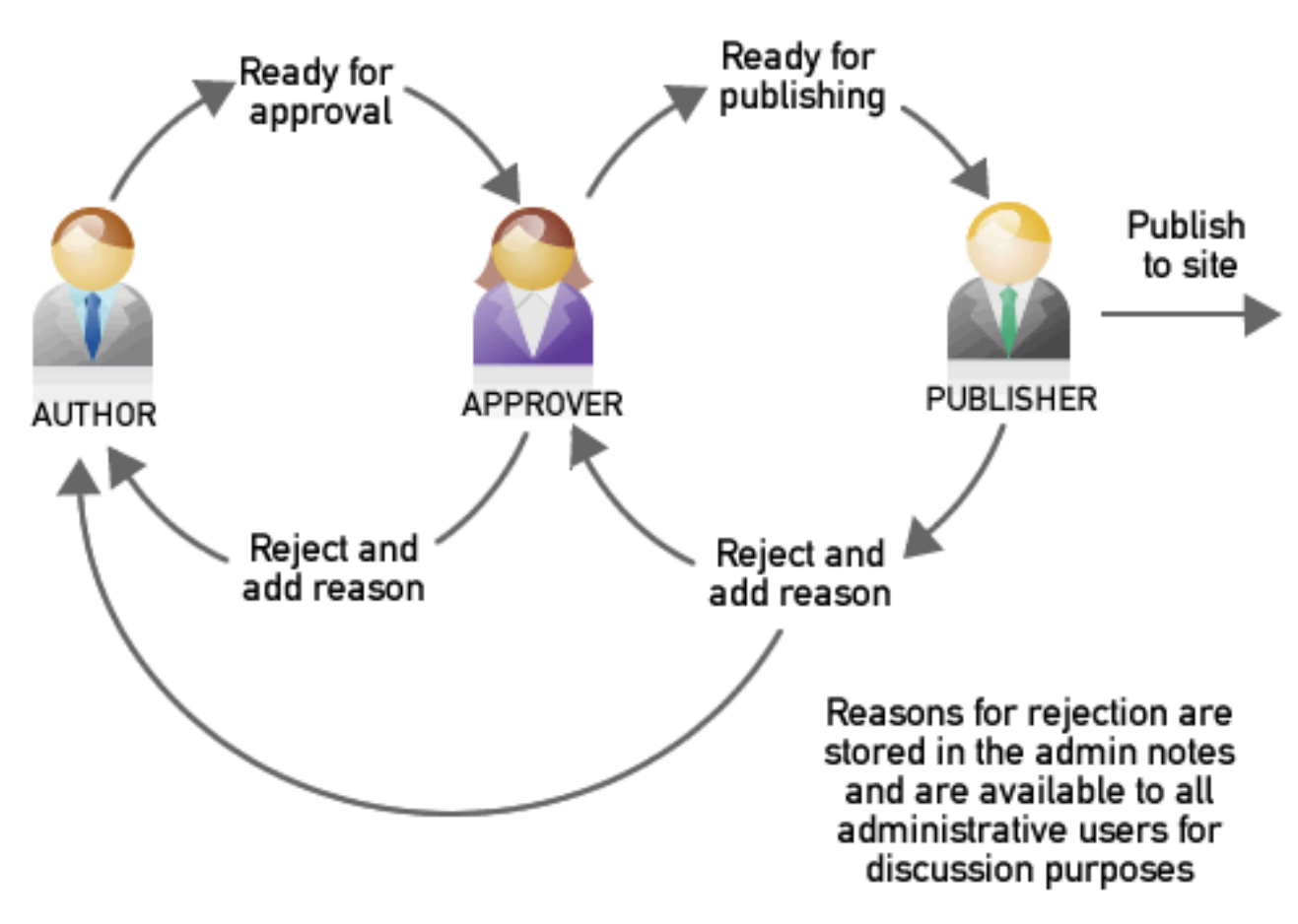


Focus Groups



What are Focus Groups
Characteristics of Focus Groups
The Process of Conducting Focus Group Interviews
Sample Questioning Routes
Standard Introduction and Overview for Focus Group Interviews

User Groups


Ready for approval
Ready for publishing
Publish to site
AUTHOR
APPROVER
PUBLISHER
Reject and add reason
Reject and add reason
Reasons for rejection are stored in the admin notes and are available to all administrative users for discussion purposes

In - house Judgments



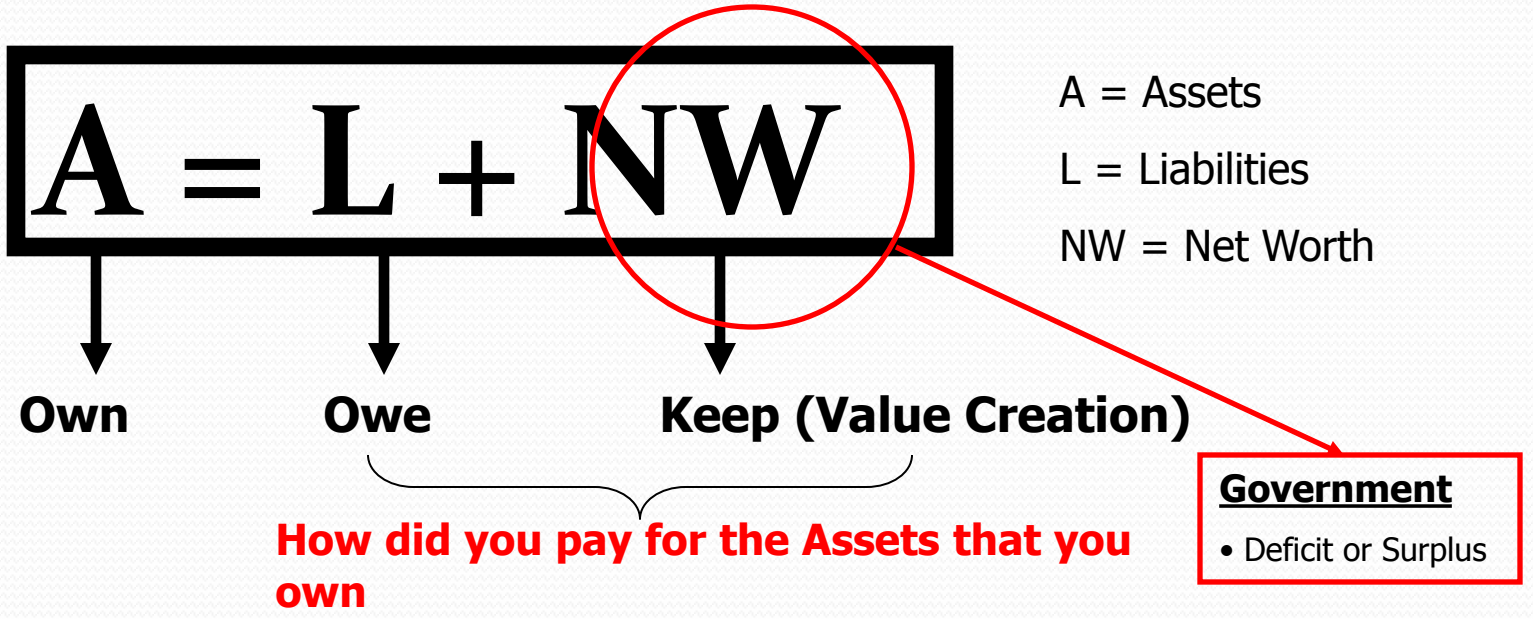
Budget Planning, Implementation and Monitoring

First Step: Understanding Financial Statements – Corporate Approach

Table of Contents

- **Accounting Definitions, Terms and Concepts**
- **Using Financial Statements**
- **Financial Ratio Analysis**

Accounting Definitions and Concepts

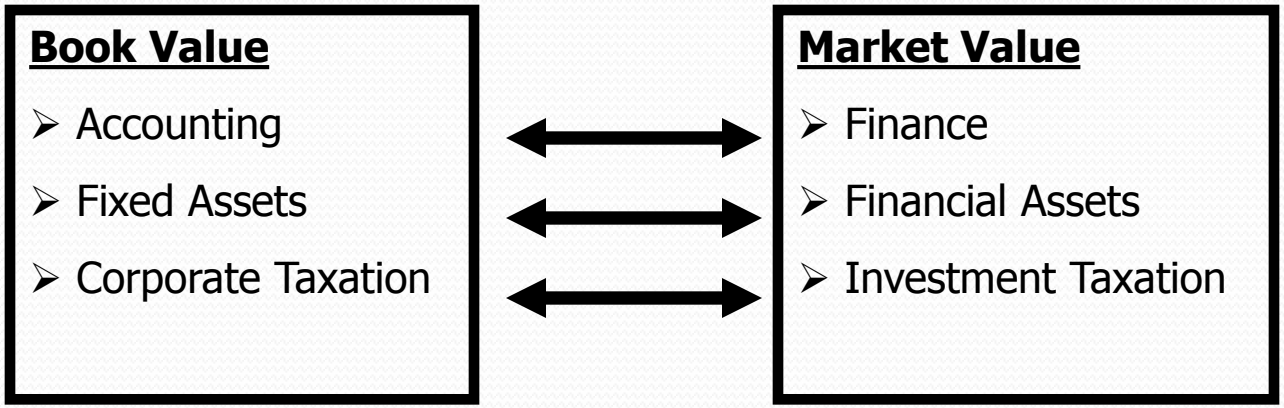


Similar Concepts in Other Areas of Finance:

- Consumer finance: Value of the House = Mortgage + Equity
- Corporation Value: Enterprise Value = Net Debt + Equity
- Investments: Value of the Investment: Margin Loan + Equity

Accounting Definitions and Concepts

Book Value Vs Market Value



Accounting Definitions and Concepts

Income Vs Cash

The Perfect World:

Every business is run like a lemonade Stand



Income Statement	
Lemonade Sales	
Sold 100 cups @ $1 each	$ 100.00
Expenses	
Box of 100 Cups	$ 5.00
Lemonade concetrate	$ 5.00
4 Gallons of Water	$ 10.00
Total Expenses	$ 20.00
Net Income (Profit)	$ 80.00

Cash Flow Statement	
Profit	$ 80.00
Plus Money that we owe	$0.00
Less Money owed to us	$0.00
Net Working Capital	$0.00
Cash	$ 80.00

Accounting Definitions and Concepts

Income Vs Cash

Not So Perfect World:

The world of IOUs



Income Statement	
Lemonade Sales	
Sold 100 cups @ $1 each	$ 100.00
Expenses	
Box of 100 Cups	$ 5.00
Lemonade concetrate	$ 5.00
4 Gallons of Water	$ 10.00
Total Expenses	$ 20.00
Net Income (Profit)	$ 80.00

Cash Flow Statement	
Profit	$ 80.00
Plus Money that we owe	$0.00
Less Money owed to us	-$1.00
Net Working Capital	-$1.00
Cash	$ 79.00

Income Statement

- Measurement of Profit and Loss over a Period of Time
- Top Line to Bottom Line
- Revenue (Sales) Less Expenses = Profit or Loss

Income Statement

	Income Statement (000's)		2009	2010
50	**Revenues by Geography**			
51	U.S.		800,000	920,000
52	Europe		120,000	140,000
53	Asia		40,000	50,000
54	Total Revenue		960,000	1,110,000
56	**Cost of Revenues by Geography**			
57	U.S.		220,000	270,000
58	Europe		100,000	115,000
59	Asia		25,000	35,000
60	Total Cost of Revenue		345,000	420,000
62	Gross Profit		615,000	690,000
64	**Operating Expenses**			
65	Administrative & General		145,000	165,000
66	Marketing Expenses		75,000	80,000
67	Other Operating Expenses		10,000	12,000
68	Total Operating Expenses		230,000	257,000
70	**EBITDA**		385,000	433,000
72	**Depreciation & Amortization**		60,000	65,000
74	**EBIT**		325,000	368,000
76	**Interest Expense**		130,000	120,000
78	EBT		195,000	248,000
80	**Taxes**	40%	78,000	99,200
82	Net Income		117,000	148,800

Balance Sheet Statement

- It shows us on a snap shot the Wealth of the Company
- The statement is set-up in Order of Liquidity

Balance Sheet Statement

	Balance Sheet (000's)	2009	2010	$ Change	% Change
6	**Current Assets**				
7	Cash	45,000	65,800	20,800	46.2%
8	Accounts Receivable	45,000	60,000	15,000	33.3%
9	Inventories	35,000	40,000	5,000	14.3%
10	Prepaid Expenses	10,000	9,000	(1,000)	-10.0%
11	Total Current Assets	135,000	174,800	39,800	29.5%
13	**Property and Equipment**				
14	Land	2,500,000	2,500,000	-	0.0%
15	Building	450,000	550,000	100,000	22.2%
16	Furniture & Equipment	50,000	75,000	25,000	50.0%
17	Total Gross P&E	3,000,000	3,125,000	125,000	4.2%
18	Less Accumulated Depreciaition	(300,000)	(365,000)	(65,000)	21.7%
19	Net P&E	2,700,000	2,760,000	60,000	2.2%
21	Long-Term Investments	200,000	250,000	50,000	25.0%
23	Total Assets	3,035,000	3,184,800	149,800	4.9%
25	**Liabilities and Owners Equity**				
27	**Current Liabilities**				
28	Accounts Payable	35,000	40,000	5,000	14.3%
29	Accrued Income Taxes	12,000	10,000	(2,000)	-16.7%
30	Accrued Expenses	10,000	8,000	(2,000)	-20.0%
31	Current Portion of Long Term Debt	20,000	10,000	(10,000)	-50.0%
32	Total Current Liabilities	77,000	68,000	(9,000)	-11.7%
34	Long-Term Debt:	1,200,000	1,180,000	(20,000)	-1.7%
36	Deferred Income Taxes	12,000	17,000	5,000	41.7%
38	Total Liabilties	1,289,000	1,265,000	(24,000)	-1.9%
40	**Owners' Equity**				
41	Common Stock	1,000,000	1,000,000	-	0.0%
42	Paid-in-Capital	-	25,000	25,000	
43	Retained Earnings	746,000	894,800	148,800	19.9%
44	Total Owners' Equity	1,746,000	1,919,800	173,800	10.0%
46	Total Liabilities & Owner's Equity	3,035,000	3,184,800	149,800	4.9%

Cash Flow Statement

- It shows the Company's Cash Inflow and Outflow over a period of time
- Differences between Income Statement and Cash Flow Statement
  - Timing Differences (Working Capital Activities)
  - Capital Expenses Vs Operating Expenses (Investment Activities)
  - Financing Expenses not included in the Income Statement (Financing Activities)
- Represents the changes from last Year's Balance Sheet to this Year's Balance Sheet
  - Asset goes Up = Cash Negative
  - Asset goes down = Cash Positive
  - Liability goes up = Cash Positive
  - Liability goes down = Cash Negative
  - Owner's Equity goes up = Cash Positive
  - Owner's Equity goes down = Cash Negative

Cash Flow Statement

Adjusting Income to Cash

Balance Sheet (000's)	2009	2010	$ Change
Current Assets			
Cash	45,000	65,800	20,800
Accounts Receivable	45,000	60,000	15,000
Inventories	35,000	40,000	5,000
Prepaid Expenses	10,000	9,000	(1,000)
Total Current Assets	135,000	174,800	39,800
Property and Equipment			
Land	2,500,000	2,500,000	-
Building	450,000	550,000	100,000
Furniture & Equipment	50,000	75,000	25,000
Total Gross P&E	3,000,000	3,125,000	125,000
Less Accumulated Depreciaition	(300,000)	(365,000)	(65,000)
Net P&E	2,700,000	2,760,000	60,000
Long-Term Investments	200,000	250,000	50,000
Total Assets	3,035,000	3,184,800	149,800
Liabilities and Owners Equity			
Current Liabilities			
Accounts Payable	35,000	40,000	5,000
Accrued Income Taxes	12,000	10,000	(2,000)
Accrued Expenses	10,000	8,000	(2,000)
Current Portion of Long Term Debt	20,000	10,000	(10,000)
Total Current Liabilities	77,000	68,000	(9,000)
Long-Term Debt:	1,200,000	1,180,000	(20,000)
Deferred Income Taxes	**12,000**	**17,000**	**5,000**
Total Liabilties	1,289,000	1,265,000	(24,000)
Owners' Equity			
Common Stock	1,000,000	1,000,000	-
Paid-in-Capital	-	25,000	25,000
Retained Earnings	**746,000**	**894,800**	**148,800**
Total Owners' Equity	1,746,000	1,919,800	173,800
Total Liabilities & Owner's Equity	3,035,000	3,184,800	149,800

Cash Flow Statement (000's)	2010
Net Income	148,800
Plus Depreciation	65,000
Plus Deffered Taxes	5,000
Cash Income	218,800

Cash Flow Statement

Working Capital Activities

Balance Sheet (000's)	2009	2010	$ Change
Current Assets			
Cash	45,000	65,800	20,800
Accounts Receivable	45,000	60,000	15,000
Inventories	35,000	40,000	5,000
Prepaid Expenses	10,000	9,000	(1,000)
Total Current Assets	135,000	174,800	39,800
Property and Equipment			
Land	2,500,000	2,500,000	-
Building	450,000	550,000	100,000
Furniture & Equipment	50,000	75,000	25,000
Total Gross P&E	3,000,000	3,125,000	125,000
Less Accumulated Depreciaition	(300,000)	(365,000)	(65,000)
Net P&E	2,700,000	2,760,000	60,000
Long-Term Investments	200,000	250,000	50,000
Total Assets	3,035,000	3,184,800	149,800
Liabilities and Owners Equity			
Current Liabilities			
Accounts Payable	35,000	40,000	5,000
Accrued Income Taxes	12,000	10,000	(2,000)
Accrued Expenses	10,000	8,000	(2,000)
Current Portion of Long Term Debt	20,000	10,000	(10,000)
Total Current Liabilities	77,000	68,000	(9,000)
Long-Term Debt:	1,200,000	1,180,000	(20,000)
Deferred Income Taxes	12,000	17,000	5,000
Total Liabilties	1,289,000	1,265,000	(24,000)
Owners' Equity			
Common Stock	1,000,000	1,000,000	-
Paid-in-Capital	-	25,000	25,000
Retained Earnings	746,000	894,800	148,800
Total Owners' Equity	1,746,000	1,919,800	173,800
Total Liabilities & Owner's Equity	3,035,000	3,184,800	149,800

Cash Flow Statement (000's)	2010
Net Income	148,800
Plus Depreciation	65,000
Plus Deffered Taxes	5,000
Cash Income	218,800
Working Capital Activities	
Change in Accounts Receivable	(15,000)
Change in Inventory	(5,000)
Change in Prepaid Expenses	1,000
Change in Accounts Payable	5,000
Change in Accrued Income Taxes	(2,000)
Change in Accrued Expenses	(2,000)
Total Change in Working Capital	(18,000)
Operating Cash Flow (OCF)	200,800

Cash Flow Statement

Investment Activities

Balance Sheet (000's)	2009	2010	$ Change
Current Assets			
Cash	45,000	65,800	20,800
Accounts Receivable	45,000	60,000	15,000
Inventories	35,000	40,000	5,000
Prepaid Expenses	10,000	9,000	(1,000)
Total Current Assets	135,000	174,800	39,800
Property and Equipment			
Land	**2,500,000**	**2,500,000**	**-**
Building	**450,000**	**550,000**	**100,000**
Furniture & Equipment	**50,000**	**75,000**	**25,000**
Total Gross P&E	**3,000,000**	**3,125,000**	**125,000**
Less Accumulated Depreciaition	(300,000)	(365,000)	(65,000)
Net P&E	2,700,000	2,760,000	60,000
Long-Term Investments	**200,000**	**250,000**	**50,000**
Total Assets	3,035,000	3,184,800	149,800
Liabilities and Owners Equity			
Current Liabilities			
Accounts Payable	35,000	40,000	5,000
Accrued Income Taxes	12,000	10,000	(2,000)
Accrued Expenses	10,000	8,000	(2,000)
Current Portion of Long Term Debt	20,000	10,000	(10,000)
Total Current Liabilities	77,000	68,000	(9,000)
Long-Term Debt:	1,200,000	1,180,000	(20,000)
Deferred Income Taxes	12,000	17,000	5,000
Total Liabilties	1,289,000	1,265,000	(24,000)
Owners' Equity			
Common Stock	1,000,000	1,000,000	-
Paid-in-Capital	-	25,000	25,000
Retained Earnings	746,000	894,800	148,800
Total Owners' Equity	1,746,000	1,919,800	173,800
Total Liabilities & Owner's Equity	3,035,000	3,184,800	149,800

Cash Flow Statement (000's)	2010
Net Income	148,800
Plus Depreciation	65,000
Plus Deffered Taxes	5,000
Cash Income	218,800
Working Capital Activities	
Change in Accounts Receivable	(15,000)
Change in Inventory	(5,000)
Change in Prepaid Expenses	1,000
Change in Accounts Payable	5,000
Change in Accrued Income Taxes	(2,000)
Change in Accrued Expenses	(2,000)
Total Change in Working Capital	(18,000)
Operating Cash Flow (OCF)	200,800
Investment Activities	
Capital Expenditures	(125,000)
Investments (Change)	(50,000)
Total Financing Activities	(175,000)
Cash Available for Debt Service (CAFDS)	25,800

Cash Flow Statement

Financing Activities

Balance Sheet (000's)	2009	2010	$ Change
Current Assets			
Cash	45,000	65,800	20,800
Accounts Receivable	45,000	60,000	15,000
Inventories	35,000	40,000	5,000
Prepaid Expenses	10,000	9,000	(1,000)
Total Current Assets	135,000	174,800	39,800
Property and Equipment			
Land	2,500,000	2,500,000	-
Building	450,000	550,000	100,000
Furniture & Equipment	50,000	75,000	25,000
Total Gross P&E	3,000,000	3,125,000	125,000
Less Accumulated Depreciaition	(300,000)	(365,000)	(65,000)
Net P&E	2,700,000	2,760,000	60,000
Long-Term Investments	200,000	250,000	50,000
Total Assets	3,035,000	3,184,800	149,800
Liabilities and Owners Equity			
Current Liabilities			
Accounts Payable	35,000	40,000	5,000
Accrued Income Taxes	12,000	10,000	(2,000)
Accrued Expenses	10,000	8,000	(2,000)
Current Portion of Long Term Debt	**20,000**	**10,000**	**(10,000)**
Total Current Liabilities	77,000	68,000	(9,000)
Long-Term Debt:	**1,200,000**	**1,180,000**	**(20,000)**
Deferred Income Taxes	12,000	17,000	5,000
Total Liabilties	1,289,000	1,265,000	(24,000)
Owners' Equity			
Common Stock	1,000,000	1,000,000	-
Paid-in-Capital	-	25,000	25,000
Retained Earnings	746,000	894,800	148,800
Total Owners' Equity	1,746,000	1,919,800	173,800
Total Liabilities & Owner's Equity	3,035,000	3,184,800	149,800

Cash Flow Statement (000's)	2010
Net Income	148,800
Plus Depreciation	65,000
Plus Deffered Taxes	5,000
Cash Income	218,800
Working Capital Activities	
Change in Accounts Receivable	(15,000)
Change in Inventory	(5,000)
Change in Prepaid Expenses	1,000
Change in Accounts Payable	5,000
Change in Accrued Income Taxes	(2,000)
Change in Accrued Expenses	(2,000)
Total Change in Working Capital	(18,000)
Operating Cash Flow (OCF)	200,800
Investment Activities	
Capital Expenditures	(125,000)
Investments (Change)	(50,000)
Total Financing Activities	(175,000)
Cash Available for Debt Service (CAFDS)	25,800
Financing Activities	
ST Debt Payments	**(10,000)**
LT Payments	**(20,000)**
Equity Contribution	**25,000**
Total Financing Activities	(5,000)
Free Cash Flow	20,800

Cash Flow Statement

Recap

	Cash Flow Statement (000's)	2010
86	Net Income	148,800
87	Plus Depreciation	65,000
88	Plus Deffered Taxes	5,000
89	Cash Income	218,800
91	**Working Capital Activities**	
92	Change in Accounts Receivable	(15,000)
93	Change in Inventory	(5,000)
94	Change in Prepaid Expenses	1,000
95	Change in Accounts Payable	5,000
96	Change in Accrued Income Taxes	(2,000)
97	Change in Accrued Expenses	(2,000)
98	Total Change in Working Capital	(18,000)
100	Operating Cash Flow (OCF)	200,800
102	**Investment Activities**	
103	Capital Expenditures	(125,000)
104	Investments (Change)	(50,000)
105	Total Financing Activities	(175,000)
106		
107	Cash Available for Debt Service (CAFDS)	25,800
109	**Financing Activities**	
110	ST Debt Payments	(10,000)
111	LT Payments	(20,000)
112	Equity Contribution	25,000
113	Total Financing Activities	(5,000)
115	**Free Cash Flow**	20,800
117	Beginning Cash	45,000
119	Ending Cash	65,800

Balance Sheet (000's)	2009	2010	$ Change
Retained Earnings	746,000	894,800	148,800

Timing Differences (Working Capital Activities)

Investment Activities

Financing Activities

Balance Sheet (000's)	2009	2010	$ Change
Current Assets			
Cash	45,000	65,800	20,800

Financial Analysis

- Management Discussion and Analysis (MD&A)
- Equity & Bond Research – Wall Street Analysts
- The Financial Statements could be used by analysts to project the Company's performance and valuation
- For an effective performance of the Company, you need to ask the three following questions:
  1. How is the Company doing versus Last Year
  2. How is the Company doing versus its competitors / piers/ market
  3. How is the Company doing versus expectations

Financial Ratio Analysis

- Trend Analysis

	2010	Definition
Trend Analysis Ratios		
U.S. Revenue Growth	15.0%	(Rev 2010/Rev 2009) -1
Europe Revenue Growth	16.7%	
Asia Revenue Growth	25.0%	
Total Revenue Growth	15.6%	
EBITDA Growth	12.5%	(EBITDA 2010/EBITDA 2009) -1

Financial Ratio Analysis

- Liquidity Ratio
  - How well the Company manages **Cash**

	2010	Definition
Liquidity Ratios		
Current Ratio	2.57x	CA/CL
Quick ratio	1.85x	(Cash + A/R) / CL
Accounts Receivable Turnover (ART)	21.14x	Revenue/Avg AR
Accounts Receivable Days	17.26	365 / ART

Financial Ratio Analysis

- Solvency Ratio
  - How well the Company manages **Debt**

	2010	Definition
Solvency Ratios		
LTD / Total Capitalization	38.1%	LTD / (LTD + Equity)
EBITDA / Interest (Coverage Ratio)	3.61x	EBITDA / Interest
LTD / EBITDA (Leverage Ratio)	2.73x	LTD / EBITDA

Financial Ratio Analysis

- Activity and Operating Ratios
  - It measures productivity and efficiency for running the business

	2010	Definition
Activity Ratios / Operating Ratios		
Inventory Ratio (IR)	11.20x	Cost of Revenues/Avg Inventory
Inventory Ratio - Days	32.59	365 / IR

Please note that there are a lot of ratios establish by specialization (i.e. for a Hotel company is Occupancy Rate or for a Cable company is revenue per subscriber)

Financial Ratio Analysis

- Profitability Ratio
  - How profitable is the company

	2010	Definition
Profitability Ratios		
Gross Margin	62.2%	Gross Margin / Revenues
EBITDA Margin	39.0%	EBITDA / Revenue
EBIT Margin	33.2%	EBIT / Revenue
Return on Assets (ROA)	4.8%	NI / Avg Assets
Gross Return on Assets	11.8%	EBIT / Avg Assets
Return on Equity (ROE)	8.1%	NI / Avg Equity

Budget Planning, Implementation and Monitoring

Second Step: Building the Projections – Corporate Approach

Table of Contents

- Top to Bottom / Bottom to Top Line (Government Approach)
- Revenue Growth & Operating Assumptions
- Striving for Cash Flow / Profit
- Performance measurements

Top to Bottom Line Drivers

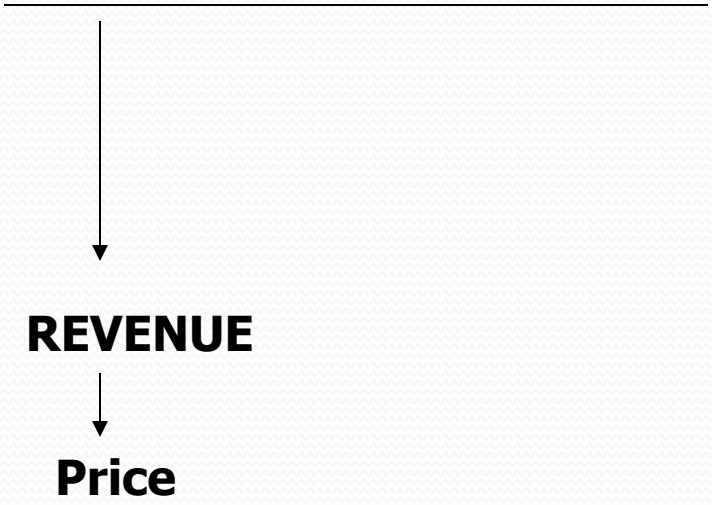
- Revenue Drivers
  - Growth Assumptions (increase/decrease)
    - Historical averages
    - Future assumptions / views
    - Demand and Supply: Volume Vs Price
  - “Volume” concept
    - “Same Store Sales”
    - “Acquisitions / “New Stores”
  - “Price” concept
    - Market Conditions / Pass-through concepts
- Revenue Segments (subsidiaries, product/services, geographical, departments)

Top to Bottom Line Drivers

- Cost / Expense Drivers
  - Direct Expenses / Gross Profit
    - Cost of Revenue as % of Revenue
      - Material / Labor / Overhead
    - Cost per Unit / Hourly Wages
  - Indirect Expenses / EBIT or EBITDA Margins
    - Operating Assumptions as % of Revenues
      - Selling / General / Administrative
      - Utility Expenses
      - Depreciation Expenses (% of Revenue / Based on Assets and Average Life)
  - Interest Expense
    - New or Existing Debt
  - Taxes / Tax Rate

Bottom to Top Line Approach

- Cost Drives Revenue
  - Gross Margin / Operating Margin
  - EBITDA / Net Income



Operating Assumptions / Drivers

	Ratio Analysis / Assumptions	2009	2010	2011	2012	2013	2014	2015
123	**Trend Analysis Ratios**							
124	Revenue Growth - USA		15.0%	**5.0%**	**5.0%**	**5.0%**	**5.0%**	**5.0%**
125	Revenue Growth - Europe		16.7%	**5.0%**	**5.0%**	**5.0%**	**5.0%**	**5.0%**
126	Revenue Growth - Asia		25.0%	**10.0%**	**10.0%**	**10.0%**	**10.0%**	**10.0%**
127	Revenue Growth		15.6%					
129	**Liquidity Ratios**							
130	Current Ratio	1.75x	2.56x	3.53x	4.04x	4.38x	4.60x	4.74x
131	Quick ratio	1.23x	1.91x	2.82x	3.32x	3.66x	3.88x	4.02x
132	Accounts Receivable Turnover (ART)		21.14x	**21.14x**	**21.14x**	**21.14x**	**21.14x**	**21.14x**
133	Accounts Receivable Days		17.26	17.26	17.26	17.26	17.26	17.26
135	**Solvency Ratios**							
136	Debt/Equity Ratio	68.7%	61.5%	54.3%	47.0%	39.6%	32.3%	25.3%
137	LTD / Total Capitalization	40.7%	38.1%	35.2%	32.0%	28.4%	24.4%	20.2%
138	**EBITDA / Interest (Coverage Ratio)**	2.96x	3.61x	3.84x	4.25x	4.75x	5.46x	6.47x
139	EBIT / Interest	2.50x	3.07x	3.26x	3.61x	4.04x	4.63x	5.49x
140	Fixed Charge Coverage Ratio		1.72x	1.81x	1.86x	1.82x	1.81x	1.82x
141	Cash Avail.for Debt Service / Debt Svce		0.97x	1.26x	1.21x	1.16x	1.12x	1.10x
142	**LTD / EBITDA (Leverage Ratio)**	3.12x	2.73x	2.48x	2.22x	1.93x	1.63x	1.32x

Operating Assumptions / Drivers

	Ratio Analysis / Assumptions	2009	2010	2011	2012	2013	2014	2015
144	**Activity Ratios / Operating Ratios**							
145	Inventory Ratio (IR)		12.92x	**12.92x**	**12.92x**	**12.92x**	**12.92x**	**12.92x**
146	Inventory Ratio - Days		28.24	28.24	28.24	28.24	28.24	28.24
147	Fixed Asset Turnover Ratio		0.407x	0.418x	0.430x	0.442x	0.454x	0.467x
148	Asset Turnover Ratio		0.36x	0.36x	0.37x	0.37x	0.38x	0.39x
150	**Profitability Ratios**							
151	Gross Margin	64.1%	62.2%	62.1%	62.0%	61.9%	61.9%	61.8%
152	EBITDA Margin	40.1%	39.0%	38.9%	38.9%	38.8%	38.7%	38.6%
153	EBIT Margin	33.9%	33.2%	33.1%	33.0%	32.9%	32.9%	32.8%
154	Return on Assets (ROA)		4.8%	5.0%	5.3%	5.6%	5.9%	6.3%
155	Gross Return on Assets		11.8%	11.9%	12.1%	12.3%	12.6%	12.8%
156	Return on Equity (ROE)		8.1%	8.0%	8.1%	8.2%	8.2%	8.3%
157								
158	**Operating Assumptions**							
159	Cost of Revenues % of Revenues							
160	U.S.	27.5%	29.3%	**29.3%**	**29.3%**	**29.3%**	**29.3%**	**29.3%**
161	Europe	83.3%	82.1%	**82.1%**	**82.1%**	**82.1%**	**82.1%**	**82.1%**
162	Asia	62.5%	70.0%	**70.0%**	**70.0%**	**70.0%**	**70.0%**	**70.0%**
163	Operating Expense % of Revenues							
164	Administrative & General	15.1%	14.9%	**14.9%**	**14.9%**	**14.9%**	**14.9%**	**14.9%**
165	Marketing Expenses	7.8%	7.2%	**7.2%**	**7.2%**	**7.2%**	**7.2%**	**7.2%**
166	Other Operating Expenses	1.0%	1.1%	**1.1%**	**1.1%**	**1.1%**	**1.1%**	**1.1%**
167	Depreciation Expense % of Revenues	6.3%	5.9%	**5.9%**	**5.9%**	**5.9%**	**5.9%**	**5.9%**
168	Tax Rate			**40%**	**40%**	**40%**	**40%**	**40%**

Operating Assumptions / Drivers

	Ratio Analysis / Assumptions	2009	2010	2011	2012	2013	2014	2015
169								
170	**Cash Flow Statement Assumptions as % of Revenues**							
171	Prepaid Expenses	1.0%	0.8%	**0.8%**	**0.8%**	**0.8%**	**0.8%**	**0.8%**
172	Accrued Income Taxes	1.3%	0.9%	**0.9%**	**0.9%**	**0.9%**	**0.9%**	**0.9%**
173	Accounts Payable	3.6%	3.6%	**3.6%**	**3.6%**	**3.6%**	**3.6%**	**3.6%**
174	Accrued Income Taxes	1.3%	0.9%	**0.9%**	**0.9%**	**0.9%**	**0.9%**	**0.9%**
175	Accrued Expenses	1.0%	0.7%	**0.7%**	**0.7%**	**0.7%**	**0.7%**	**0.7%**
176	Capital Expenditures		11.3%	**11.3%**	**11.3%**	**11.3%**	**11.3%**	**11.3%**
177	Deferred Income Taxes	1.3%	1.5%	**1.5%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**
178								
179	**Debt Assumptions**							
180	Short-term Outstanding Debt	20,000	10,000	-	-	-	-	-
181	Principal Payments - Short-Term		(10,000)	(10,000)	-	-	-	-
182	Long-term Outstanding Debt	1,200,000	1,180,000	1,130,000	1,060,000	970,000	860,000	730,000
183	Principal Payments - LongTerm		(20,000)	(50,000)	(70,000)	(90,000)	(110,000)	(130,000)
184	Total Outstanding	1,220,000	1,190,000	1,130,000	1,060,000	970,000	860,000	730,000
185	Interest Payments			118,506	112,531	105,560	96,598	85,643
186	Average Interest Rate			10.0%	10.0%	10.0%	10.0%	10.0%
187								
188	Total Interest + Principal payments (Debt Service)			178,506	182,531	195,560	206,598	215,643

Results

		Historical		Projections				
	Income Statement (000's)	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
50	**Revenues by Geography**							
51	U.S.	800,000	920,000	966,000	1,014,300	1,065,015	1,118,266	1,174,179
52	Europe	120,000	140,000	147,000	154,350	162,068	170,171	178,679
53	Asia	40,000	50,000	55,000	60,500	66,550	73,205	80,526
54	Total Revenue	960,000	1,110,000	1,168,000	1,229,150	1,293,633	1,361,642	1,433,384
56	**Cost of Revenues by Geography**							
57	U.S.	220,000	270,000	283,500	297,675	312,559	328,187	344,596
58	Europe	100,000	115,000	120,750	126,788	133,127	139,783	146,772
59	Asia	25,000	35,000	38,500	42,350	46,585	51,244	56,368
60	Total Cost of Revenue	345,000	420,000	442,750	466,813	492,271	519,213	547,736
62	Gross Profit	615,000	690,000	725,250	762,338	801,362	842,428	885,648
64	**Operating Expenses**							
65	Administrative & General	145,000	165,000	173,622	182,711	192,297	202,406	213,071
66	Marketing Expenses	75,000	80,000	84,180	88,587	93,235	98,136	103,307
67	Other Operating Expenses	10,000	12,000	12,627	13,288	13,985	14,720	15,496
68	Total Operating Expenses	230,000	257,000	270,429	284,587	299,517	315,263	331,874
70	**EBITDA**	385,000	433,000	454,821	477,751	501,845	527,165	553,774
72	**Depreciation**	60,000	65,000	68,396	71,977	75,753	79,736	83,937
74	**EBIT**	325,000	368,000	386,425	405,773	426,092	447,429	469,837
76	**Interest Expense**	130,000	120,000	118,506	112,531	105,560	96,598	85,643
78	EBT	195,000	248,000	267,919	293,242	320,532	350,832	384,194
80	**Taxes**	78,000	99,200	107,167	117,297	128,213	140,333	153,678
82	Net Income	117,000	148,800	160,751	175,945	192,319	210,499	230,516

Results

		Historical	Projections				
	Cash Flow Statement (000's)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
86	Net Income	148,800	160,751	175,945	192,319	210,499	230,516
87	Plus Depreciation	65,000	68,396	71,977	75,753	79,736	83,937
88	Plus Deffered Taxes	5,000	888	937	988	1,042	1,099
89	Cash Income	218,800	230,036	248,859	269,060	291,277	315,552
91	**Working Capital Activities**						
92	Change in Accounts Receivable	(15,000)	4,757	(2,892)	(3,050)	(3,217)	(3,393)
93	Change in Inventory	(5,000)	740	(1,862)	(1,970)	(2,085)	(2,207)
94	Change in Prepaid Expenses	1,000	(470)	(496)	(523)	(551)	(582)
95	Change in Accounts Payable	5,000	2,090	2,204	2,324	2,451	2,585
96	Change in Accrued Income Taxes	(2,000)	523	551	581	613	646
97	Change in Accrued Expenses	(2,000)	418	441	465	490	517
98	Total Change in Working Capital	(18,000)	8,057	(2,055)	(2,173)	(2,299)	(2,433)
99							
100	Operating Cash Flow (OCF)	200,800	238,093	246,804	266,887	288,977	313,119
102	**Investment Activities**						
103	Capital Expenditures	(125,000)	(131,532)	(138,418)	(145,679)	(153,338)	(161,417)
104	Investments (Change)	(50,000)	-	-	-	-	-
105	Total Financing Activities	(175,000)	(131,532)	(138,418)	(145,679)	(153,338)	(161,417)
106							
107	Cash Available Before Financing Activities	25,800	106,561	108,386	121,207	135,639	151,702
109	**Financing Activities**						
110	ST Debt Payments	(10,000)	(10,000)	-	-	-	-
111	LT Payments	(20,000)	(50,000)	(70,000)	(90,000)	(110,000)	(130,000)
112	Equity Contribution / (Dividend)	24,200	-	-	-	-	-
113	Total Financing Activities	(5,800)	(60,000)	(70,000)	(90,000)	(110,000)	(130,000)
115	**Free Cash Flow**	20,000	46,561	38,386	31,207	25,639	21,702
117	Beginning Cash	50,000	70,000	116,561	154,947	186,155	211,794
119	Ending Cash	70,000	116,561	154,947	186,155	211,794	233,496

Results

	Historical		Projections				
Balance Sheet (000's)	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Current Assets							
Cash	50,000	70,000	116,561	154,947	186,155	211,794	233,496
Accounts Receivable	45,000	60,000	55,243	58,135	61,185	64,402	67,795
Inventories	30,000	35,000	34,260	36,122	38,092	40,177	42,384
Prepaid Expenses	10,000	9,000	9,470	9,966	10,489	11,040	11,622
Total Current Assets	135,000	174,000	215,535	259,171	295,921	327,413	355,297
Property and Equipment							
Land	2,500,000	2,500,000					
Building	450,000	550,000					
Furniture & Equipment	50,000	75,000					
Total Gross P&E	3,000,000	3,125,000	3,256,532	3,394,949	3,540,629	3,693,967	3,855,384
Less Accumulated Depreciaition	(300,000)	(365,000)	(433,396)	(505,374)	(581,127)	(660,863)	(744,800)
Net P&E	2,700,000	2,760,000	2,823,135	2,889,576	2,959,502	3,033,104	3,110,584
Long-Term Investments	200,000	250,000	250,000	250,000	250,000	250,000	250,000
Total Assets	3,035,000	3,184,000	3,288,670	3,398,747	3,505,423	3,610,517	3,715,881
Liabilities and Owners Equity							
Current Liabilities							
Accounts Payable	35,000	40,000	42,090	44,294	46,617	49,068	51,653
Accrued Income Taxes	12,000	10,000	10,523	11,073	11,654	12,267	12,913
Accrued Expenses	10,000	8,000	8,418	8,859	9,323	9,814	10,331
Current Portion of Long Term Debt	20,000	10,000	-	-	-	-	-
Total Current Liabilities	77,000	68,000	61,031	64,226	67,595	71,149	74,898
Long-Term Debt:	1,200,000	1,180,000	1,130,000	1,060,000	970,000	860,000	730,000
Deferred Income Taxes	12,000	17,000	17,888	18,825	19,812	20,854	21,953
Total Liabilties	1,289,000	1,265,000	1,208,919	1,143,051	1,057,408	952,003	826,850
Owners' Equity							
Common Stock	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Paid-in-Capital	-	24,200	24,200	24,200	24,200	24,200	24,200
Retained Earnings	746,000	894,800	1,055,551	1,231,496	1,423,815	1,634,315	1,864,831
Total Owners' Equity	1,746,000	1,919,000	2,079,751	2,255,696	2,448,015	2,658,515	2,889,031
Total Liabilities & Owner's Equity	3,035,000	3,184,000	3,288,670	3,398,747	3,505,423	3,610,517	3,715,881

Performance Measurements

	Quick & Dirty Cash Flow	2012	% of Rev
192	Revenues	1,229,150	100.0%
193	Less Cost of Revenue	(466,813)	-38.0%
194	Less Operating Expenses	(284,587)	-23.2%
195	EBITDA	477,751	38.9%
197	Less Interest	(112,531)	-9.2%
198	Less Cash Taxes	(116,360)	-9.5%
199	Less Working Capital	(2,055)	-0.2%
200	Less Capex	(138,418)	-11.3%
201	**Cash Flow Available for Debt Service**	**108,386**	**8.8%**
203	Less Principal Payments	(70,000)	-5.7%
204	Free Cash Flow	38,386	3.1%

Performance Measurements

- Solvency Ratios – Managing Debt
  - Leverage Ratio / Debt Capacity
  - Coverage Ratio / Adequate coverage of Obligations
- Profitability Ratios
  - Cost efficiencies / Cost Rationalization
  - Revenue Drivers / Acquisition Growth Rationale
  - Striving for Higher Margin Business
- Activity Ratios
  - Inventory Management
  - Working Capital Management

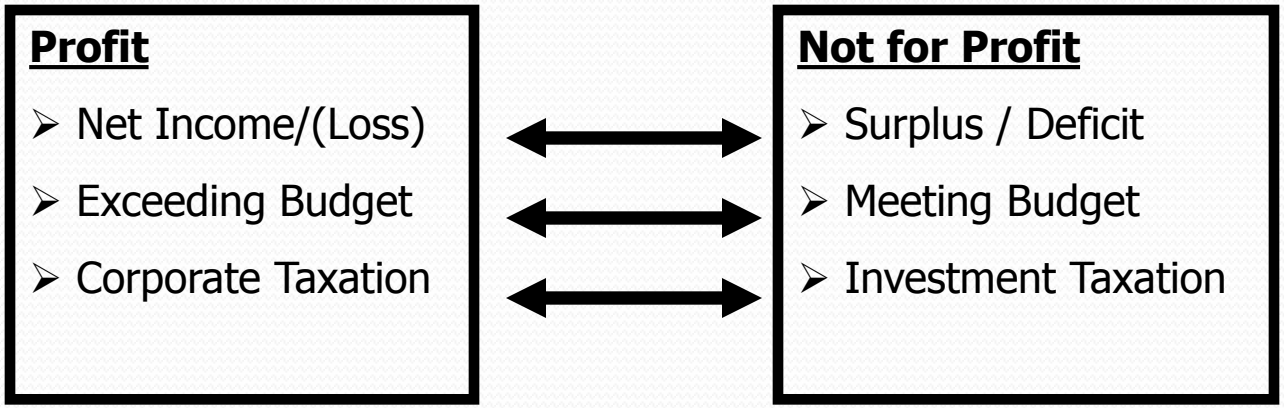
Budget Planning, Implementation and Monitoring

Step Three: Understanding Government's Financial Statements & Fiscal Budget

Table of Contents

- Corporate Vs Government Planning
- An Overview of Government / Public / Federal Budgeting
- Constitution Economics
- Public Finance – Managing Debt

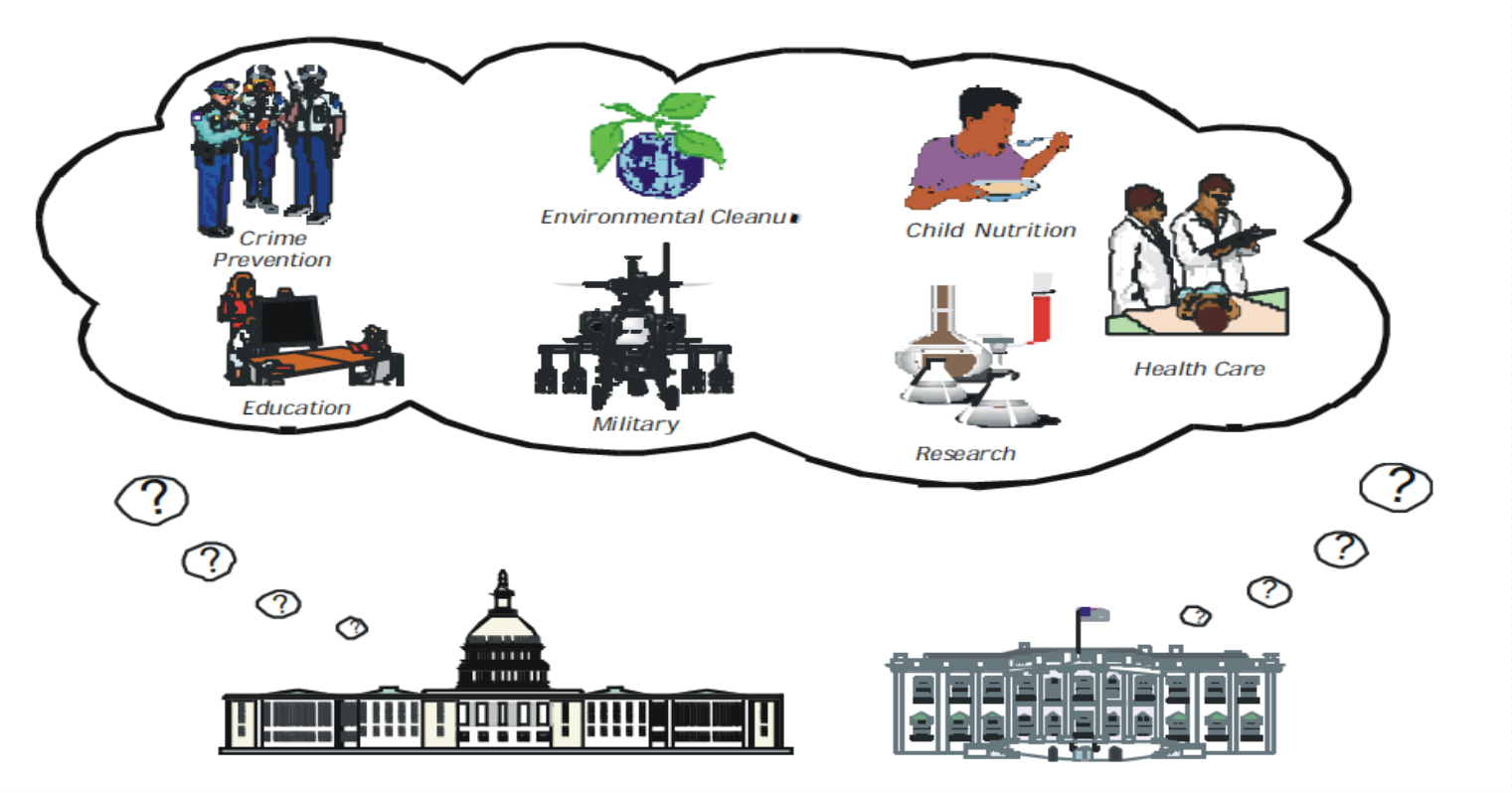
Corporate Vs Government "Profit & Loss"



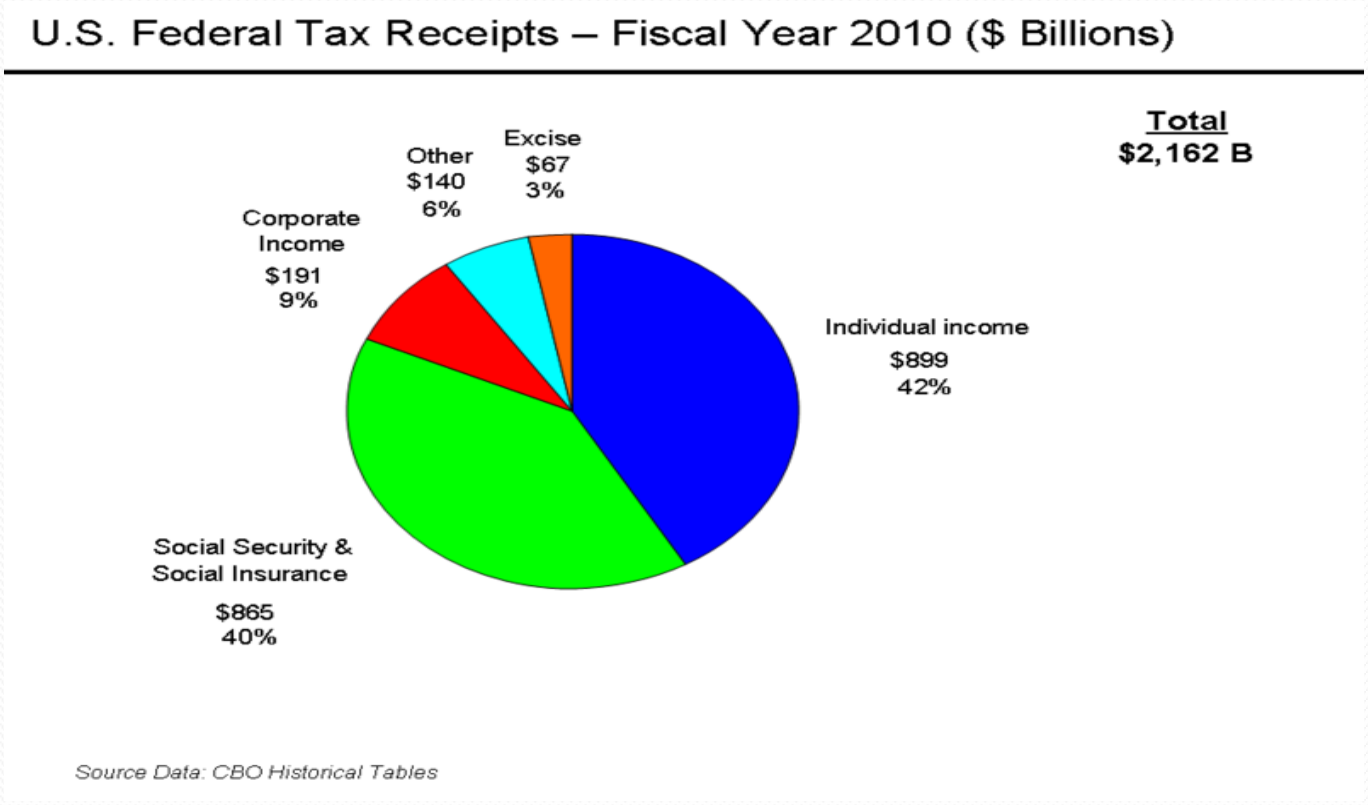
What is the Federal Budget

- A plan for how the Government spends your money.
- A plan for how the Government pays for its activities.
- How much revenue does it raise through different kinds of taxes
- A plan for how the Government manages it's Debt obligations

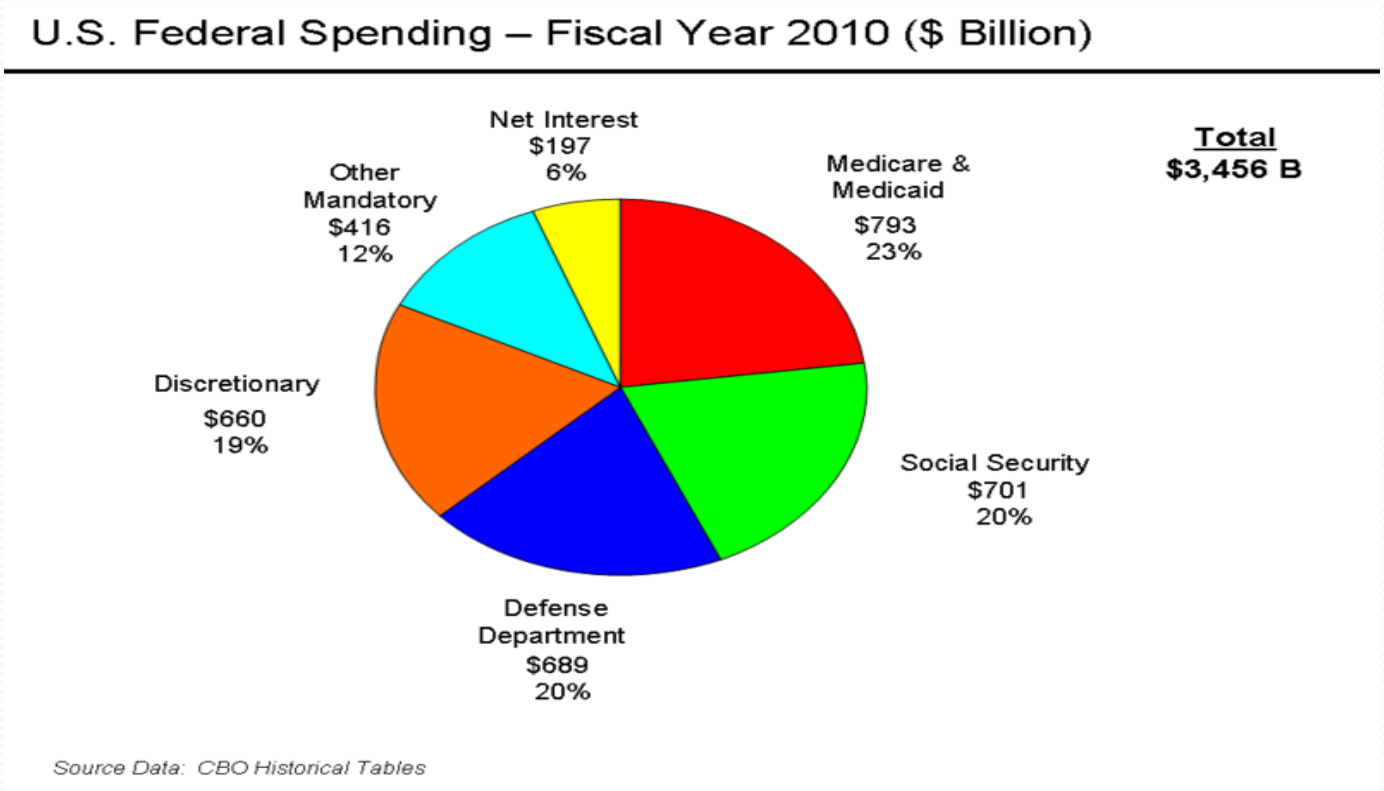
What is the Federal Budget



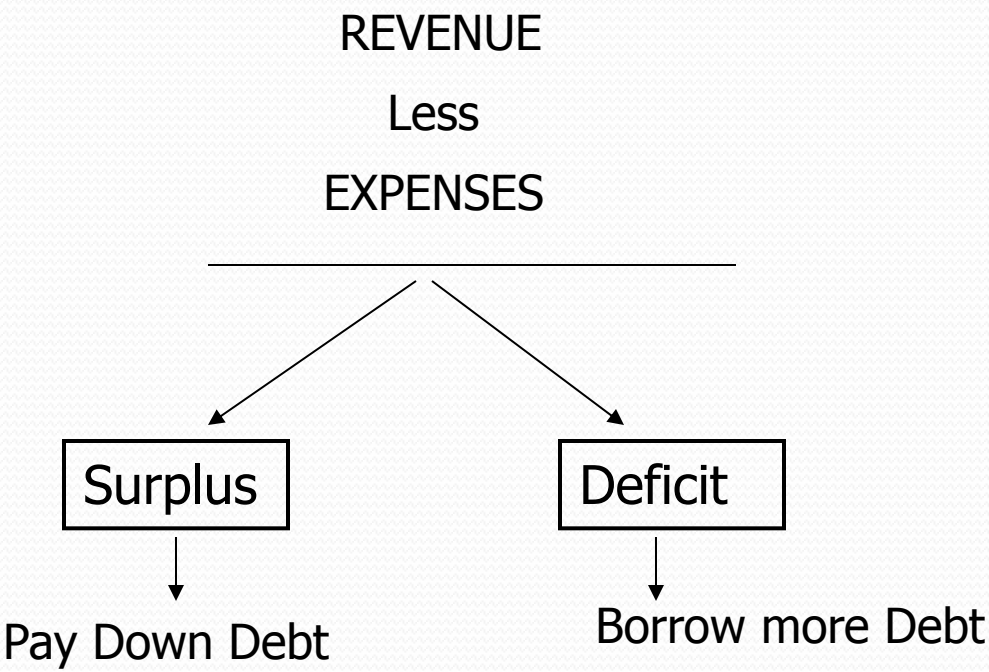
What is the Federal Budget



What is the Federal Budget



Government's Goal: Balance Budget



Balance Budget Approach

Government Revenues

Government Revenues

- Individual Income Taxes
- Corporate Income Taxes
- Social Insurance Payroll Taxes
    - Social Security Taxes
    - Medicare Taxes
    - Unemployment Insurance Taxes
    - Federal employee retirement payments
- Excise taxes – taxes on alcohol, tobacco, transportation fuels and telephone services
- Miscellaneous Revenues including Estate and Gift Taxes, Customs Duties, Fines, penalties

Government Expenses

Government Spending

Mandatory Spending

- Social Security
- Medicare (elderly and disabled)
- Medicaid (poor)
- Other Mandatory
  - Food Stamps
  - Supplement Security Income
  - Child Nutrition
  - Veterans' Pensions

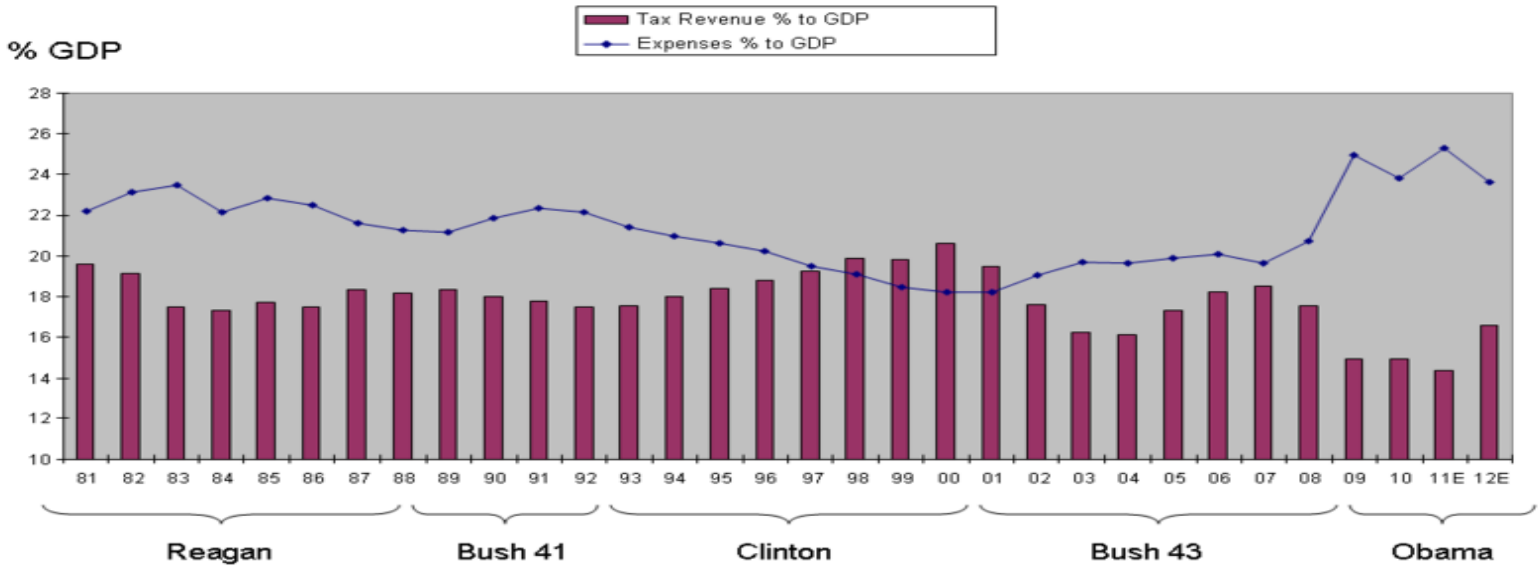
Interest Payment

Discretionary Spending

- National Defense
- International Affairs
- Technology, Space, Science
- Energy
- Natural Resources & Environment
- Agriculture
- Commerce and Housing
- Transportation
- Education, Training and Social Services
- General Government

Tracking Performance of the Budget Vs Economy

Federal Tax Revenue & Expenses as % to GDP (FY 1981 – 2012)



Averages	Reagan	Bush 41	Clinton	Bush 43	Obama
Expenses:	22.4	21.9	19.8	19.6	24.4
Revenue:	18.2	17.9	19.0	17.6	15.2

Source Data: Congressional Budget Office; 2011 Budget

Tracking Performance of the Budget Vs Economy

Table S–1. Budget Totals

(In billions of dollars and as a percent of GDP)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Totals 2012-2016	Totals 2012-2021
Budget Totals in Billions of Dollars:														
Receipts	2,163	2,174	2,627	3,003	3,333	3,583	3,819	4,042	4,257	4,473	4,686	4,923	16,366	38,747
Outlays	3,456	3,819	3,729	3,771	3,977	4,190	4,468	4,669	4,876	5,154	5,422	5,697	20,134	45,952
Deficit	1,293	1,645	1,101	768	645	607	649	627	619	681	735	774	3,769	7,205
Debt held by the public	9,019	10,856	11,881	12,784	13,562	14,301	15,064	15,795	16,513	17,284	18,103	18,967		
Debt net of financial assets	7,894	9,505	10,585	11,344	11,988	12,595	13,243	13,869	14,488	15,169	15,903	16,677		
Gross domestic product (GDP)	14,508	15,080	15,813	16,752	17,782	18,804	19,791	20,755	21,679	22,624	23,608	24,633		
Budget Totals as a Percent of GDP:														
Receipts	14.9%	14.4%	16.6%	17.9%	18.7%	19.1%	19.3%	19.5%	19.6%	19.8%	19.9%	20.0%	18.3%	19.0%
Outlays	23.8%	25.3%	23.6%	22.5%	22.4%	22.3%	22.6%	22.5%	22.5%	22.8%	23.0%	23.1%	22.7%	22.7%
Deficit	8.9%	10.9%	7.0%	4.6%	3.6%	3.2%	3.3%	3.0%	2.9%	3.0%	3.1%	3.1%	4.3%	3.7%
Debt held by the public	62.2%	72.0%	75.1%	76.3%	76.3%	76.1%	76.1%	76.1%	76.2%	76.4%	76.7%	77.0%		
Debt net of financial assets	54.4%	63.0%	66.9%	67.7%	67.4%	67.0%	66.9%	66.8%	66.8%	67.0%	67.4%	67.7%		
Memorandum, budget totals with AMT relief fully paid for:														
In billions of dollars:														
Deficit	1,293	1,645	1,101	768	645	579	475	452	415	445	463	464		
Debt held by the public	9,019	10,856	11,881	12,784	13,562	14,274	14,862	15,419	15,932	16,467	17,015	17,568		
Debt net of financial assets	7,894	9,505	10,585	11,344	11,988	12,567	13,041	13,493	13,907	14,352	14,815	15,278		
As a percent of GDP:														
Deficit	8.9%	10.9%	7.0%	4.6%	3.6%	3.1%	2.4%	2.2%	1.9%	2.0%	2.0%	1.9%		
Debt held by the public	62.2%	72.0%	75.1%	76.3%	76.3%	75.9%	75.1%	74.3%	73.5%	72.8%	72.1%	71.3%		
Debt net of financial assets	54.4%	63.0%	66.9%	67.7%	67.4%	66.8%	65.9%	65.0%	64.2%	63.4%	62.8%	62.0%		

Tracking Performance of the Budget Vs Economy

Table S–4. Proposed Budget by Category

(In billions of dollars)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Totals 2012-2016	Totals 2012-2021
Outlays:														
Appropriated ("discretionary") programs:														
Security	815	908	884	819	808	818	829	845	863	880	897	914	4,158	8,559
Non-security	491	507	456	423	412	402	408	413	426	434	449	453	2,101	4,275
Subtotal, appropriated programs	1,306	1,416	1,340	1,243	1,220	1,220	1,237	1,258	1,289	1,314	1,346	1,367	6,259	12,833
Mandatory programs:														
Social Security	701	742	761	802	846	894	945	1,002	1,062	1,126	1,196	1,269	4,248	9,902
Medicare	446	488	485	528	557	582	631	650	672	732	785	840	2,783	6,462
Medicaid	273	276	269	288	352	391	427	457	488	522	557	595	1,727	4,345
Troubled Asset Relief Program (TARP)[1]	–110	–28	13	10	5	4	2	1	*	*	*	.....	34	35
Other mandatory programs	644	716	612	573	570	596	654	665	671	709	736	771	3,004	6,557
Subtotal, mandatory programs	1,954	2,194	2,140	2,199	2,331	2,467	2,659	2,774	2,892	3,090	3,273	3,475	11,797	27,302
Net interest	196	207	242	321	418	494	562	627	685	741	793	844	2,037	5,726
Disaster costs[2]	.....	2	6	8	8	9	10	10	10	10	10	10	42	92
Total outlays	3,456	3,819	3,729	3,771	3,977	4,190	4,468	4,669	4,876	5,154	5,422	5,697	20,134	45,952
Receipts:														
Individual income taxes	899	956	1,141	1,344	1,508	1,648	1,786	1,923	2,056	2,187	2,315	2,439	7,427	18,346
Corporation income taxes	191	198	329	405	440	455	467	479	479	482	495	512	2,096	4,544
Social insurance and retirement receipts:														
Social Security payroll taxes	632	559	659	730	772	815	870	915	963	1,014	1,056	1,109	3,845	8,901
Medicare payroll taxes	180	187	201	217	235	250	268	282	297	313	326	343	1,171	2,733
Unemployment insurance	45	52	57	61	79	89	88	87	83	73	72	75	375	765
Other retirement	8	8	8	8	8	9	9	9	9	9	10	10	42	89
Excise taxes	67	74	103	121	138	145	149	155	164	176	182	189	656	1,522
Estate and gift taxes	19	12	14	15	25	28	30	32	35	37	40	43	111	299
Customs duties	25	28	30	33	36	38	39	41	44	47	49	52	176	408
Deposits of earnings, Federal Reserve System	76	80	66	47	38	37	41	45	47	49	52	53	230	476
Other miscellaneous receipts	21	19	20	21	53	69	73	75	79	85	91	97	237	663
Total receipts	2,163	2,174	2,627	3,003	3,333	3,583	3,819	4,042	4,257	4,473	4,686	4,923	16,366	38,747
Deficit	**1,293**	**1,645**	**1,101**	**768**	**645**	**607**	**649**	**627**	**619**	**681**	**735**	**774**	**3,769**	**7,205**
Net interest	196	207	242	321	418	494	562	627	685	741	793	844	2,037	5,726
Primary deficit/surplus (–)	**1,097**	**1,438**	**860**	**447**	**227**	**112**	**87**	**–***	**–66**	**–59**	**–58**	**–70**	**1,732**	**1,479**

EBITDA

Assessing Government's performance

Coverage Ratio = The First performance measurement

- Projecting Expenses – Mandatory
- Adjusting Expenses – Discretionary
- View on the Economy and Outlook
- Achieving desired Growth
  - To Increase Tax or not to
  - Tax Incentives on Investments / businesses / lending
- Debt Management (Payment / Borrow)

Assessing Government's performance

The Relationship of Surplus and Debt = The Second performance measurement

Table 4–1. Federal Government Financing and Debt

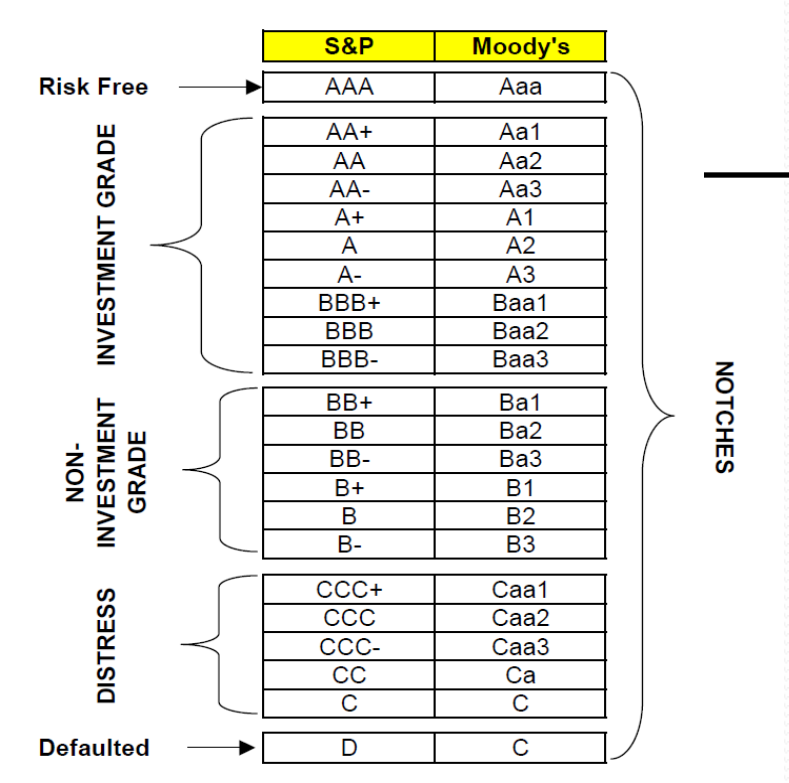
(In billions of dollars)

	2000 Actual	Estimate					
		2001	2002	2003	2004	2005	2006
Federal Government financing:							
Unified budget surplus	236	281	231	242	262	269	305
On-budget surplus/reserve for contingencies[1]	87	125	59	49	52	32	52
Off-budget surplus	150	156	172	193	211	237	252
Financing other than the change in debt held by the public	−13	−45	−4	−15	−16	−15	−14
Amount available to repay debt held by the public;	223	236	227	227	246	254	291
Federal Government debt:							
Debt subject to legal limit	5,592	5,588	5,627	5,688	5,749	5,822	5,881
Gross Federal debt	5,629	5,625	5,664	5,724	5,784	5,856	5,913
Debt held by Government accounts.	2,219	2,451	2,717	3,004	3,310	3,636	3,985
Debt held by the public	3,410	3,174	2,947	2,720	2,473	2,219	1,928

[1] The actual amount of annual debt retirement will vary depending upon the availability of eligible redeemable debt, and the use, if any, of the contingency reserve.

Assessing Government's performance

The Relationship of Surplus and Debt = The Second performance measurement



Capital markets

- **Coupon Vs Yield (secondary)**
- **Maturity (short Vs long)**

Other Concepts:

- Quantitative Easing (QE1 & 2)

Budget Planning, Implementation and Monitoring

Last Step: Budget Implementation and Monitoring – Government Approach

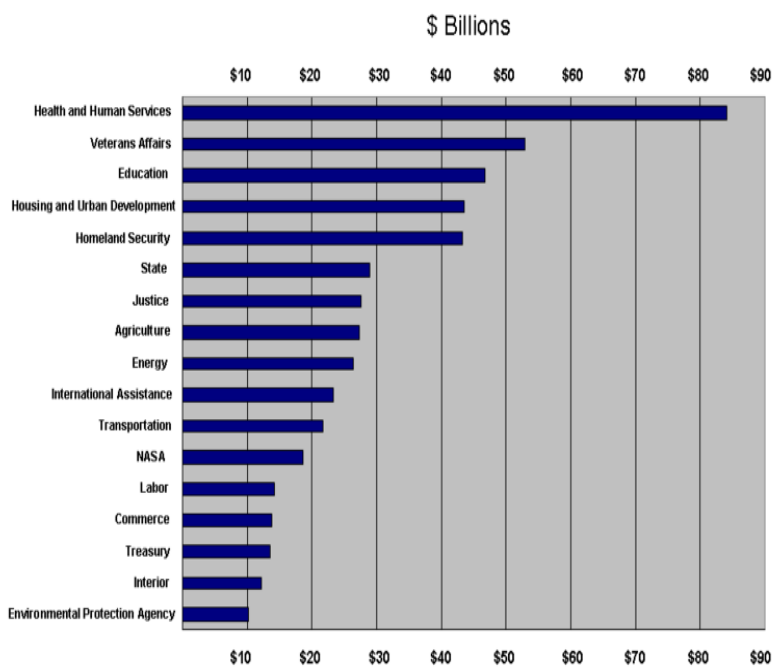
Table of Contents

- Distinguish Mandatory Spending Vs Discretionary
- Discipline on Discretionary – The IRR/Payback approach
- Implement and Revaluate – Set up Performance Ratios
- Moody's Rating Approach

Spending Drives Revenues

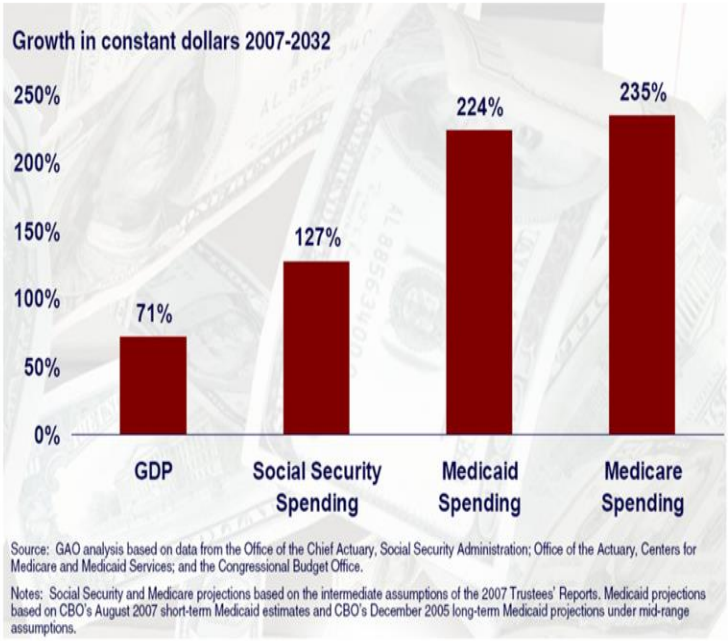
Can the U.S. outgrow the problem?

Discretionary Spending – 2010E



Source: 2011 Budget

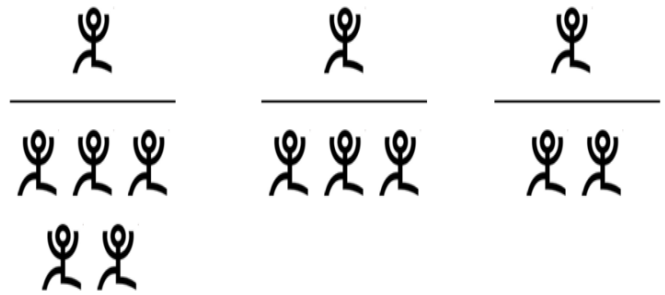
Projected Growth in Mandatory Spending vs. GDP



Source: GAO-U.S. Financial Condition and Fiscal Future Briefing; January 2008.

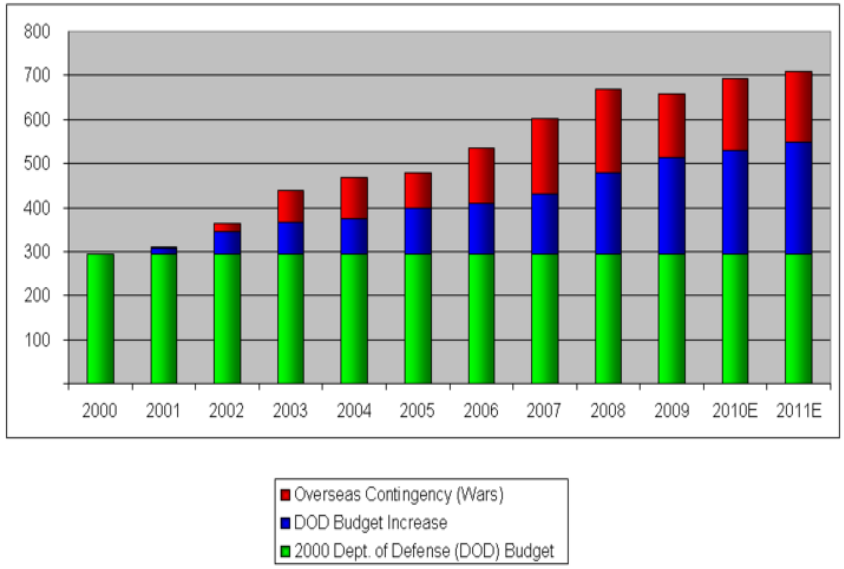
Spending Drives Revenues

Social Security: Worker to Beneficiary Ratio



Source: Social Security Administration Trustees Report Table IV.B2
Ratio of covered workers to beneficiaries

U.S. Defense Spending Trends 2000-2011 ($ Billion)



Source Data: OMB – Annual Budget Documents
Data excludes Homeland Security and Veteran's Affairs

Spending Drives Revenues

Table 2–2. Spending Summary
(In billions of dollars)

	Estimate					
	2001	2002	2003	2004	2005	2006
Outlays:						
Discretionary	649	692	712	731	754	770
Mandatory:						
Social Security	430	452	474	498	524	553
Medicare	216	226	239	252	279	292
Medicaid	129	142	153	166	181	196
Other mandatory	226	260	264	268	286	285
Subtotal, mandatory	1,001	1,081	1,129	1,184	1,270	1,326
Net interest	206	188	175	161	145	127
Total, outlays	1,856	1,961	2,016	2,077	2,169	2,224
Receipts	2,137	2,192	2,258	2,339	2,438	2,529
Unified surplus	281	231	242	262	269	305
On-budget surplus/contingency	125	59	49	52	32	52
Off-budget surplus	156	172	193	211	237	252

Revenue Discretion

Table 2–1. Revenues By Source—Summary

(In billions of dollars)

Source	2000 Actual	Estimate					
		2001	2002	2003	2004	2005	2006
Individual income taxes	1,004	1,073	1,079	1,092	1,118	1,157	1,197
Corporate income taxes	207	213	219	227	235	244	252
Payroll taxes	653	690	726	766	806	856	896
Excise taxes	69	71	74	76	78	81	82
Estate and gift taxes	29	31	29	27	28	25	22
Customs duties	20	21	23	24	25	26	28
Miscellaneous revenues	43	38	43	45	48	49	51
Total revenues	**2,025**	**2,137**	**2,192**	**2,258**	**2,339**	**2,438**	**2,529**

Note: The revenues listed in this table do not include revenues from the Government's business-like activities—such as entrance fees at national parks. Instead of counting these collections as revenues, the Government subtracts them from spending. This produces totals for revenues and spending that show the level of Government activity without the business-like activity.

The 2011 U.S Budget – Case Study - Lessons Learned

- 2011 Budget of the United States federal government
- **Submitted** February 1, 2010 by Barack Obama to the Congress
- **Congress Passed** Public Law 112-10
- **Total revenue** $2.17 trillion *(estimated)*
- **Total expenditures** $3.82 trillion *(estimated)*
- **Deficit** *$1.65 trillion* (estimated)

The 2011 U.S Budget – Case Study - Lessons Learned

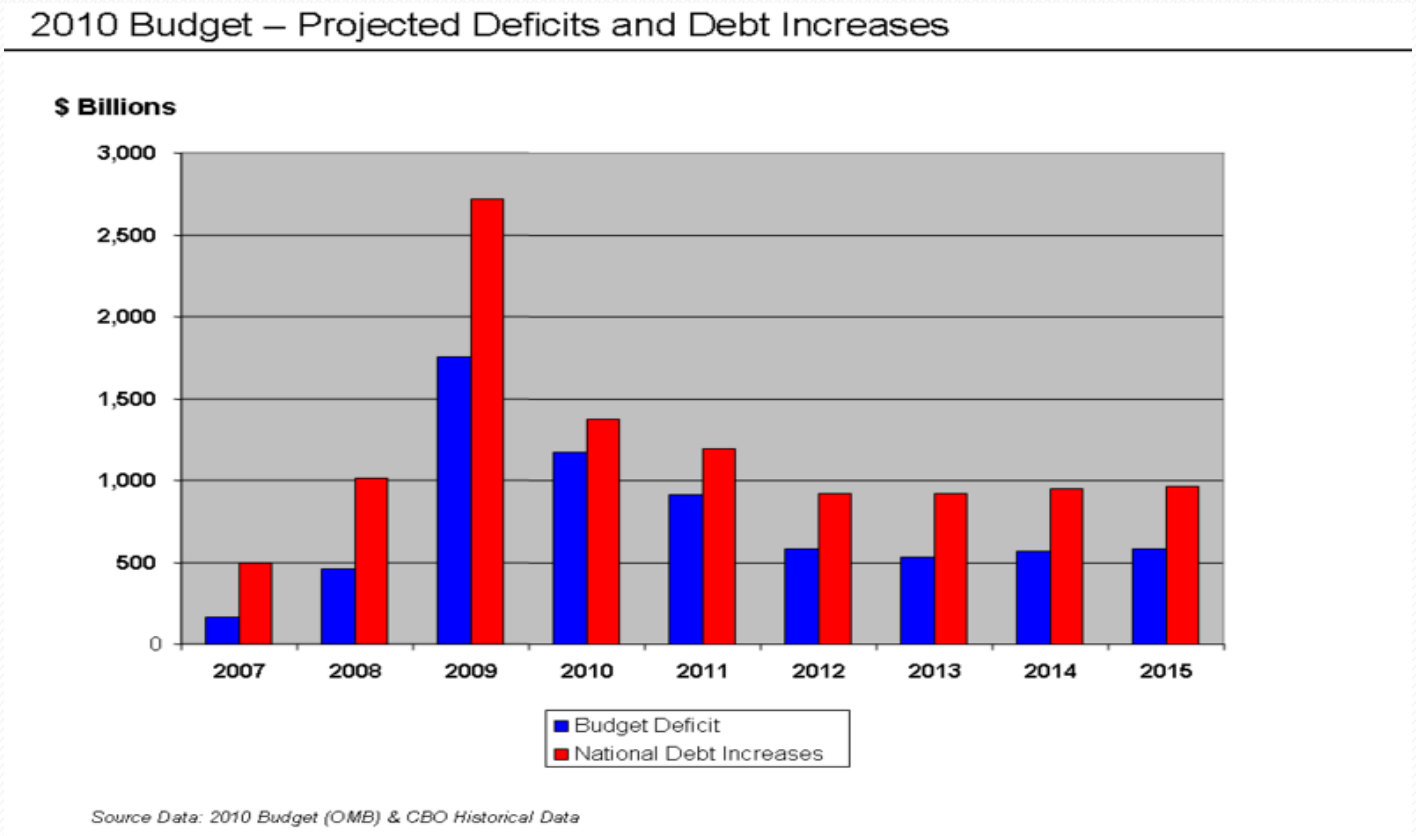
- President Barack Obama proposed his 2011 budget during February 2010.
  - **He has indicated that jobs, health care, clean energy, education, and infrastructure will be priorities**.

	Obama's Initial Plan (2/2010)	Congress Initial Plan (4/2010)	Obama's Revised Plan (2/2011)	New Projections 4/2011
	2011	2011	2011	2011
Request Spending	3.83	3.71	3.82	
Projected Revenue	2.56	2.21	2.17	
Budget Deficit	1.27	1.50	1.65	
Debt	15.10	15.10	15.10	15.10
Revenue / Debt Ratio	5.90x	6.84x	6.95x	
GDP	15.31	15.31	15.31	13.51
Deficit % of GDP	8.3%	9.8%	10.7%	
Debt % of GDP	98.7%	98.7%	98.7%	111.7%

The 2011 U.S Budget – Case Study - Lessons Learned

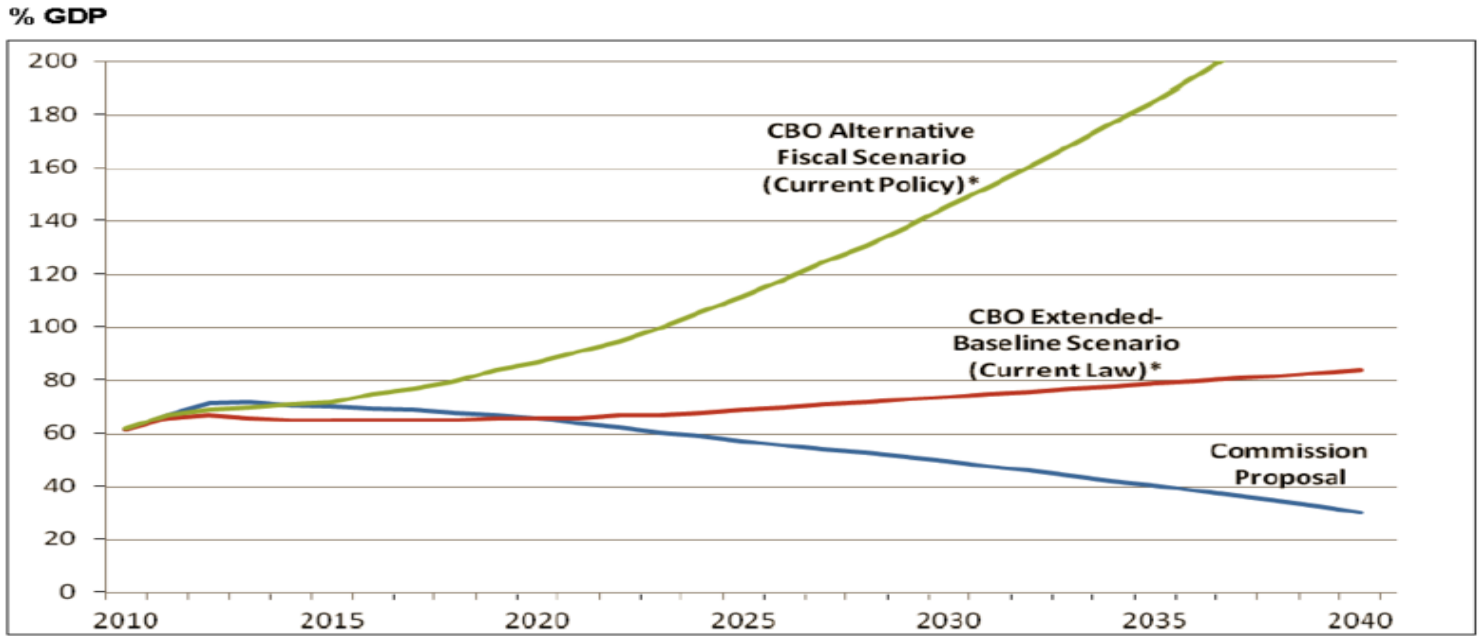
- It was widely anticipated that a government shutdown on April 8, 2011 was possible if a budget resolution or a seventh continuing resolution was not passed by the expiration of the sixth continuing resolution on April 8, 2011, which would have caused the furlough of 800,000 out of 2 million civilian federal employees.
- However, a deal was reached with just hours remaining before the deadline, averting the shutdown.
- The deal included $38.5 billion in cuts from what had been budgeted for 2010, in addition to another $10 billion in cuts that had been imposed in some of the continuing resolution.
- However, the April 13 Congressional Budget Office estimate showed that, compared with then-current spending rates, the spending bill would cut federal outlays from non-war accounts by just $352 million through Sept. 30. About $8 billion in immediate cuts to domestic programs and foreign aid were offset by nearly equal increases in defense spending

The 2011 U.S Budget – Case Study - Lessons Learned



The 2011 U.S Budget – Case Study - Lessons Learned

U.S. Public Debt as a % GDP Under Various Scenarios



Source: *Report of the National Commission on Fiscal Responsibility and Reform* - December 2010
*Note: Explanations of the Alternative and Baseline scenarios are included on graph's article page.

The Moody's Rating Approach

- Moody's general obligation bond ratings are forward-looking assessments of an entity's relative credit strength, and reflect our analysis of four rating factors – Economic Condition and Outlook, Financial Position and Performance, Debt Profile, and Management – as measured against a combination of qualitative and quantitative criteria.

- The rating outcome reflects a weighting of these assessments according to the following weighting system:

  - Economic Strength 40%
  - Financial Strength 30%
  - Management and Governance 20%
  - Debt Profile 10%

Time Series Analysis and Forecasting

Time Series Analysis and Forecasting

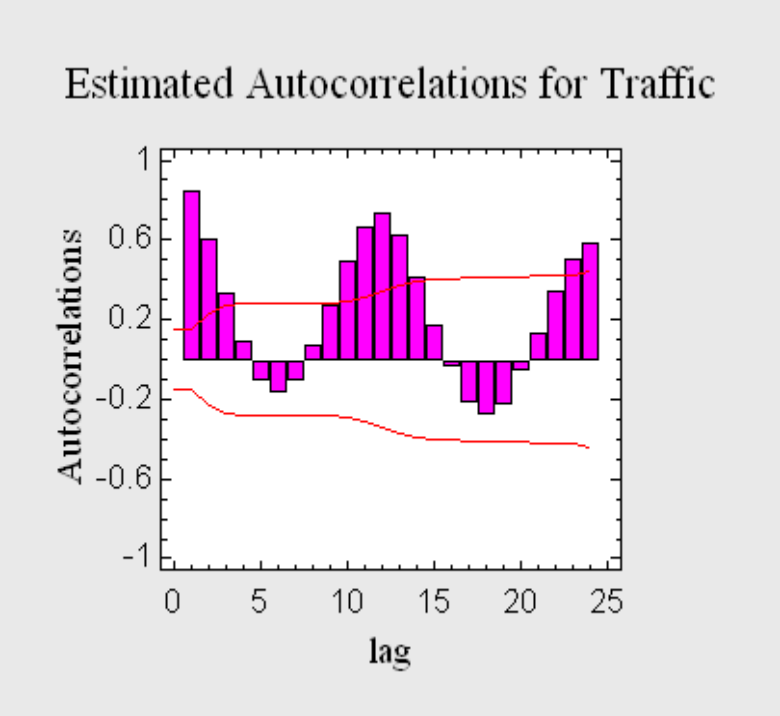
Many types of data are collected over time. Stock prices, sales volumes, interest rates, and quality measurements are typical examples.

Because of the sequential nature of the data, special statistical techniques that account for the dynamic nature of the data are required.

Analyzing time series data

1. *Descriptive Methods* - time sequence plots, autocorrelation functions, partial autocorrelation functions, periodograms, and cross-correlation functions are all important tools for characterizing time series data.
2. *Smoothing* - a variety of smoothers are available to estimate the underlying trend in a time series.
3. *Seasonal Decomposition* - decomposes time series data into trend, cycle, seasonal, and irregular components, and returns seasonally adjusted data if desired.
4. *Forecasting* - creation of forecasts beyond the end of the data, using trend models, moving averages, exponential smoothers, or ARIMA models. (autoregressive integrated moving average)
5. *Automatic Forecasting* - selects the best forecasting method for a time series by optimizing a specified information criterion.

Descriptive Methods

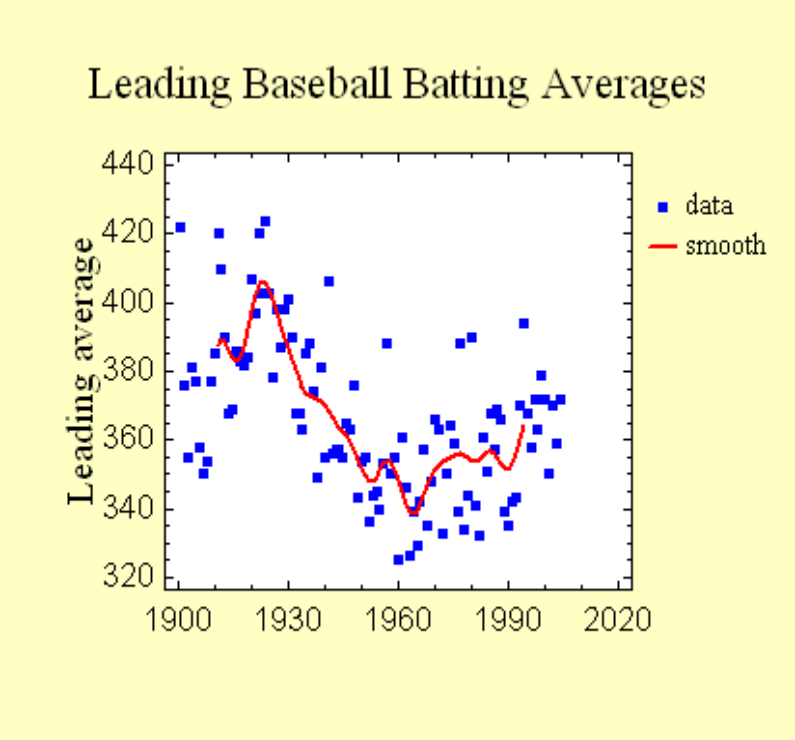


Characterizing a time series involves estimating not only a mean and standard deviation but also the correlations between observations separated in time.

Tools such as the autocorrelation function are important for displaying the manner in which the past continues to affect the future.

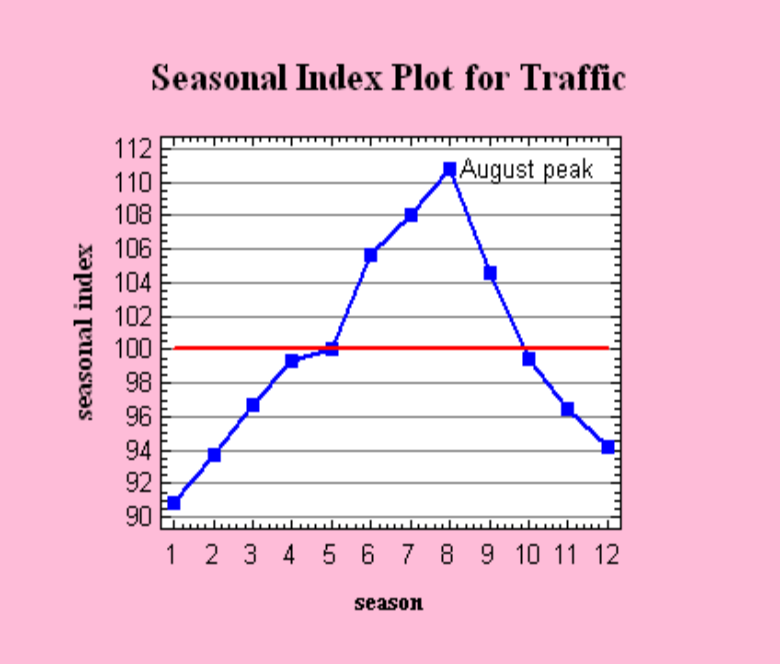
Other tools, such as the periodogram, are useful when the data contain oscillations at specific frequencies.

Smoothing



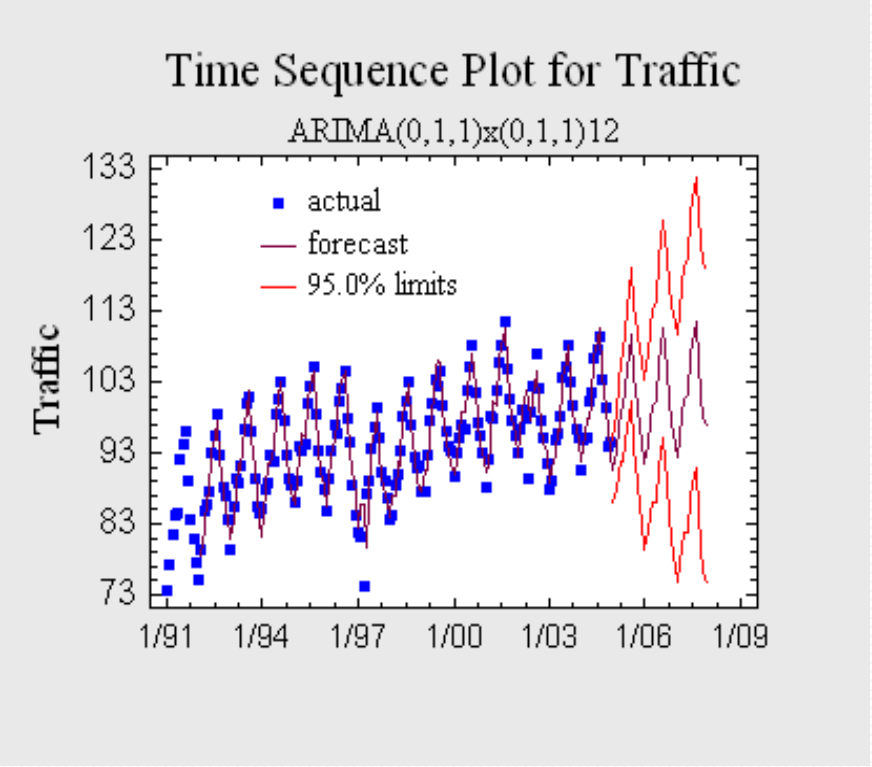
When a time series contains a large amount of noise, it can be difficult to visualize any underlying trend. Various linear and nonlinear smoothers are provided to separate the signal from the noise.

Seasonal Decomposition



When the data contain a strong seasonal effect, it is often important to separate the seasonality from the other components in the time series. This enables one to estimate the seasonal patterns and to generate seasonally adjusted data.

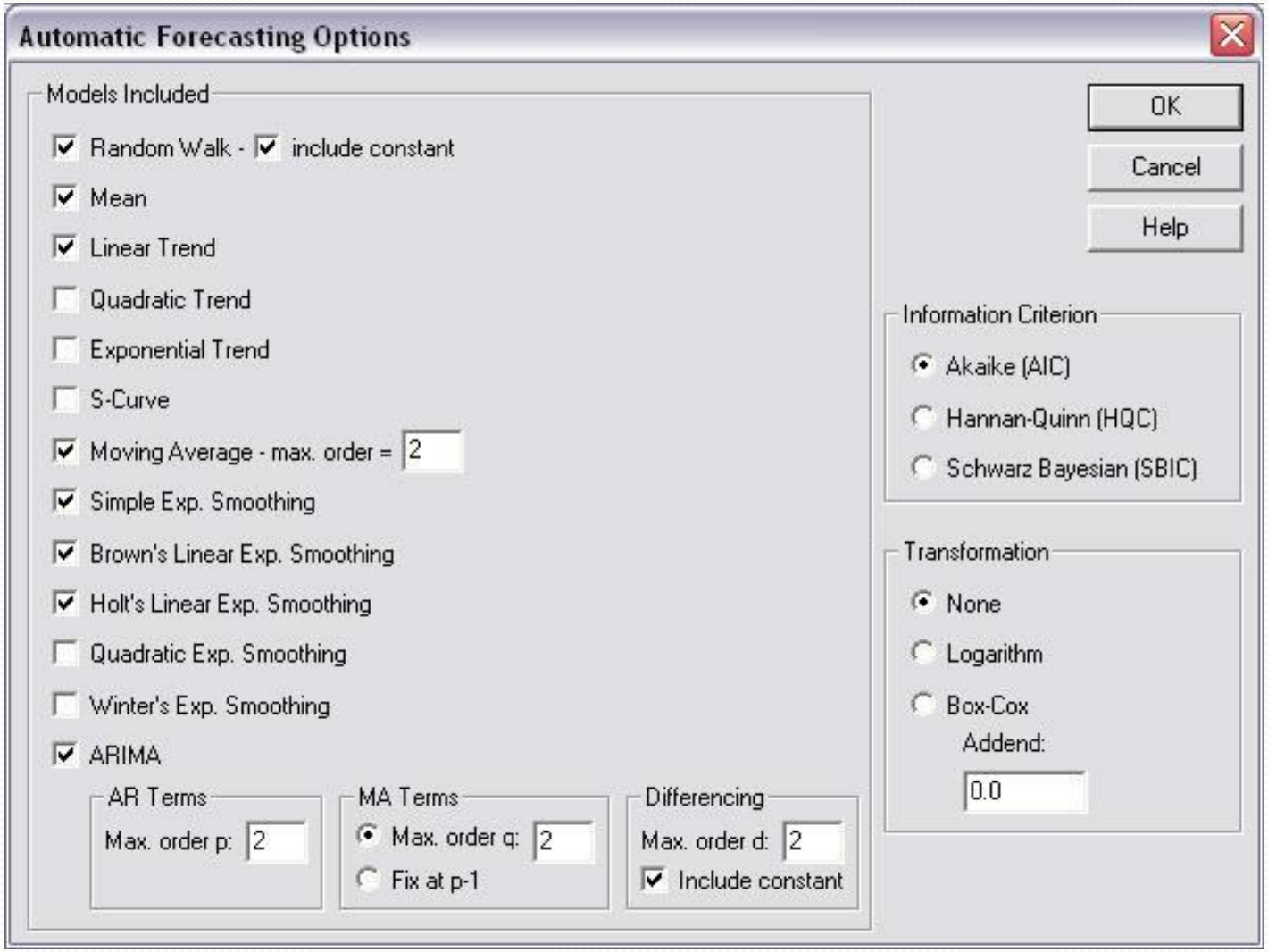
Forecasting



A common goal of time series analysis is extrapolating past behavior into the future. The STATGRAPHICS forecasting procedures include random walks, moving averages, trend models, simple, linear, quadratic, and seasonal exponential smoothing, and ARIMA parametric time series models.

Users may compare various models by withholding samples at the end of the time series for validation purposes.

Automatic Forecasting



Automatic Forecasting

If desired, users may elect to let STATGRAPHICS select a forecasting model for them by comparing multiple models and automatically picking the model that maximizes a specified information criterion.

The available criteria are based on the mean squared forecast error, penalized for the number of model parameters that must be estimated from the data.

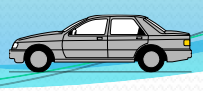
A common use of this procedure in Six Sigma is to select an ARIMA model on which to base an ARIMA control chart, which unlike most control charts does not assume independence between successive measurements.

In such cases, the analyst may elect to consider only models of the ARMA(p,p-1) form, which theory suggests can characterize many dynamic processes.

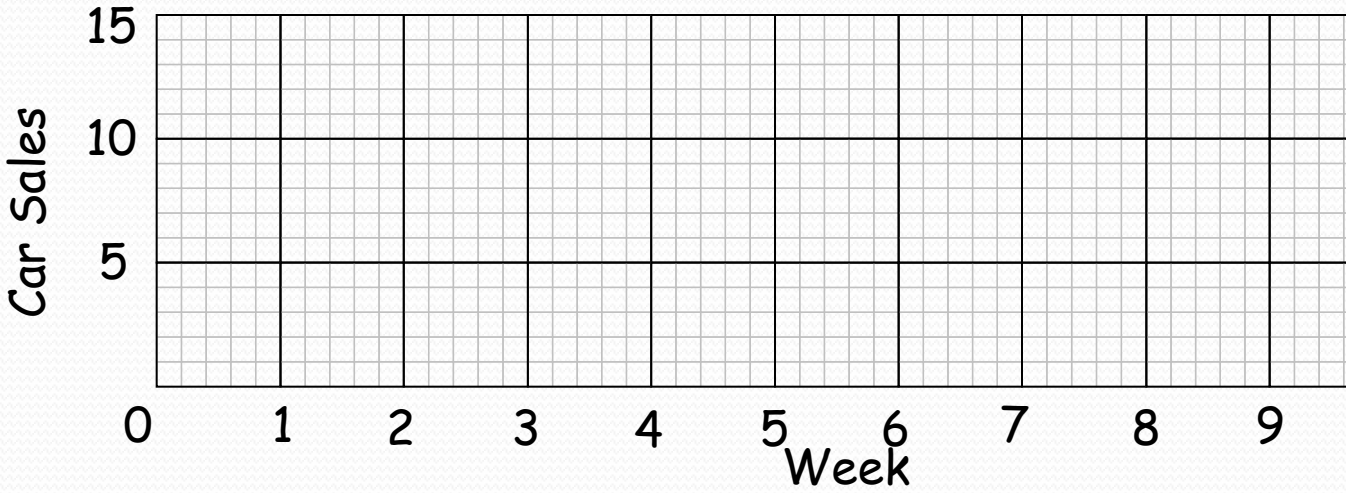
Moving Averages

A form of Regression analysis

Car Sales

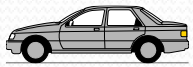


Week	1	2	3	4	5	6	7	8	9	10	11	12
Cars Sold	5	7	3	8	7	0	14	7	3	5	13	6



Moving Averages

Moving averages are used to level out the large fluctuations that can occur in a set of data that varies over time. They are an important tool in the financial/retail sectors as they can help identify trend within the data.



Week	1	2	3	4	5	6	7	8	9	10	11	12
Cars Sold	5	7	3	8	7	0	14	7	3	5	13	6

In order to have a clearer picture of trend we will calculate a 3 point moving average.

Mean for weeks 1-3 (5 + 7 + 3)/3 = 5

2-4 (7 + 3 + 8)/3 = 6

3-5 (3 + 8 + 7)/3 = 6

4-6 (8 + 7 + 0)/3 = 5

5 -7 (7 + 0 + 14)/3 = 7

Mean for weeks 6-8 (0 + 14 + 7)/3 = 7

7-9 (14 + 7 + 3)/3 = 8

8-10 (7 + 3 + 5)/3 = 5

9-11 (3 + 5 + 13)/3 = 7

10-12 (5 + 13 + 6)/3 = 8

Moving Averages

Week	1	2	3	4	5	6	7	8	9	10	11	12
Cars Sold	5	7	3	8	7	0	14	7	3	5	13	6

Mean for weeks 1-3 (5 + 7 + 3)/3 = 5

2-4 (7 + 3 + 8)/3 = 6

3-5 (3 + 8 + 7)/3 = 6

4-6 (8 + 7 + 0)/3 = 5

5 -7 (7 + 0 + 14)/3 = 7

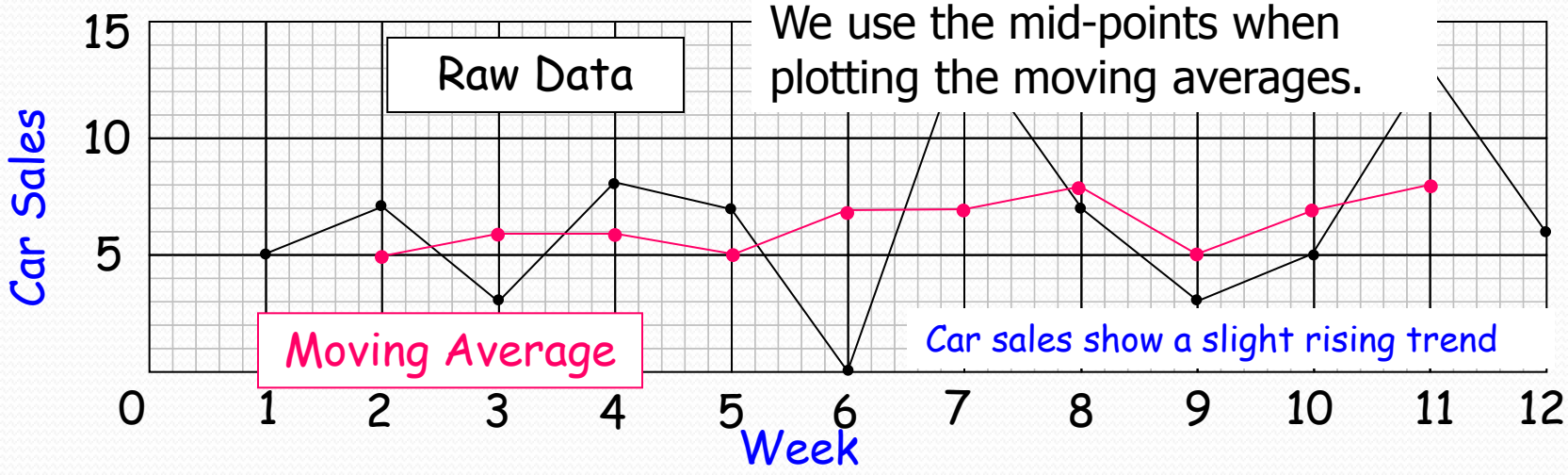
Mean for weeks 6-8 (0 + 14 + 7)/3 = 7

7-9 (14 + 7 + 3)/3 = 8

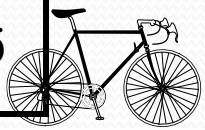
8-10 (7 + 3 + 5)/3 = 5

9-11 (3 + 5 + 13)/3 = 7

10-12 (5 + 13 + 6)/3 = 8

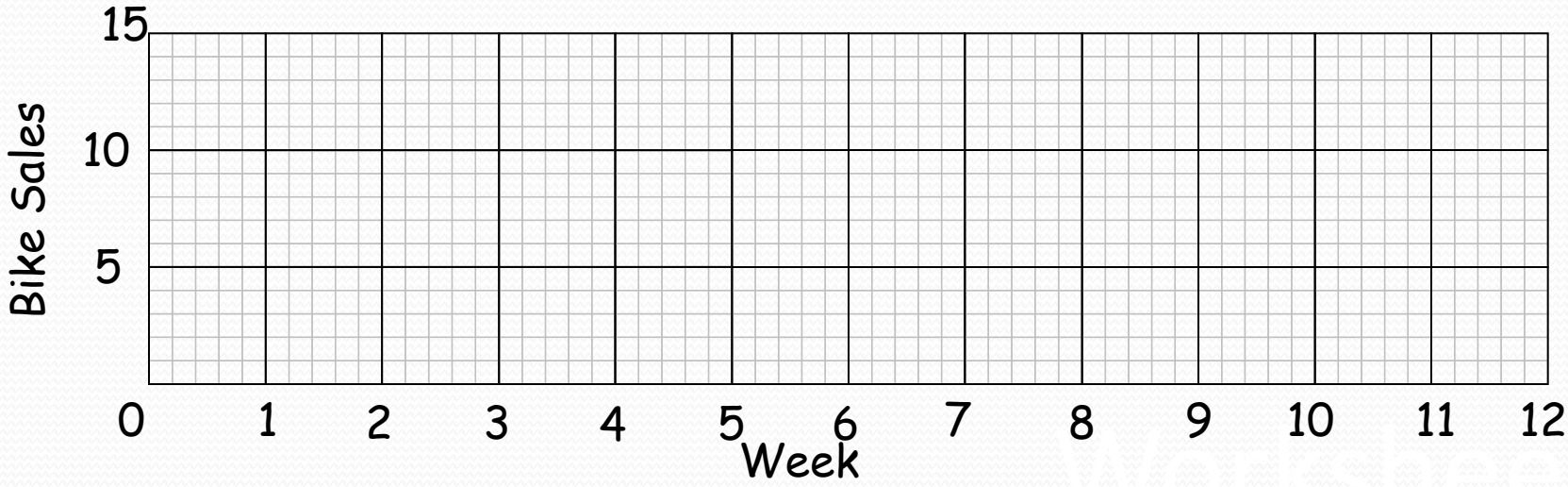


Week	1	2	3	4	5	6	7	8	9	10	11	12
Bikes Sold	7	14	6	5	3	10	10	1	3	6	6	5



Mean for weeks:

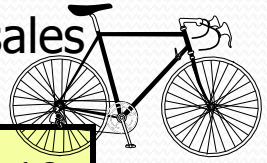
Mean for weeks:



Moving Averages

Moving averages are used to level out the large fluctuations that can occur in a set of data that varies over time. They are an important tool in the financial/retail sectors as they can help identify trend within the data.

Example 2: The data in the table below gives information on cycle sales from a cycle shop over a 12 week period last autumn.



Week	1	2	3	4	5	6	7	8	9	10	11	12
Bikes Sold	7	14	6	5	3	10	10	1	3	6	6	5

In order to have a clearer idea of trend we will calculate a 4 point moving average.

Mean for weeks:

1-4 $(7 + 14 + 6 + 5)/4 = 8$

2-5 $(14 + 6 + 5 + 3)/4 = 7$

3-6 $(6 + 5 + 3 + 10)/4 = 6$

4-7 $(5 + 3 + 10 + 10)/4 = 7$

5 -8 $(3 + 10 + 10 + 1)/4 = 6$

Mean for weeks:

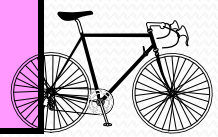
6-9 $(10 + 10 + 1 + 3)/4 = 6$

7-10 $(10 + 1 + 3 + 6)/4 = 5$

8-11 $(1 + 3 + 6 + 6)/4 = 4$

9-12 $(3 + 6 + 6 + 5)/4 = 5$

Week	1	2	3	4	5	6	7	8	9	10	11	12
Bikes Sold	7	14	6	5	3	10	10	1	3	6	6	5



Mean for weeks:

1-4 $(7 + 14 + 6 + 5)/4 = 8$

2-5 $(14 + 6 + 5 + 3)/4 = 7$

3-6 $(6 + 5 + 3 + 10)/4 = 6$

4-7 $(5 + 3 + 10 + 10)/4 = 7$

5 -8 $(3 + 10 + 10 + 1)/4 = 6$

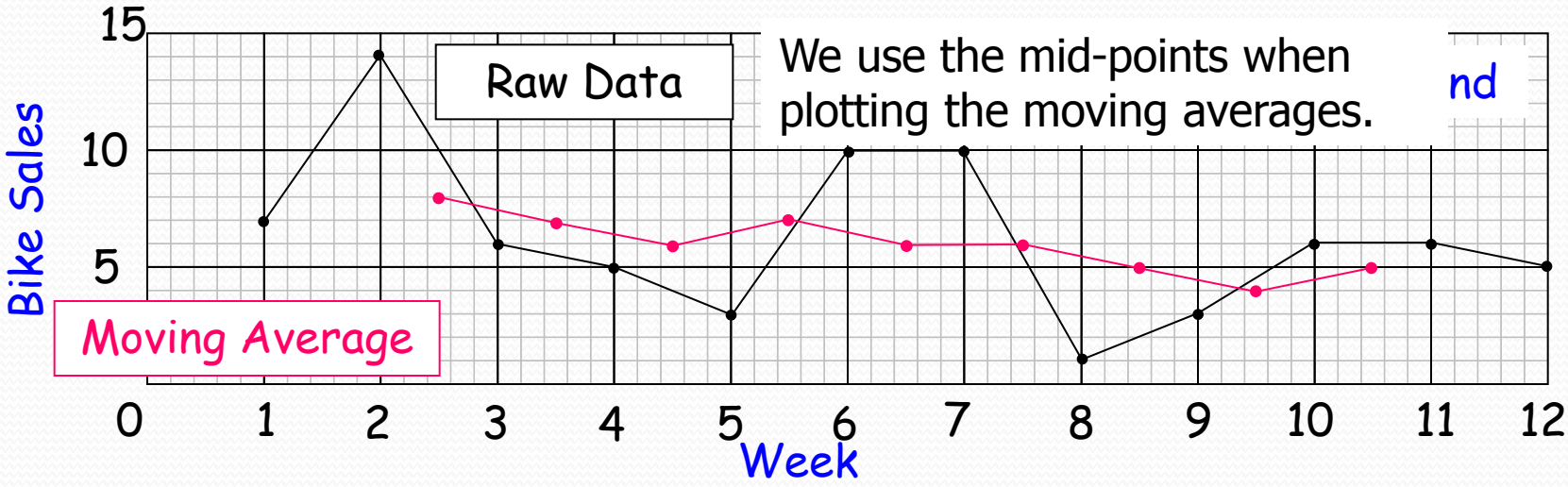
Mean for weeks:

6-9 $(10 + 10 + 1 + 3)/4 = 6$

7-10 $(10 + 1 + 3 + 6)/4 = 5$

8-11 $(1 + 3 + 6 + 6)/4 = 4$

9-12 $(3 + 6 + 6 + 5)/4 = 5$



Business Forecasting

1

Forecasting for Management Decisions

Topics

- Introduction
- Importance of Forecasting
- Financial and Strategic Importance of Forecasting
- The Commonality of Forecasting

Importance of Business Forecasting

- Allows organizations to improve profits
- Essential in eliminating waste such as:
  - Inventory shortages
  - Missed due dates
  - Plant shut-downs
  - Lost sales
  - Lost customers
  - Expensive expediting
  - Missed strategic opportunities.

Financial and Strategic Importance

- Better strategic information
- Better marketing information
- Better financial information
- Better operating information
- Increased customer service
- Better allocation of resources

(*Continued*)

Financial and Strategic Importance

- Increased manufacturing and operating efficiency
- Higher productivity
- Stability in planning
- Reduced finished goods inventory
- Elimination of waste
- Increased profitability
- Increased return on investment.

The Commonality of Forecasting

- All organizations wish for excellence in management (whether manufacturing or a hospital).

- Demand for products, labor, materials, and other resources must be estimated using either formal or informal forecasting methods.

Business Forecasting

- The Art and Science of Forecasting
- The Forecasting Process

Business Forecasting Process

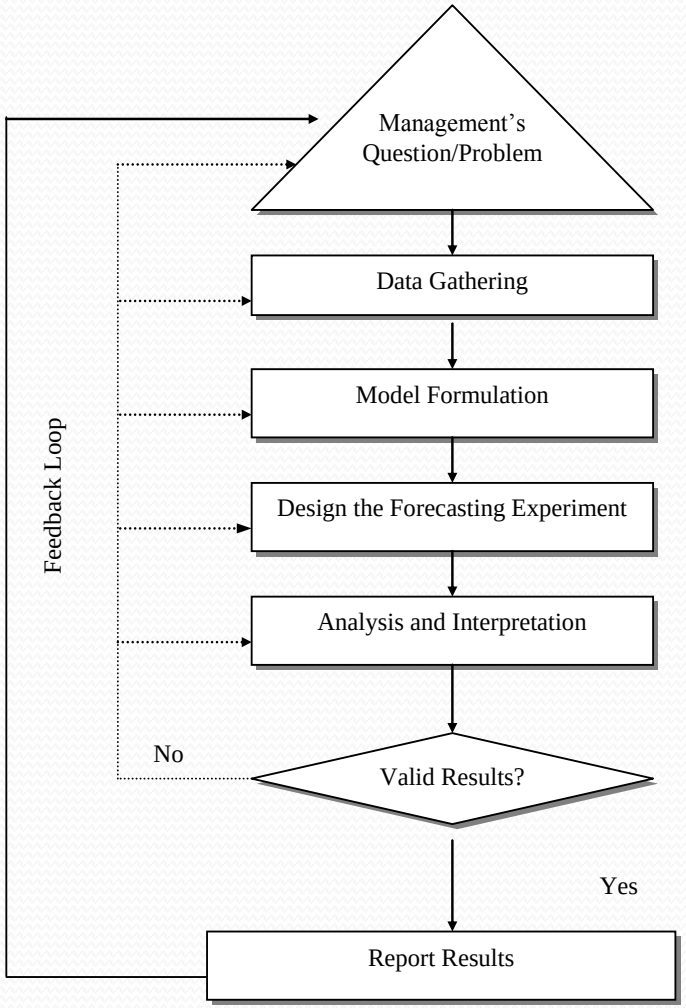


Figure 1.1 The Forecasting Process

Summary

- Importance of Business Forecasting
  - As a Strategic Tool
  - Planning and Control Tool
- Various Application of Forecasting in Business
- The Art and Science of Forecasting
- The Process of Forecasting

Business Forecasting

2

Data Patterns and Choice of Forecasting Techniques

Topics

- Data Patterns
- Forecasting Methodologies
- Technique Selection
- Model Evaluation

Data Pattern and Choice of Technique

- The pattern of data
- The nature of the past relationship in the data
- The level of subjectivity in making a forecast

All of the above help us in how we classify the forecasting technique.

Data Pattern and Choice of Technique

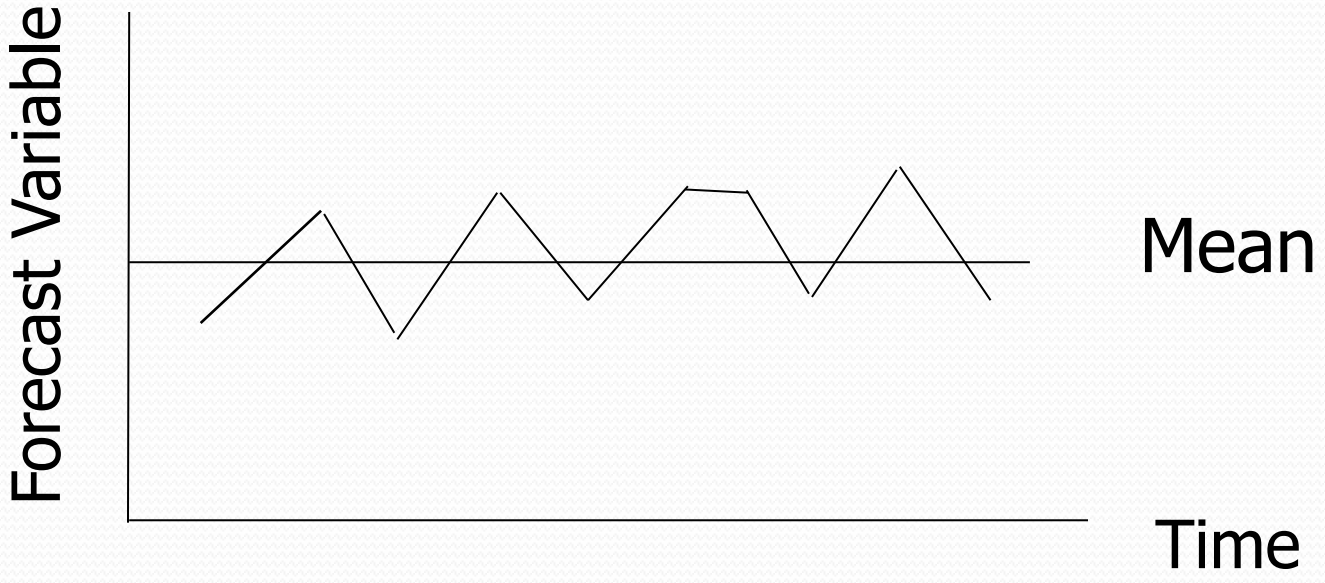
- Univariate forecasting techniques depend on:
  - Past data patterns.
- Multivariate forecasting techniques depend on
  - Past relationships.
- Qualitative forecasts depend on:
  - Subjectivity: Forecasters intuition.

Data Patterns

- Data Patterns as a Guide
  - Simple observation of the data will show the way that data have behaved over time.
  - Data pattern may suggest the existence of a relationship between two or more variables.
  - Four Patterns: Horizontal, Trend, Seasonal, Cyclical.

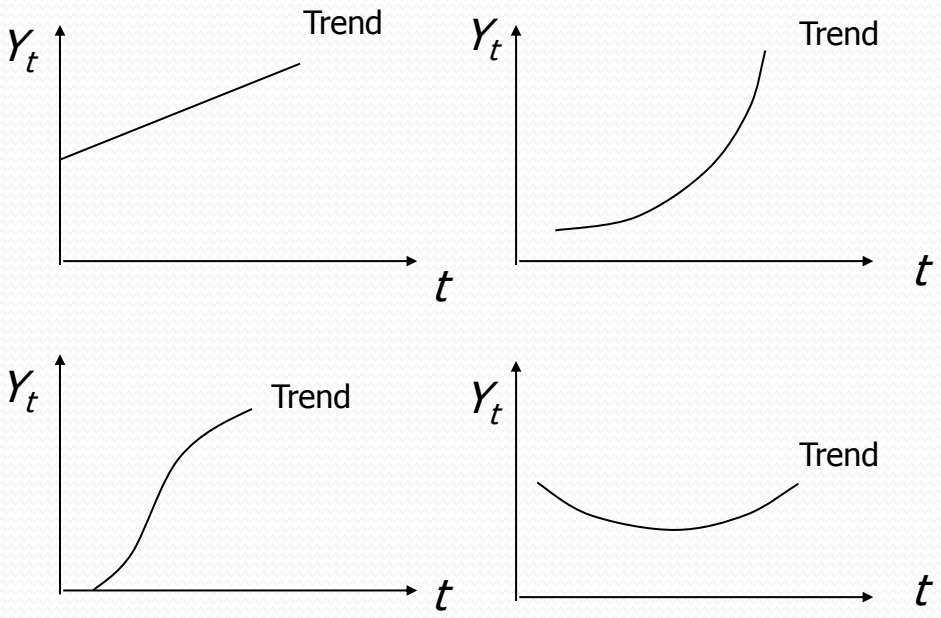
Data Patterns

- Horizontal
  - When there is no trend in the data pattern, we deal with horizontal data pattern.



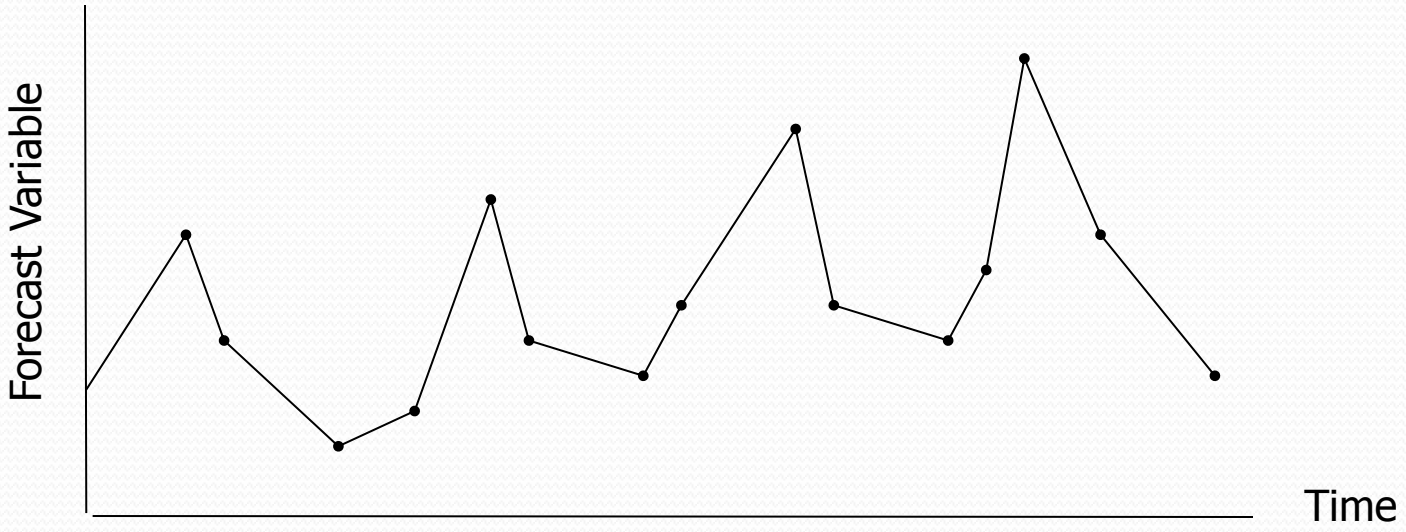
Data Patterns

- Trend
  - Long-term growth movement of a time series



Data Patterns

- Seasonal Pattern
  - A predictable and repetitive movement observed around a trend line within a period of 1 year or less.



Data Patterns

- Cyclical
  - Occurs with business and economic expansions and contractions.
  - Lasts longer than 1 year.
  - Correlated with business cycles.

Other Data Patterns

- Autocorrelated Pattern
  - Data in one period are related to their values in the previous period.
  - Generally, if there is a high positive autocorrelation, the value in the month of June, for example, is positively related to the values in the month of May.
  - This pattern is more fully discussed when we talk about the Box–Jenkins methodology.

Measures of Accuracy in Forecasting

- Error in Forecasting

$$e_t = Y_t - \hat{Y}_t$$

  - Measures the average error that can be expected over time.
  - The average error concept has some problems with it. The positive and negative values cancel each other out and the mean is very likely to be close to zero.

Error in Forecasting

- Mean Average Deviation (MAD)

$$\mathrm{MAD} = \frac{\sum_{t=1}^{n} |e_t|}{n}$$

Error in Forecasting

- Mean Square Error (MSE)

$$\mathrm{MSE} = \frac{\sum_{t=1}^{n} (e_t^2)}{n}$$

Error in Forecasting

- Mean Absolute Percentage Error

$$\text{MAPE} = \sum_{t=1}^{n} \frac{\left|(e_t / Y_t) \cdot 100\right|}{n}$$

Error in Forecasting

- Mean Percentage Error

$$\text{MPE} = \frac{\sum_{t=1}^{n} (e_t / Y_t)}{n}$$

- No bias, MPE should be zero.

Evaluating Reliability

- Forecasters use the following two approaches to determine if the forecast is reliable or not:
  - Root Mean Square (RMS)

$$RMS = \sqrt{\frac{\sum_{t=1}^{n} e_t^2}{n}}$$

Evaluating Reliability

- Root Percent Mean Square (R%MS)

$$R\%MS = \sqrt{\frac{\sum_{t=1}^{n} (e_t^2 / Y_t)}{n}}$$

Forecasting Methodologies

- Forecasting methodologies fall into three categories:
  - Quantitative Models
  - Qualitative Models
  - Technological Approaches

Forecasting Methodologies

- Quantitative Models
  - Also known as statistical models.
  - Include time series and regression approaches.
  - Forecast future values entirely on the historical observation of a variable.

Forecasting Methodologies

- Quantitative Models
  - An example of a quantitative model is shown below:

$$Y_{t+1} = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{t-1}$$

= Sales one time period into the future

Y_{t+1} = Sales in the current period

Y_t = Sales in the last period

Y_{t-1}

Forecasting Methodologies

- Qualitative Models
  - Non-statistical or judgment models
  - Expert opinion
  - Executive opinion
  - Sale force composite forecast
  - Focus groups
  - Delphi method

Forecasting Methodologies

- Technological Approach
  - Combines quantitative and qualitative methods.
  - The objective of the model is to combine technological, societal, political, and economic changes.

Technique Selection

- Forecasters depend on:
  - The characteristics of the decision making situation which may include:
    - Time horizon
    - Planning vs. control
    - Level of detail
    - Economic conditions in the market (stability vs. state of flux)

Technique Selection

- Forecasters depend on:
  - The characteristics of the forecasting method
    - Forecast horizon
    - Pattern of data
    - Type of model
    - Costs associated with the model
    - Level of accuracy and ease of application

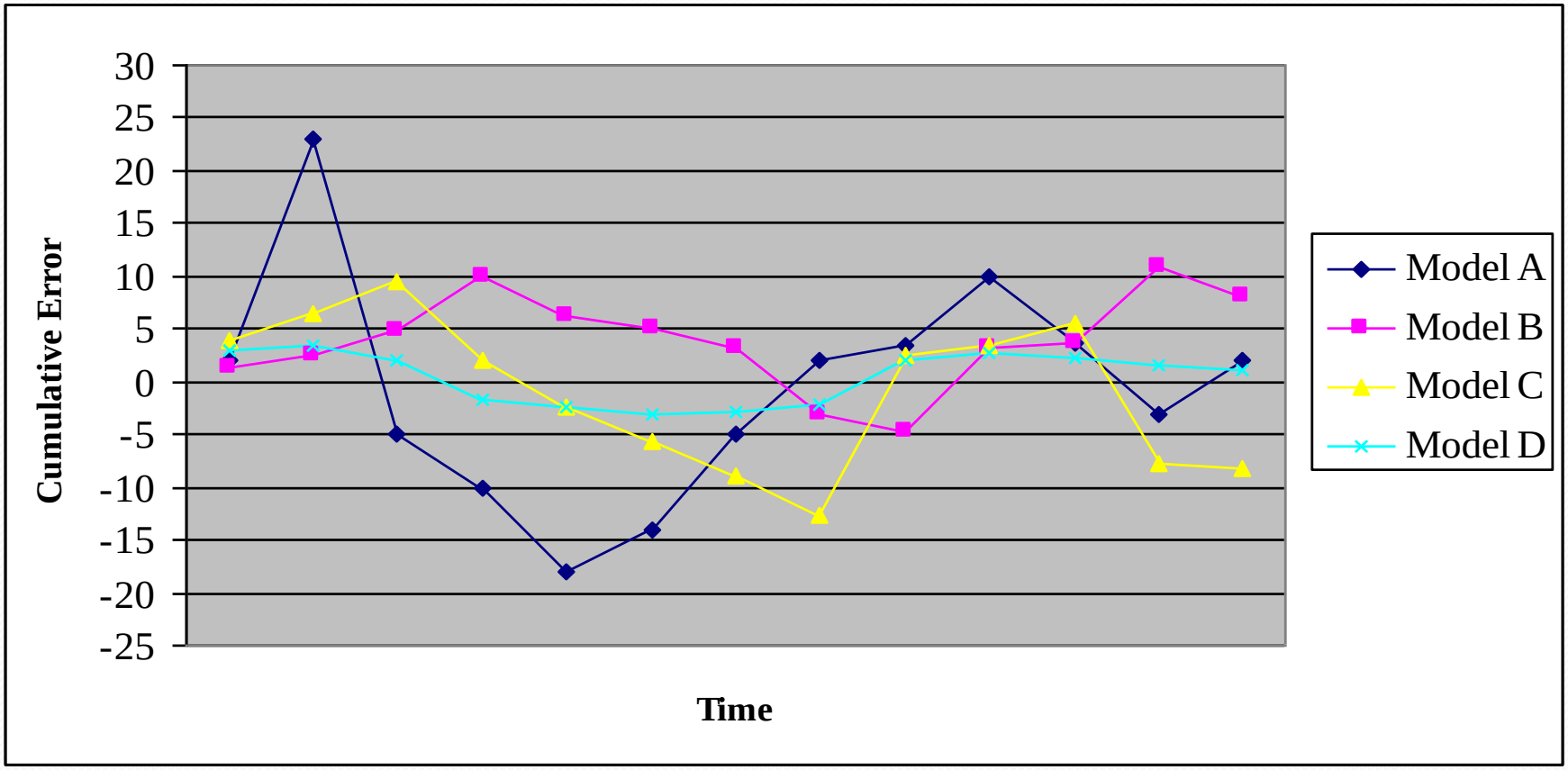
Model Evaluation

- Forecasters depend on:
  - The level of error associated with each model.
  - Error is computed and looked at graphically.
  - Control charts are used for model evaluations.
  - Turning point diagram is used to evaluate a model.

Model Evaluation

- A pattern of cumulative errors moving systematically away from zero in either direction is a signal that the model is generating biased forecasts.
- Management has to establish the upper and lower control limits.
- One fairly common rule of thumb is that the control limits are equal to 2 or 3 time the standard error.

Model Evaluation



Model Evaluation

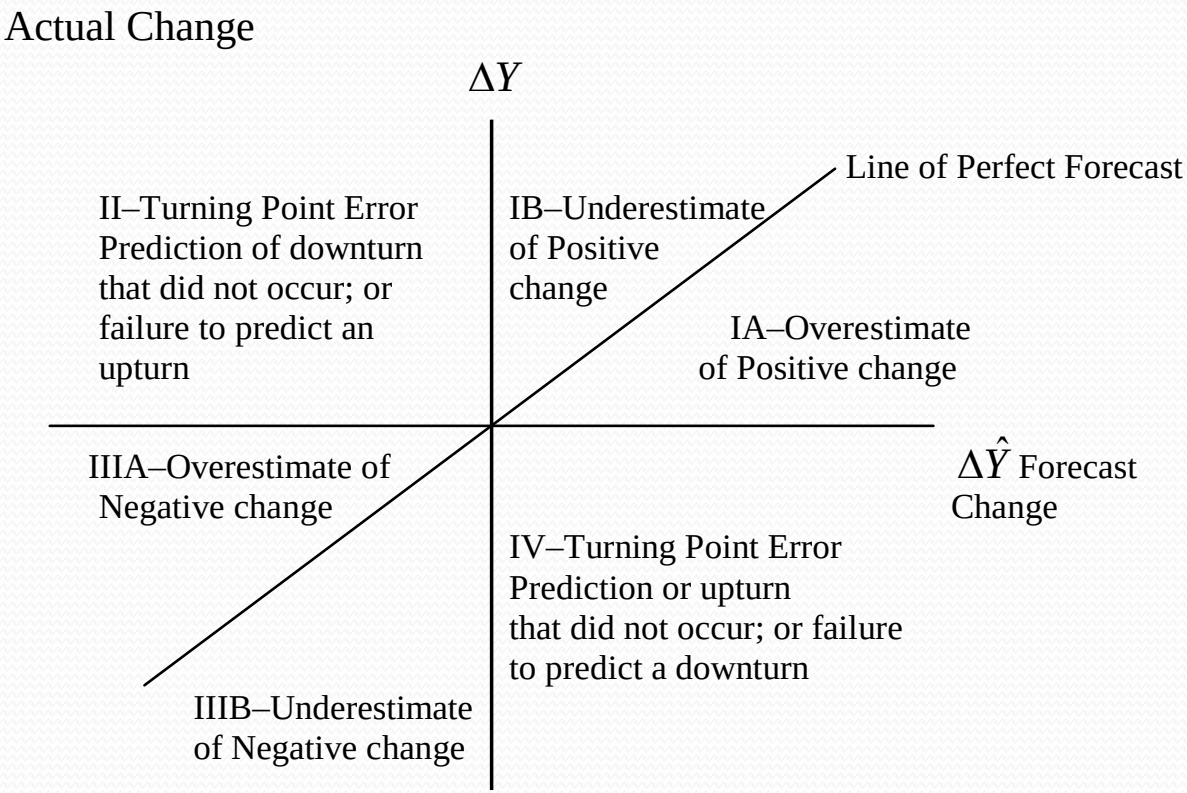


Figure 2.6 Turning Point Error Diagram

Model Evaluation

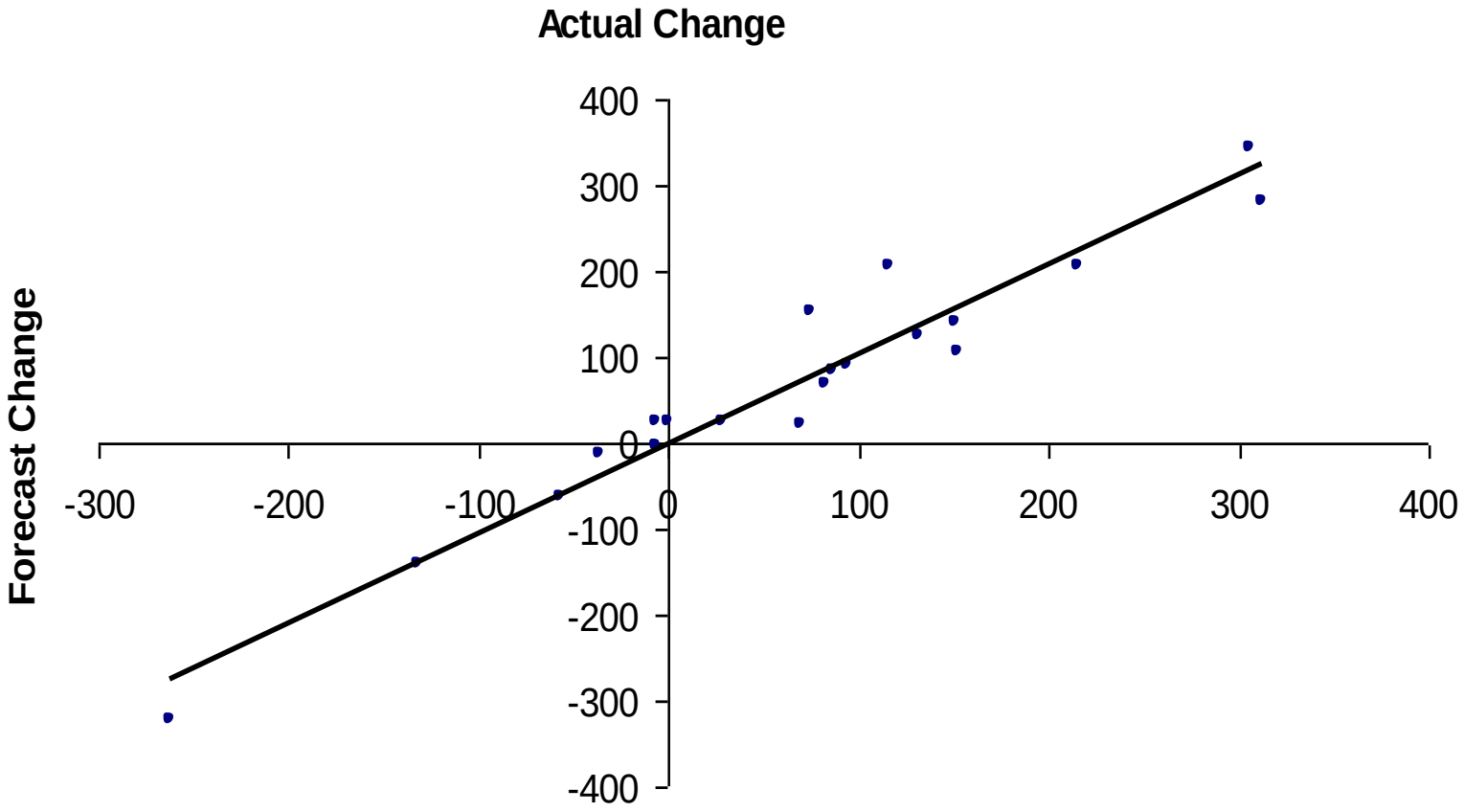


Figure 2.7 Turning Point Analysis for Model C

Summary

- Data Patterns
- Forecasting Methodologies
- Technique Selection
- Model Evaluation

Business Forecasting

3

The Macroeconomy and Business Forecasts

Topics

- Introduction
  - Cyclical Linkages and Forecasting
- Phases of Business Cycles
  - Peaks
  - Recession
  - Trough
  - Recovery
- Historical events of Business Cycles

Topics

- Macroeconomic Models and Forecasting
- Use of Macroeconomic Models at Industry and Firm Level

Business Cycles

- Peak
  - Refers to economic condition at which business activity has reached a temporary maximum.
  - During this phase the economy shows full employment and the level of real output is at, or very close to, its capacity.
  - There is expectation of a price rise at this phase.

Business Cycles

- Recession
  - A decline in output, income, employment, and trade lasting more than 6 months.
  - Often a widespread contraction of the business in many sectors of the economy.
  - Prices may not decline (stickiness) as fast unless there is a prolonged recession or depression.

Business Cycles

- Trough
  - Output and employment “bottom out” at their lowest level.
  - Duration of the trough may be short or long.

- Recovery
  - Output and employment surge toward full employment.
  - Price level may begin to rise before full employment is reached.

Historical Events and their impact on Business Cycles

Growth Rate for the Various Macroeconomic Indicators

Series	1886–1916	1920–1940	1948–1997
	%	%	%
Industrial Production	6.2	16.0	5.0
GNP	3.0	7.1	2.5
Commodity Output	5.2	9.0	4.9
Unemployment Rate	1.4		1.1

Historical Events and their impact on Business Cycles

Dates of Peaks and Troughs

1886–1916		1920–1940		1948–1997	
Peak	Trough	Peak	Trough	Peak	Trough
1887:2	1887:7	1920:1	1921:3	1948:11	1949:10
1893:1	1894:2	1923:5	1924:7	1953:7	1954:5
1896:1	1897:1	1927:3	1927:12	1957:8	1958:4
1900:4	1900:12	1929:9	1932:7	1960:4	1961:2
1903:7	1904:3	1937:8	1938:6	1969:12	1970:11
1907:7	1908:6	1939:12	1940:3	1973:11	1975:3
1910:1	1911:5			1980:1	1980:7
1914:6	1914:12			1981:7	1982:11
1916:5	1917:1			1990:7	1991:3

Historical Events and their impact on Business Cycles

Length of Recessions and Expansions

1886–1916			1920–1940			1948–1997		
Year of Peak	Months to Trough	Months from Trough to Peak	Year of Peak	Months to Trough	Months from Trough to Peak	Year of Peak	Months to Trough	Months from Trough to Peak
1887	5	66	1920	14	26	1948	11	45
1893	13	23	1923	14	32	1953	10	39
1896	12	39	1927	9	21	1957	8	24
1900	8	31	1929	34	61	1960	10	106
1903	8	40	1937	10	18	1969	11	36
1907	11	19	1939	3		1973	16	58
1910	16	37				1980	6	12
1914	6	17				1981	16	92
1916	8					1990	8	
Avg.	9.7	34.0	Avg.	14.0	31.6	Avg.	10.7	51.5

Source: Romer, C.D. (1999). "Changes in business cycles: evidence and explanations." *Journal of Economic Perspective* 13 (Spring): 31.

Macroeconomic Models and Forecasting

- Many variables interact to shape the economy.
- Forecasters use necessary tools to observe the interrelationships in the overall economy.
- Macroeconomic models are general equilibrium models.
- In building macroeconomic models for forecasting, we depend on theory and statistical techniques.

Use of Macroeconomic Models at the Industry and Firm Level

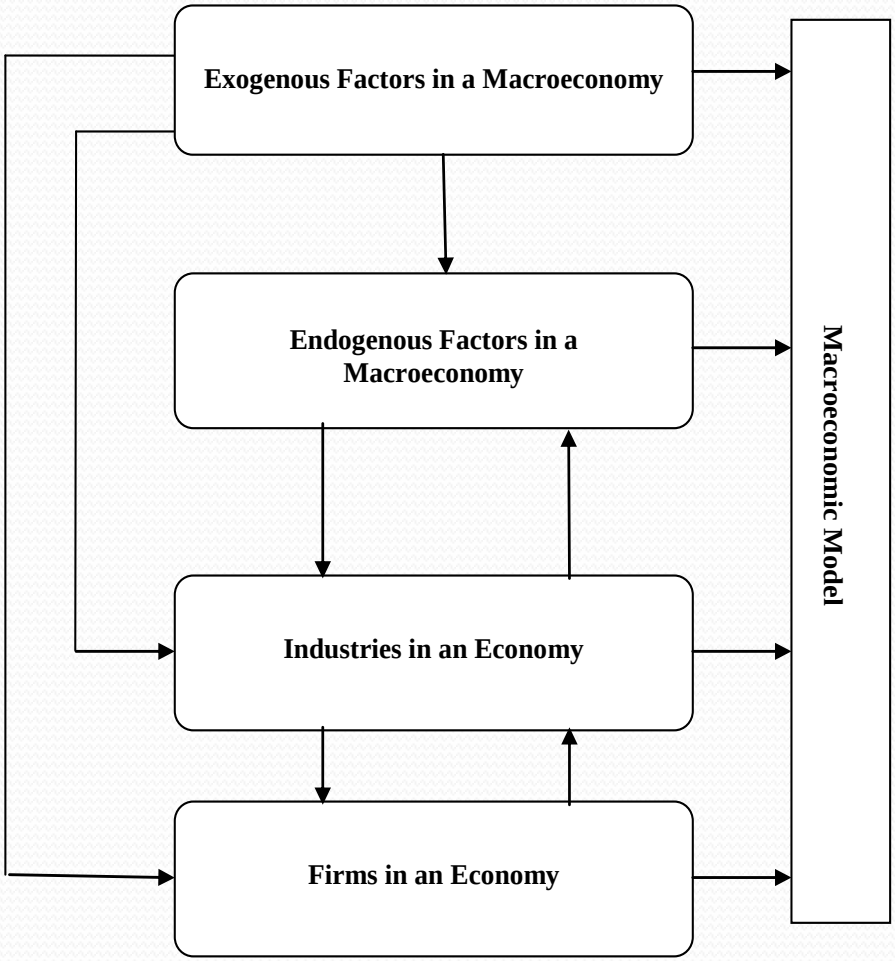


Figure 3.1 Linkages between the Macroeconomy, Industry, and Firms

Summary

- Business decisions are made in the context of the overall economy.
- Long-term trends, seasonal patterns, cyclical movements, and irregular factors play an important role in the overall economy.
- Understanding the various phases of business cycles is helpful to forecasters.

Business Forecasting

4

Data Collection and Analysis in Forecasting

Topics

- Preliminary Adjustments to Data
- Data Transformation
- Patterns in Time Series Data
- The Classical Decomposition Method

Preliminary Data Adjustments

- Trading Day Adjustments
- Price Change Adjustments
- Population Change Adjustments

Trading Day Adjustments

Yr	J	F	M	A	M	J	J	A	S	O	N	D
05	21	20	23	21	22	22	21	23	22	21	22	22
06	22	20	23	20	23	22	21	23	22	22	22	21
07	23	20	22	21	23	21	22	23	20	23	22	21

Trading Day Adjustment

Average Trading Days for Each Month

Month	*Average Number of Trading Days*
January	22.00
February	20.00
March	22.67
April	20.67
May	22.67
June	21.67
July	21.33
August	23.00
September	21.33
October	22.00
November	22.00
December	21.33

Trading Day Adjustments

Trading Day Computation for October

Year	*Trading Days*	*Trading Day Coefficient*	*Actual Data*	*Adjusted Data*
2005	21	21/22 = 0.954	5,000,000	5,241,090
2006	22	22/22 = 1.000	5,000,000	5,000,000
2007	23	23/22 = 1.045	4,000,000	3,827,751

Price Change Adjustments

Compunet Sales Data, 1990–2005

(1) Year	(2) Compunet Sales in Current $ (Thousands)	(3) Computer Price Index 1995=100	(4) Software Price Index 1995=100	(5) Price Index* 1995=100	(6) Sales in Constant $ (Thousands)
1990	89.0	58.40	63.81	59.48	149.63
1991	90.0	57.03	71.98	60.02	149.94
1992	95.4	66.57	77.61	68.78	138.71
1993	96.6	72.47	86.19	75.21	128.44
1994	98.9	79.27	91.55	81.73	121.01
1995	99.4	100.00	100.00	100.00	99.40
1996	100.2	110.14	114.61	111.03	90.24
1997	106.2	123.15	144.10	127.34	83.40
1998	107.5	131.92	166.22	138.78	77.46
1999	108.3	145.23	204.56	157.10	68.94
2000	120.0	153.40	236.19	169.96	70.60
2001	105.0	129.20	234.18	150.20	69.91
2002	103.8	116.79	224.66	138.37	75.02
2003	102.1	117.70	229.76	140.11	72.87
2004	98.7	124.51	247.05	149.02	66.23
2005	99.6	128.74	260.05	155.01	64.26

Price Change Adjustments

- Having computed the price index, we are now able to deflate the sales revenue with the weighted price index in the following way:

$$\textit{Deflated}\ 1990\ \textit{sales} = (89.0)\left(\frac{100}{59.48.0}\right) = 149.63$$

Price Change Adjustments

- To see the impact of separating the effect of price level changes, we graph the price of computers in constant and current dollars.

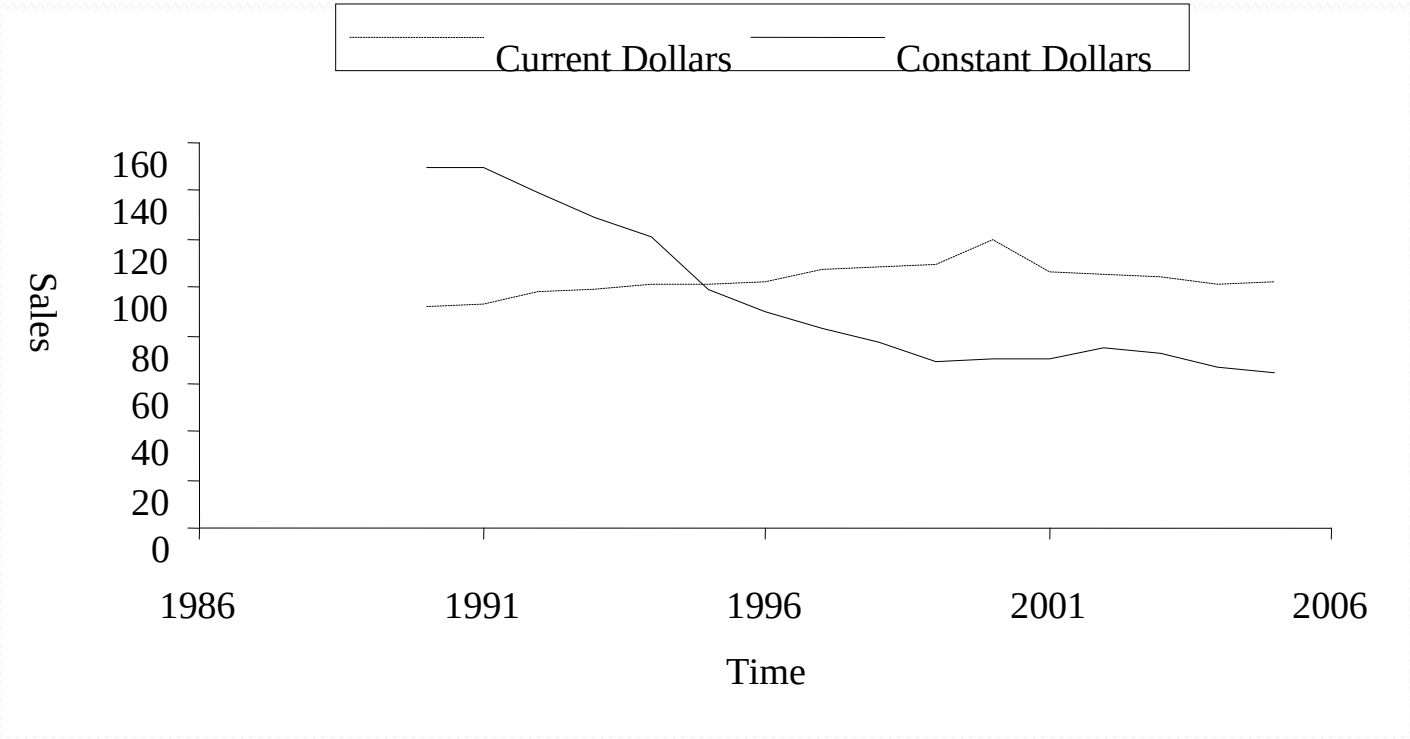


Figure 4.1 Computer Sales in Current and Constant Dollars

Population Change Adjustments

Disposable Personal Income and Per Capita Income for the U.S. 1990 and 2005

Year	Disposable Income Billions of Dollars	Population (in Millions)	Per Capita Disposable Income ($)
1990	4285.8	250.2	17,129.50
1991	4464.3	253.5	17,610.65
.....	.....	.....	.....
.....	.....	.....	.....
1999	6695.0	279.3	23,970.64
2000	7194.0	282.4	25,474.50
2001	7486.8	285.4	26,232.66
2002	7830.1	288.3	27,159.56
2003	8162.5	291.1	28,040.19
2004	8681.6	293.9	29,539.30
2005	9036.1	296.7	30,455.34

Data Transformation

- Most appropriate remedial measure for variance heterogeneity.
- Original data are converted into a new scale, resulting in a new data set that is expected to satisfy the condition of homogeneity of variance.
- Several transformation techniques are available.

Data Transformation

- Linear Transformation:
  - An important assumption in using the regression model for forecasting is that the pattern of observation is linear.
  - Obviously, there are many situations in which this is not a valid assumption.
    - For example, if we were forecasting monthly sales and it was believed that those sales varied according to the season of the year, then the assumption of linearity would not hold.

Linear Transformation

- A forecasting equation may be of the form:

$$Y = \alpha e^{\beta X} . \mathrm{u}$$

- The above could easily be transformed into a linear form for estimation purposes:

$$\log Y = \log \alpha + \beta X + \log u$$

Logarithmic Transformation

Southwest Airlines Operating Revenue between 1990 and 2006

Year	*Operating Revenue (Million Dollars)*	*Logarithmic Transformation*
1990	1237	3.09
1991	1379	3.14
1992	1803	3.26
……	……	……
……	……	……
2003	5937	3.77
2004	6530	3.81
2005	7584	3.88
2006	9086	3.96

Logarithmic Transformation

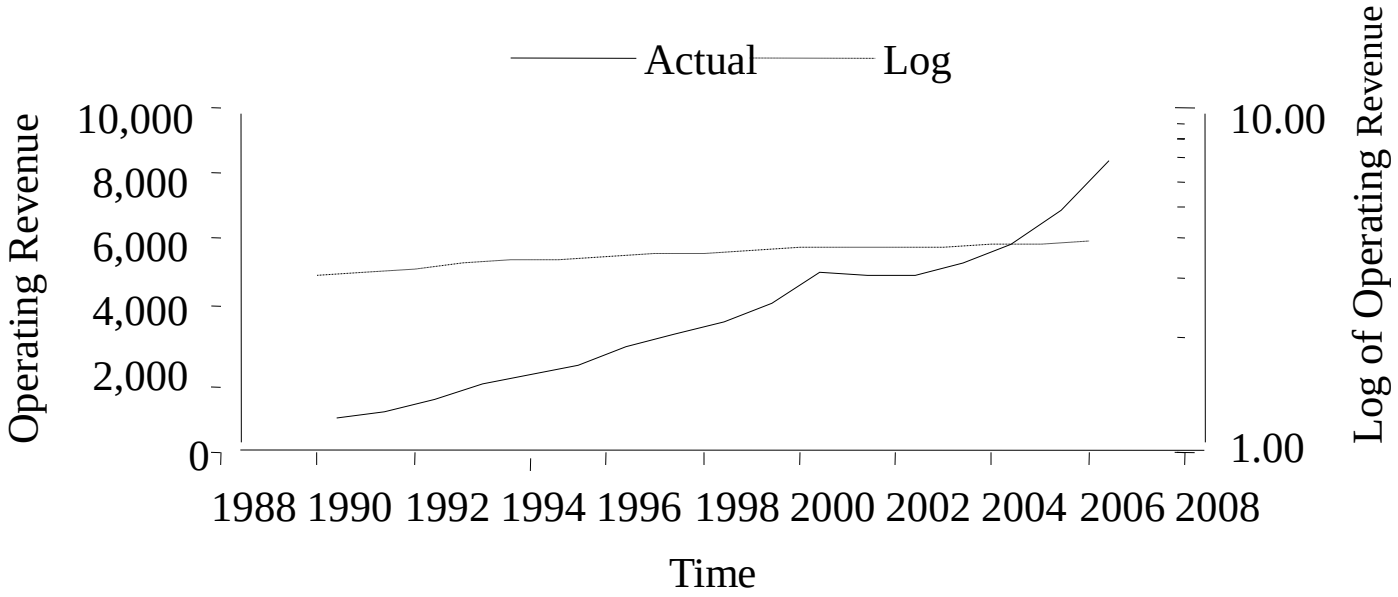


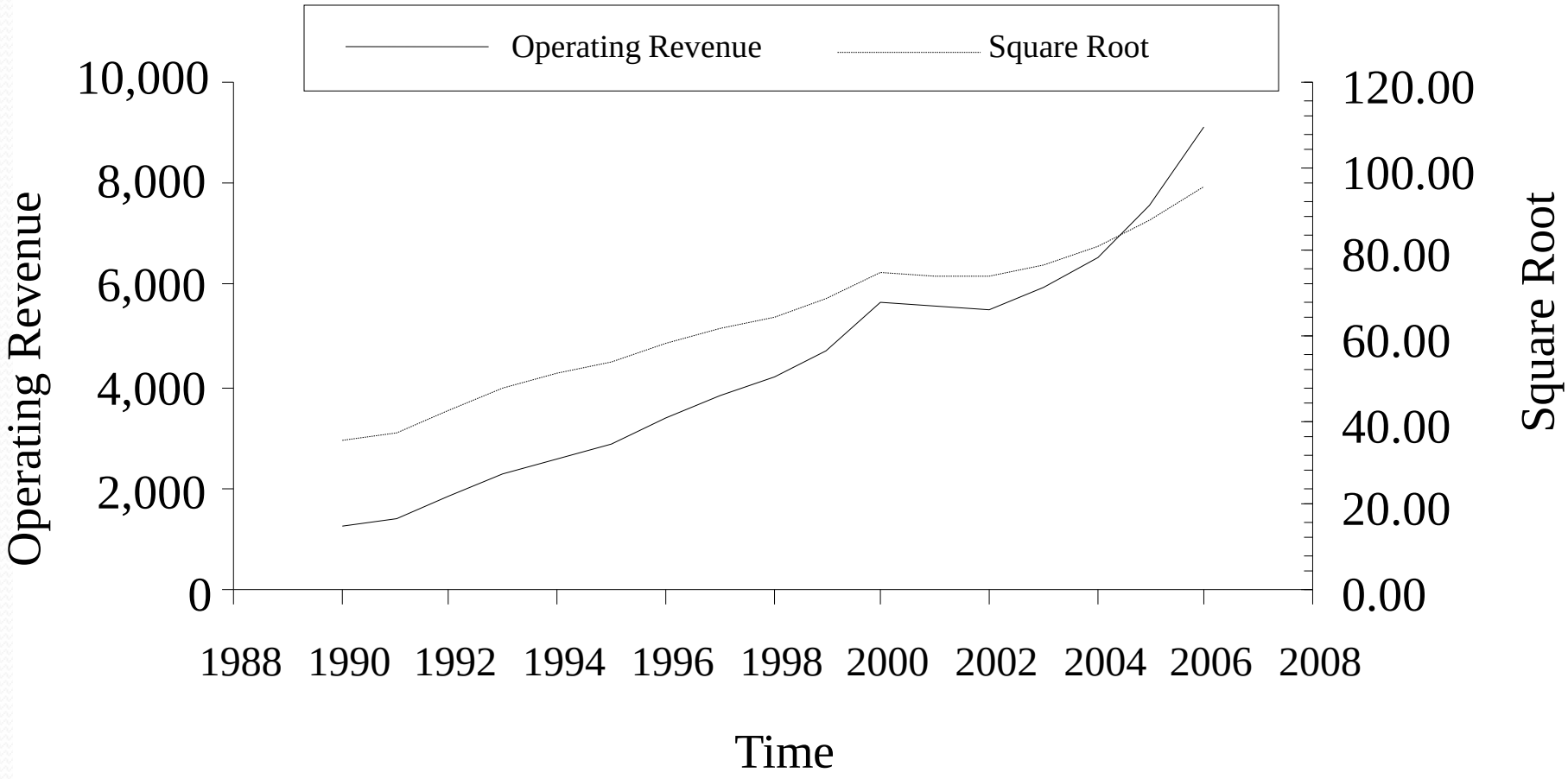
Figure 4.2 Actual and Logarithmically Transformed Operating Revenue for Southwest Airlines

Square Root Transformation

Southwest Airlines Operating Revenue for the Years 1990 and 2006

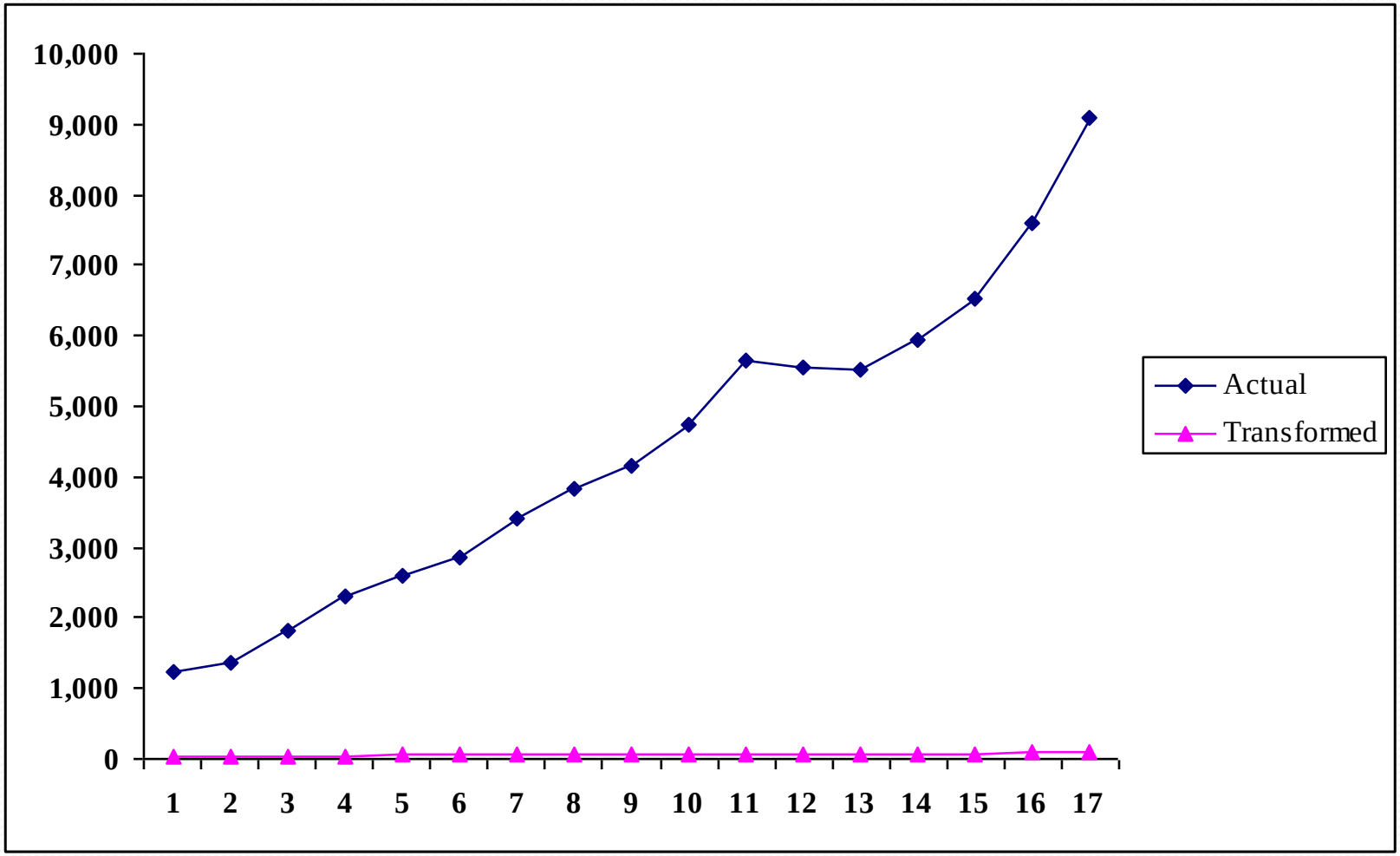
Year	*Operating Revenue (Million Dollars)*	*Square Root Transformation*
1990	1,237	35.17
1991	1,379	37.13
……	……	……
……	……	……
2002	5,522	74.31
2003	5,937	77.05
2004	6,530	80.81
2005	7,584	87.09
2006	9,086	95.32

Square Root Transformation (Scaled Square Root Data)



Square Root Transformation

(Unscaled Square Root Data)



Classical Time Series Model

- Secular Trend (T)
- Seasonal Variation (S)
- Cyclical Variation (C)
- Random or Irregular Variation

Trend

- Linear Trend

$$Y_t = a + bx$$

- Non-linear Trend

$$Y_t = e^{a+b_t}$$

$$Y_t = a + bT + cT^2$$

Trend

- Computing the Linear Trend
  - The Freehand Method
  - The Semi-average Method
  - The Least Squares Method

Freehand Method

U.S. Private Fixed Investment for the Years 1995–2005

Year	*Total Private Fixed Investment ($ Billion)*
1995	1,112.9
1996	1,209.9
1997	1,317.8
1998	1,438.4
1999	1,558.8
2000	1,679.0
2001	1,646.1
2002	1,570.2
2003	1,649.8
2004	1,830.6
2005	2,036.2

Freehand Method

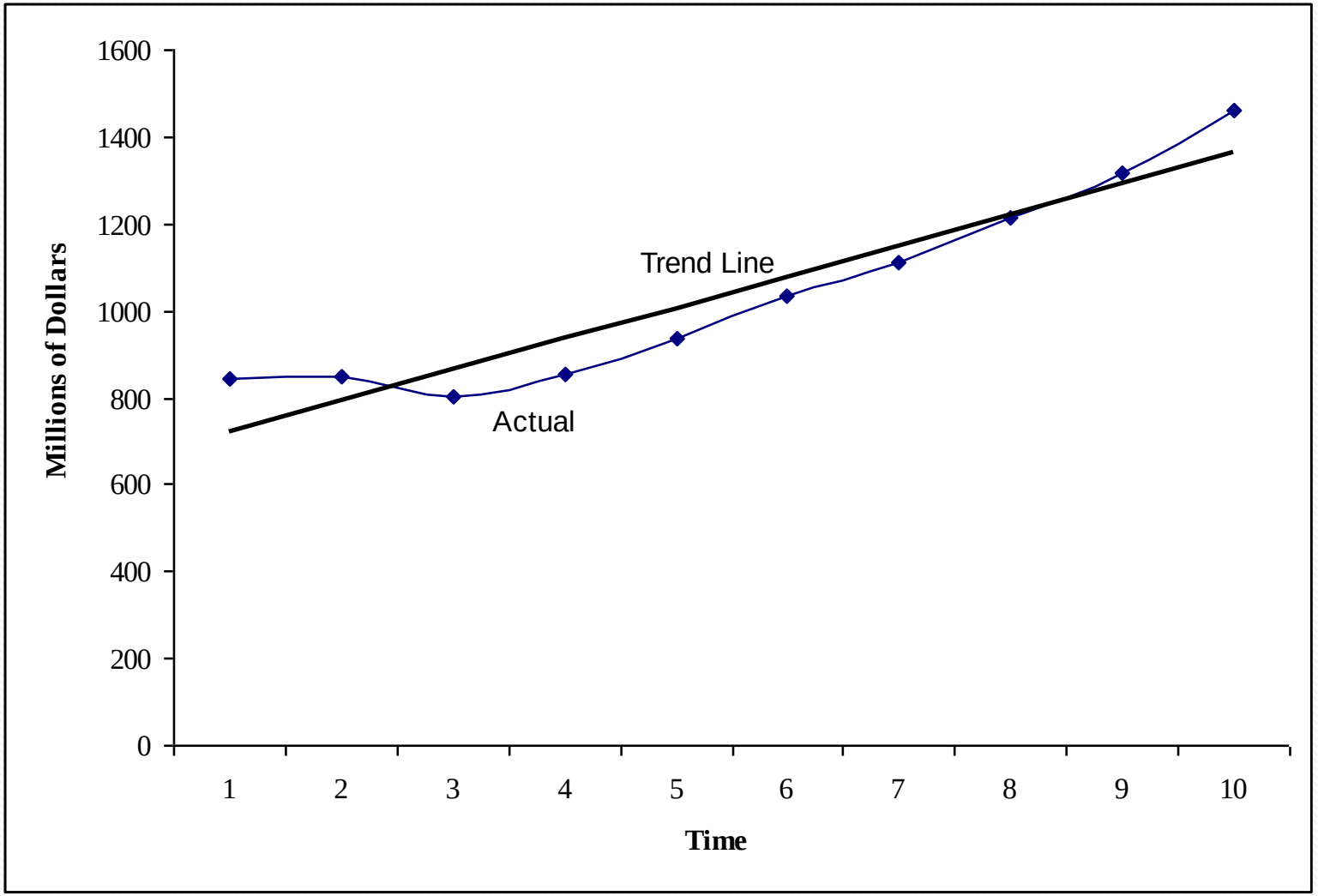
Since a linear trend by this method is simply an approximation of a straight line equation, we have to determine the intercept and the slope of the line.

$$Y_t = a + bx$$

Based on our data, we have:

$$\hat{Y}_t = 845.2 + 61.48x$$

Freehand Method



Freehand Method

- Now we can use this equation to make a forecast of the trend. For example, the forecast for 2006 would be:

$$\hat{Y}_t = 1{,}112.9 + 83.94(12)$$

$$\hat{Y}_{2006} = 2{,}120.18 \text{ Billion Dollars}$$

Freehand Method

- Based on your understanding, what are the pitfalls of using the freehand method?
- Simple method but not objective.
- Why not objective?

The Semi-average Method

- Simple but objective method in fitting a trend line.
- Divides the data into two equal parts and computes the average for each part.
- The computed averages for each part provide two points on a straight line.
- The slope of the line is computed by taking the difference between the averages and dividing it by half of the total number of observations.

The Semi-average Method

Fitting a Straight Line by the Semi-Average Method to Income from the Export of Durable Goods, 1996–2005

Year	Income	Semi-total	Semi-average	Coded Time
1996	394.9			−2
1997	466.2			−1
1998	481.2	2,415.1	483.02	0
1999	503.6			1
2000	569.2			2
2001	522.2			3
2002	491.2			4
2003	499.8	2,679	535.8	5
2004	556.1			6
2005	609.7			

The Semi-average Method

We see that the intercept of the line is:

$$483.02$$

The slope is:

$$b = \frac{535.80 - 483.02}{5} = 10.56$$

The fitted equation is:

$$\hat{Y}_t = 483.02 + 10.56x$$

The Semi-average Method

- For the year 2005, the forecast revenue from export of durable goods is:

$$\hat{Y}_t = 483.02 + 10.56(7)$$

$$\hat{Y}_t = \$556.94 \text{ Billion}$$

The Least Squares Method

- Provides the best method of fitting a trend.
- The intercept and the slope are computed as follows:

$$a = \frac{\sum Y}{n}$$

$$b = \frac{\sum xY}{\sum x^2}$$

The Least Squares Method

- Using the data from the previous example, we have:

$$a = \frac{5{,}094.1}{10} = 509.4$$

$$b = \frac{2{,}571.3}{330} = 7.79$$

The Least Squares Method

- The fitted trend line equation is:

$$\hat{Y}_t = 509.4 + 7.79x$$

x = 0 in 2000 ½

1 x = ½ year

Y = Billions of Dollars

- Note: Since x is measured in a half year, we have to multiply it by two to get the full year.

The Least Squares Method

- To compare the two methods, we note:
  - Semi-average:

$$\hat{Y}_t = 483.02 + 10.56x$$

  - Least squares:

$$\hat{Y}_t = 509.4 + 15.58x$$

Nonlinear Trend

- In many business and economic environments we observe that the time series does not follow a constant rate of increase or decrease, but follows an increasing or decreasing pattern.
- Whenever there is dramatic change in production technology, we expect the trend line not to follow a constant linear pattern.

Nonlinear Trend

- A polynomial function best exemplifies business conditions.

- A second-degree parabola provides a good historical description of an increase or decrease per time period.

$$\hat{Y}_t = a + bx_t + cx_t^2$$

Nonlinear Trend

- To solve for the constants *a*, *b*, and *c* in the previous equation, we use the following simultaneous equations:

$$\sum Y = na + c\sum x^2$$

$$\sum x^2 Y = a\sum x^2 + c\sum x^4$$

$$b = \frac{\sum xY}{\sum x^2}$$

Nonlinear Trend

World Carbon Emissions from Fossil Fuel Burning 1982–1994

Year X	Million tonnes Y	x	xY	x^2Y	x^2	x^4
1982	4,960	−6	−29,760	178,560	36	1,296
1983	4,947	−5	−24,735	123,675	25	625
1984	5,109	−4	−20,436	81,744	16	256
1985	5,282	−3	−15,846	47,538	9	81
1986	5,464	−2	−10,928	21,856	4	16
1987	5,584	−1	−5,584	5,584	1	1
1988	5,801	0	0	0	0	0
1989	5,912	1	5,912	5,921	1	1
1990	5,941	2	11,882	23,764	4	16
1991	6,026	3	18,078	54,234	9	81
1992	5,910	4	23,640	94,560	16	256
1993	5,893	5	29,465	147,325	25	625
1994	5,925	6	35,550	213,300	36	1,296
	72,754	0	17,238	998,061	182	4,550

Nonlinear Trend

- The data from the table is used to compute the following:

$$\hat{Y}_t = 5{,}739.8 + 94.71x - 10.24x^2$$

x = 0 in 1988

$1x$ = one year

Y = million tonnes

Logarithmic Trend

- When we wish to fit a trend line to percentage rates of change, we use the logarithmic trend line.
- This is more prevalent when dealing with economic growth in an environment.

- The logarithmic trend equation is:

$$\log Y_t = \log a + x \log b$$

Logarithmic Trend

- The least squares trend is computed as:

$$\log a = \frac{\sum \log Y}{n}$$

$$\log b = \frac{\sum (x \log Y)}{\sum x^2}$$

Logarithmic Trend Example

Year	Chinese Exports ($100 Million)	log Y	x	x log Y	x^2
1990	620.9	2.793	−15	−41.89	225
1991	719.1	2.857	−13	−37.13	169
1992	849.4	2.929	−11	−32.22	121
1993	917.4	2.963	−9	−26.66	81
1994	1,210.1	3.083	−7	−21.57	49
1995	1,487.8	3.173	−5	−15.86	25
1996	1,510.5	3.179	−3	−9.53	9
1997	1,827.9	3.262	−1	−3.26	1
1998	1,837.1	3.264	1	3.26	1
1999	1,949.3	3.290	3	9.86	9
2000	2,492.0	3.397	5	16.98	25
2001	2,661.0	3.425	7	23.97	49
2002	3,256.0	3.513	9	31.61	81
2003	4,382.28	3.642	11	40.05	121
2004	5,933.2	3.773	13	49.05	169
2005	7,619.5	3.882	15	58.22	225
		52.42	0.00	44.89	1360.0

Logarithmic Trend Example (*continued*)

$$\log a = \frac{\sum \log Y}{n} = \frac{52.42}{16} = 3.28$$

$$\log b = \frac{\sum (x \log Y)}{\sum x^2} = \frac{44.89}{1360} = 0.033$$

Logarithmic Trend Example (*continued*)

- The estimated trend line equation is:

$$\log \hat{Y}_t = 3.28 + 0.033x$$

$$x = 0 \text{ in } 1997\ ½$$

$$1\,x = ½ \text{ year}$$

Logarithmic Trend *(continued)*

- Check the goodness of fit by substituting two data points such as 1992 and 2003, into the fitted equation.
- For 1992, we will have:

$$Log\,\hat{Y}_{1992} = 3.28 + 0.033(-11)$$

$$Log\,\hat{Y}_{1992} = 2.917$$

Logarithmic Trend *(continued)*

- For 2003, we will have:

$$\text{Log}\,\hat{Y}_{2003} = 3.28 + 0.033(11)$$

$$\text{Log}\,\hat{Y}_{2003} = 3.643$$

Logarithmic Trend

- Interpretation of the estimated trend line would be similar to a linear trend. However, before we can interpret the estimated values, we have to convert the log values into actual values of the data points.

- This is done by taking the antilog.

Logarithmic Trend

- The results are:

$$\hat{Y}_{1992} = \text{antilog}\,(\log\hat{Y}) = \text{antilog}\,2.917$$

$$\hat{Y}_{1992} = 826.04$$

And

$$\hat{Y}_{2003} = \text{antilog}\,(\log\hat{Y}) = \text{antilog}\,3.643$$

$$\hat{Y}_{2003} = 4{,}395.42$$

Logarithmic Trend

- To determine the rate of change or the slope of the line we have:

$$R = \text{antilog } 0.033 = 1.079$$

Since the rate of change (r) was defined as $R - 1$, then

$$r = 1.079 - 1 = 0.079$$

r = 7.9 percent per half-year

Therefore the growth rate is 15.8% or 16% per year.

Other Approaches to Trend Line

- Two more sophisticated methods of determining whether there is a trend in the data:
  - Differencing
  - Autocorrelation (Box–Jenkins Methodology)

- Allows the analyst to see whether a linear equation, a second-degree polynomial, or a higher-degree equation should be used to determine a trend.

Differencing

- First Difference

$$\Delta Y_t = Y_t - Y_{t-1}$$

- Second Difference

$$\Delta_2 Y_t = \Delta Y_t - \Delta Y_{t-1}$$

Differencing Method Example

First and Second Difference of Hypothetical Data

Yt	*First Difference*	*Second Difference*
20,000		
22,000	2,000	
24,300	2,300	300
26,900	2,600	300
29,800	2,900	300
33,000	3,200	300

Seasonal Analysis

- Seasonal variation is defined as a predictable and repetitive movement observed around a trend line within a period of 1 year or less.
- There are several reasons for measuring seasonal variations.
  - When analyzing the data from a time series, it is important to be able to know how much of the variation in the data is due to the seasonal factors.

Seasonal Variation (*Continued*)

- We may use seasonal variation patterns in making projections or forecasts of a short-term nature.

- By eliminating the seasonal variation from a time series, we may discover the *cyclical* pattern of the time series.

Seasonal Variation

Computation of Ratio of Original Data to Moving Average

Year and Month (1)	*Passenger Enplanement (Million)* (2)	*Moving 12-month Total* (3)	*Moving Average* (4)	*Ratio of Original Data to Moving Average, %* (5)
2001 Jan.	44.107			
Feb.	43.177			
March	53.055			
April	50.792			
May	51.120			
June	53.471			
July	55.803	560.359	46.70	119.50
Aug.	56.405	554.809	46.23	122.00
Sept.	30.546	550.277	45.86	66.61
Oct.	40.291	545.723	45.48	88.60

Seasonal Variation

- To compute a seasonal index, we do the following:
  - sum the modified means

Months

Year	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
2001							119.5	122.0	66.6	88.6	90.4	91.5
2002	87.0	87.9	111.4	102.5	104.7	108.6	111.1	110.3	86.2	103.2	94.2	105.7
2003	91.3	86.6	104.7	97.7	101.5	107.4	114.7	110.8	90.3	101.2	94.4	99.1
2004	86.7	89.0	105.8	103.5	102.2	109.0	113.6	108.6	90.0	101.6	96.7	97.6
2005	88.6	86.6	108.0	100.4	104.8	109.0	114.0					
Mean	87.4	87.1	106.2	100.2	102.8	108.3	112.9	109.9	88.8	102.0	95.1	96.1

Seasonal Variation

Month	*Mean Middle Three Ratios*	*Seasonal Index*
Jan.	87.42	87.68
Feb.	87.05	87.31
March	106.19	106.50
April	100.19	100.50
May	102.80	103.11
June	108.32	108.64
July	112.91	113.25
Aug.	109.90	110.23
Sep.	88.81	89.07
Oct.	102.00	102.31
Nov.	95.09	95.38
Dec.	96.07	96.36

Seasonal Variation

- If production is full, we expect the index to equal 100 for each month. If not, we have to adjust it by computing a correction factor.

$$\text{Correction Factor} = \frac{1200}{1197.97} = 1.002$$

- Compute the seasonal index.

Seasonal Variation

Partial Deseasonalized Data for Passenger Enplanement, 2001–2005

Year and Month (1)		*Passengers (Million) (2)*	*Seasonal Index (3)*	*Deseasonalized Passenger Enplanement [col 2 ÷ col 3] X 100*
2001	Jan.	44.107	87.68	50.306
	Feb.	43.177	87.31	49.452
	March	53.055	106.50	49.814
	April	50.792	100.50	50.539
	…..	……..	…….	…….
2005	Sept.	50.776	89.07	57.005
	Oct.	53.971	102.31	52.754
	Nov.	52.962	95.38	55.530
	Dec.	53.007	96.36	55.008

Cyclical Variation

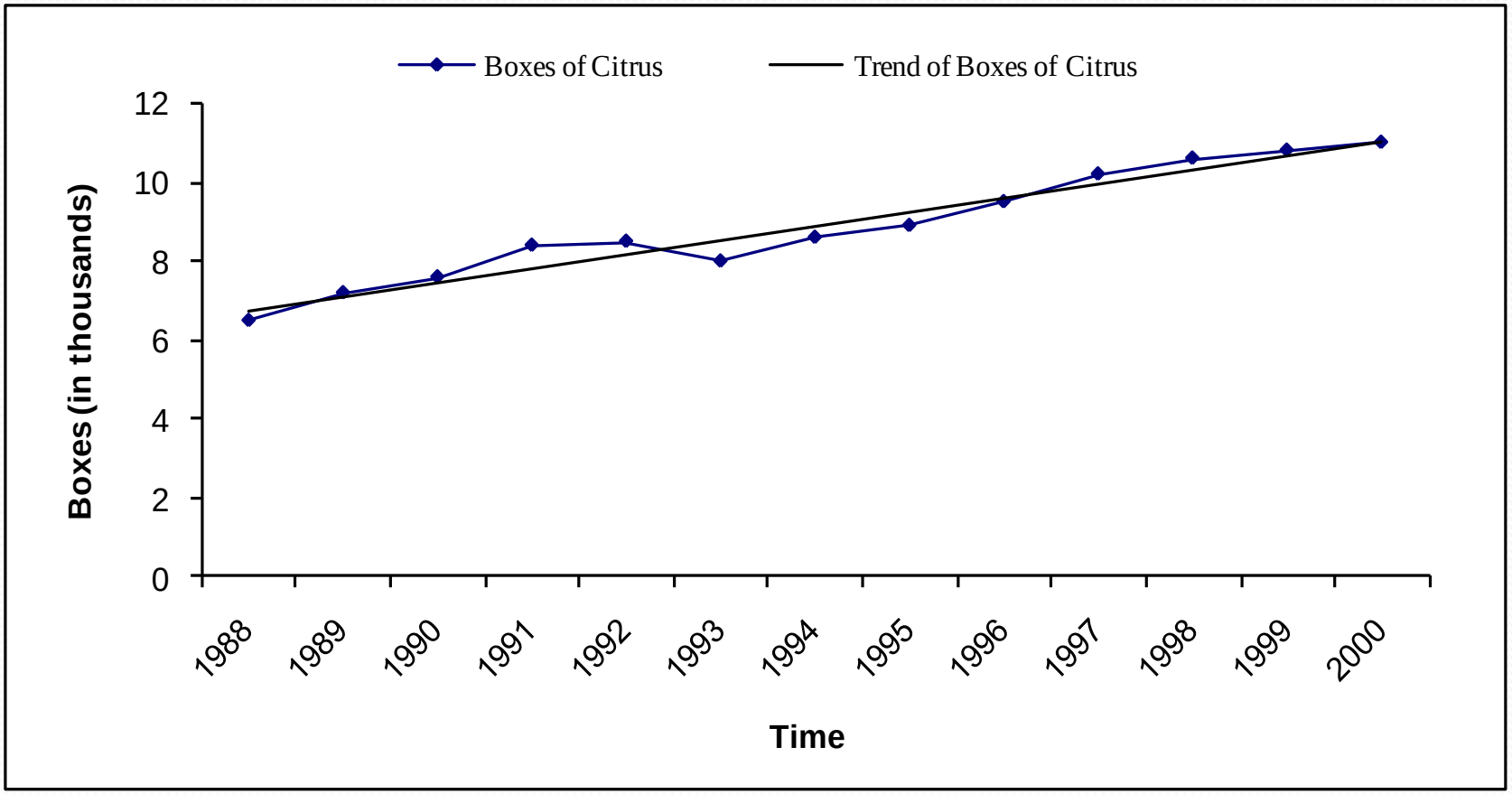
- Similar to seasonal variation except that it occurs every 5 to 10 years.
- There is a systematic pattern in the data that mirrors what is happening in the economy.
- Movements from a recession to a depression or recession to recovery follow a cycle.
- Every time series data has a random component. If there were no random components, we would have perfect prediction of future values. However, this is not the case with real-world conditions.
- The cyclical component is measured as a proportion of the trend.

Cyclical Variation

Citrus Received by the Cooperative during 1994–2006, and the Estimated Trend

Year X	*Boxes of Citrus (in 1,000)* Y	*Trend* Y_t
1994	6.5	6.7
1995	7.2	7.1
1996	7.6	7.5
1997	8.4	7.9
1998	8.5	8.3
1999	8.0	8.7
2000	8.6	8.9
2001	8.9	8.7
2002	9.5	9.5
2003	10.2	9.9
2004	10.6	10.3
2005	10.8	10.7
2006	11.0	11.1

Cyclical Variation



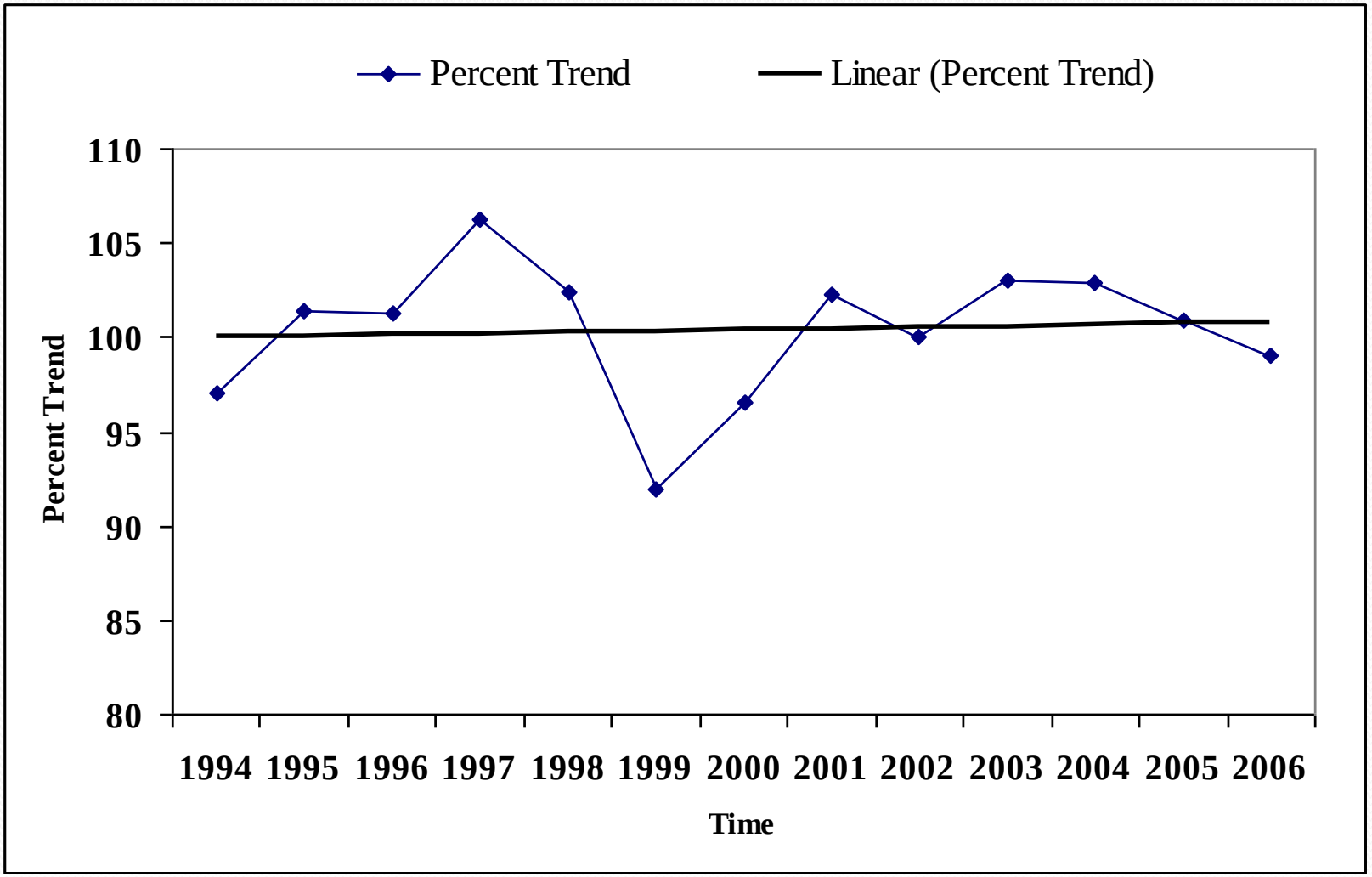
Cyclical Fluctuations around the Trend Line

Cyclical Variation

Calculation of Percent of Trend

Year X	*Boxes of Citrus (in 1,000)* Y	*Trend* Y_t	*Percent of trend* $(Y/Y_t \times 100)$
1994	6.5	6.7	97.0
1995	7.2	7.1	101.4
1996	7.6	7.5	101.3
1997	8.4	7.9	106.3
1998	8.5	8.3	102.4
1999	8.0	8.7	91.9
2000	8.6	8.9	96.6
2001	8.9	8.7	102.3
2002	9.5	9.5	100.0
2003	10.2	9.9	103.0
2004	10.6	10.3	102.9
2005	10.8	10.7	100.9
2006	11.0	11.1	99.1

Cyclical Variation Example



Summary

- Preliminary Adjustments to Data:
  - Trading Day Adjustment
  - Price Adjustment
  - Population Adjustment
- Data Transformation
- Patterns in Time Series Data
- The Classical Decomposition Method

Using Regression Analysis as a predictor and estimator

Using Regression Analysis as a predictor and estimator

- This can be used to help develop a clear line in smoothing.
- Examples and models to follow.

Mastering the use of Exponential Smoothing as a Data Analysis tool

Business Forecasting

5

Forecasting with Smoothing Techniques

Topics

- Introduction
- Naïve Model
- Forecasting with Averaging Models:
  - Simple Average Model
  - Moving Average Model
  - Double Moving Average Model
- Exponential Smoothing:
  - Double Exponential Smoothing

Exponential Smoothing

(*Continued*)

- Holt's Method
- Triple Exponential Smoothing
- Winters' Seasonal Exponential Smoothing

Introduction

- Elaborate statistical models are not always required to develop accurate forecasts.
- The principle of parsimony suggests that the simpler the model the better.
- The main advantage of simple models is that they serve as a benchmark with which to gauge applicability, reliability, and necessity of the more sophisticated models.

Introduction

- These time series models are good tools in forecasting short-term events.
- The cardinal premise underlying all time series models is that the historical pattern of the dependent variable can be used as the basis for developing forecasts.
- In these models, historical data for the forecast variable are analyzed in an attempt to discern any underlying pattern(s).

Introduction

- Time series or autoregressive forecasting models will be most useful when economic conditions can be expected to remain relatively stable.
- Reliance of time series models on analysis and extrapolation of historical patterns carries several important implications with respect to technique selection:

Introduction

1. Time series are best when applied to short-term forecasts.
2. Time series models prove most satisfactory when historical data contain either no systematic data pattern or when the changes are occurring very slowly or consistently.
3. Data requirements and ease of implementation are a function of the specific time series technique selected.

Naïve Model

- Uses recent past as the best indicator of the future.

$$\hat{Y}_{t+1} = Y_t$$

- The error associated with this model is computed as:

$$e_t = Y_t - \hat{Y}_t$$

Example for the Naïve Model

Week	Sales (in $1,000)	Forecast
1	9	-
2	8	9
3	9	8
5	12	9
6	9	12
7	12	9
8	11	12
9	?	11

Example for the Naïve Model

Week	Sales (in $1,000)	Forecast	Error	Absolute Error	Squared Error
1	9				
2	8	9	−1	1	1
3	9	8	1	1	1
5	12	9	3	3	9
6	9	12	−3	3	9
7	12	9	3	3	9
8	11	12	−1	1	1
		Sum	2	12	30
		Mean	0.33	2	5

Example for the Naïve Model

- What you should keep in mind is that, although MAD is often used as the measurement of error in evaluating a forecast, an alternative criterion is the MSE.

- Note that the difference between MAD and MSE is that the latter penalizes a forecast much more for extreme deviations than it does for small ones.

Example for the Naïve Model

- Whenever a manager evaluates alternative forecasting techniques in terms of their accuracy, it is necessary to go beyond the computation of error.
- Managers are generally concerned with two forms of accuracy:
  - Accuracy of the technique in predicting the underlying patterns or relationship of past data.
  - Accuracy of the changes in the pattern. That is, how fast forecasting procedure can respond to that basic change.

Averaging Models

- The basic premise of these models is that a weighted-average of past observations can be used to smooth the fluctuations in the data in the short term.

Simple Average Model

- Similar to the naïve model, this model uses part of the historical data to make a forecast.

$$\hat{Y}_{t+1} = \frac{\sum_{t=1}^{n} Y_t}{n}$$

Moving Average Model

- Recent observations play an important role in the forecast.
- As new observations become available, a new average is computed.
- The choice of using a smaller or larger number of observations has implications for the forecast.

Double Moving Average Model

- Used when we have a linear trend in the data.
- Two different moving averages are computed in this model.
- The idea is to remove the trend.

Double Moving Average Model

Week	Sales (in $1,000)	Simple Moving Average	Simple Moving Average Forecast	Double Moving Average
1	9			
2	11	10		
3	10	10.5	10	10.25
5	14	12	10.5	11.25
6	18	16	12	14
7	22	20	16	18
8	23	22.5	20	21.25

Exponential Smoothing Model

- The model relies on the assumption that the data are stationary.

- Most recent observations play a more important role than the distant past.

$$\hat{Y}_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \alpha(1-\alpha)^3 Y_{t-3}$$

Exponential Smoothing Model

- The model depends on three pieces of data:
  - Most recent actual
  - Most recent forecast
  - Smoothing constant.

- The value of alpha assigned as a smoothing constant is critical to the forecast.
- The best alpha should be chosen on the basis of minimal sum of error squared.

Exponential Smoothing Model

- Several approaches are followed in selecting the smoothing constant.
  - If a great amount of smoothing is desired, a small alpha should be chosen.
  - The choice of alpha is affected by the characteristics of the time series. If sharp ups and downs are noticed in the data, the best smoothing constant is 0.1. That is alpha chosen should equal 0.1.
  - If the data show that the past is very different from the present, then alpha of 0.9 is appropriate.

Exponential Smoothing Model

- Exponential smoothing is used for routine sales forecasting of inventory, production, distribution, and retail planning.

Double Exponential Smoothing Model

- Similar to the double moving average model.
- Also known as Brown's double exponential smoothing model.

$$\hat{Y}_{t+x} = a_t + b_t x$$

Double Exponential Smoothing Model

- The model is represented as:

$$\hat{Y}_{t+x} = a_t + b_t x$$

$\hat{Y}_{t+x}$ = forecast value x periods in the future

a_t = the difference between the simple A' and the double A'' smoothed values

b_t = slope in a time series

X = number of periods ahead to be forecasted

Double Exponential Smoothing Model

- To compute the difference between simple and double smoothed values:

$$A_t^{'} = \alpha Y_t + (1-\alpha) A_{t-1}^{'}$$

$$A_t^{''} = \alpha A_t^{'} + (1-\alpha) A_{t-1}^{''}$$

Double Exponential Smoothing Model

- Once we have computed the simple and double smoothed values, we then compute the intercept and the slope of the forecast line as follows:

$$a_t = 2A_t^{'} - A_t^{''}$$

$$b_t = \frac{\alpha}{1-\alpha}(A_t^{'} - A_t^{''})$$

The forecast equation is:

$$\hat{Y}_{t+x} = a_t + b_t x$$

Holt's Exponential Smoothing Model

- To handle linear trend, similar to the Brown's Method.
- The difference is that in this method we smooth the trend and the slope in the time series by using different constants for each.
- How do we find the best combination of smoothing constant?
- Low values of alpha and beta should be used when there are frequent random fluctuations in the data.
- High values of alpha and beta should be used when there is a pattern such as trend in the data.

Holt's Exponential Smoothing Model

- The following equations are used when applying the Holt's method:

$$A_t = \alpha Y_t + (1-\alpha)(A_{t-1} + T_{t-1})$$

$$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1}$$

$$\hat{Y}_{t+x} = A_t + xT_t$$

Triple Exponential Smoothing Model

- When faced with nonlinear pattern in the data, this model provides a good forecast.
- The life cycle model of products, and cost structures are environments where the triple exponential smoothing should be used.
- The forecasting equation is:

$$\hat{Y}_{t+x} = a_t + b_t x + (1/2)c_t x^2$$

Triple Exponential Smoothing Model

- In this model we have to compute three coefficients: a, b, and c .

- Each of the coefficients is computed as follows:

$$a_t = 3A_t^1 - 3A_t^2 + A_t^3$$

$$b_t = \frac{\alpha}{2(1-\alpha)^2}\left\{(6-5\alpha)A_t^1 - (10-8\alpha)A_t^2 + (4-3\alpha)A_t^3\right\}$$

$$c_t = \left[\left\{\frac{\alpha}{1-\alpha}\right\}\right]^2 (A_t^1 - 2A_t^2 + A_t^3)$$

Triple Exponential Smoothing Model

- You will note that the estimation of the coefficients (*a*, *b*, and *c*) requires us to compute three smoothing values.

$$A_t^1 = \alpha Y_t + (1-\alpha) A_{t-1}^1$$

$$A_t^2 = \alpha A_t^1 + (1-\alpha) A_{t-1}^2$$

$$A_t^3 = \alpha A_t^2 + (1-\alpha) A_{t-1}^3$$

Winters' Seasonal Exponential Smoothing

- Allows for both trend and seasonal patterns to be taken into account.
- This is an extension of the Holt's method of smoothing.
- In computing the forecast, we add an equation for seasonality as an index.
- The forecast model is:

$$\hat{Y}_{t+x} = (A_t + xT_t)I_{t-L+x}$$

Winters' Seasonal Exponential Smoothing

- The Winters' model has the following components:

Smoothing value $$A_t = \alpha \frac{Y_t}{I_{t-L}} + (1-\alpha)(A_{t-1} + T_{t-1})$$

Trend estimate $$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1}$$

Seasonality estimate $$I_t = \gamma \frac{Y_t}{A_t} + (1-\gamma)I_{t-L}$$

Summary

- Discussed how the naïve model is used in forecasting.
- Elaborated on the moving averages model, which included the simple moving average and the double moving average.
- Discussed the exponential smoothing models of Brown, Holt, and Winters.
- Identified the criteria for using the various models.

Business Forecasting

6

Adaptive Filtering as a Forecasting Technique

Topics

- Introduction
- How the Model is Used in Forecasting
- Summary

Introduction

- The adaptive filtering approach also depends heavily on historical observations.
- More complicated data patterns such as those with cycles are easily accommodated.
- The model makes it possible to learn from past errors and correct for it before making a final forecast.

Introduction

- In both the moving average and the exponential smoothing models, the forecaster depended on selecting the right value for the smoothing constant or the weight.
- In the adaptive filtering technique, the model seeks to determine the “best” set of weights that needs to be used in making a forecast.

Introduction

- The model is capable of generating information about past inaccuracy and corrects itself.

Basic Elements of the Technique

- The technique has two distinct phases:
  - The first phase is the adapting or training of a set of weights with historical data.
  - The second phase uses these weights to make a forecast.
- As in the previous methods, we compute the error for the forecast.
- The weights are adjusted based on the errors, and a new forecast is made.

Basic Elements of the Technique

- Note how we forecast for period 5, for example, using the weights:

$$\hat{Y}_5 = w_1 Y_4 + w_2 Y_3 + w_3 Y_2 + w_4 Y_1$$

- The error will be computed as:

$$e_5 = Y_5 - \hat{Y}_5$$

Adapting and Training Process

Hypothetical Data Used in Adjusting the Weights by Adaptive Filtering

Time	*Observed Data*	*Weights*	*Forecast*
1	Y_1	w_4	
2	Y_2	w_3	
3	Y_3	w_2	
4	Y_4	w_1	
5	Y_5		$\hat{Y}_5$
6	Y_6		
7	Y_7		
8	Y_8		
9	Y_9	w_4	
10	Y_{10}	w_3	
11	Y_{11}	w_2	
12	Y_{12}	w_1	
13			$\hat{Y}_{13}$

Training Phase

- In the training phase we use the following equation to adjust or revise the weights:

$$w_i' = w_i + 2k\left[e_t / y^2\right]Y_{t-i+1}$$

where :

w_i' = The revised ith weight

Training Phase

w_i = the old i th weight

k = a constant term referred to as the learning constant

e_t / y^2 = the standardized error of forecast in the period

Y_{t-i+1} = the observed value at period $t - i + 1$

$i = 1, 2, \ldots, p$ (p = number of weights)

$t = p + 1, p + 2, \ldots, N$ (N = number of observations)

y = the largest of the most recent N values of Y.

Training Phase

- As you can see, the revised set of weights is equal to the old set of weights plus some adjustments made for the error.
- The adjustment for each weight is based on:
  - The observed value
  - The value of the learning constant *k*
  - The error for that forecast.

Training Phase

- The learning constant allows the weights to be changed automatically as the time series changes its patterns.
- The steps for this adjustment process involves:
  - Specifying the number of weights
  - Specifying the learning constant (k).

Training Phase

- There are at least two ways of assigning the initial weights:
  - Forecaster uses his/her judgment to assign the weight.
  - A statistical approach is used to determine the weight as shown below:

where

$$w_i = 1/N$$

N = the number of observations in the data series.

Training Phase

- For quarterly data, *N* would equal 4 and for monthly data, *N* would equal 12
- The minimum number of weights that can be used in adaptive filtering is two.

- The learning constant (k) has a value between 0 and 1.

Training Phase

- If we choose a higher value for *k*, then we can expect rapid adjustment to changes in patterns, making it difficult to find the optimal weight.
- If we select a small value for *k*, the number of iterations needed to reach optimal weights may increase significantly.

Training Phase

- As a rule, *k* can be set to equal to 1/*p* where *p* is the number of weights.
- Alternative values of *k* are used, and the one that has the smallest standard error is selected.
- When data have a great deal of variation, a smaller *k* is recommended.

Example

Table 6.3 Quarterly Production Output

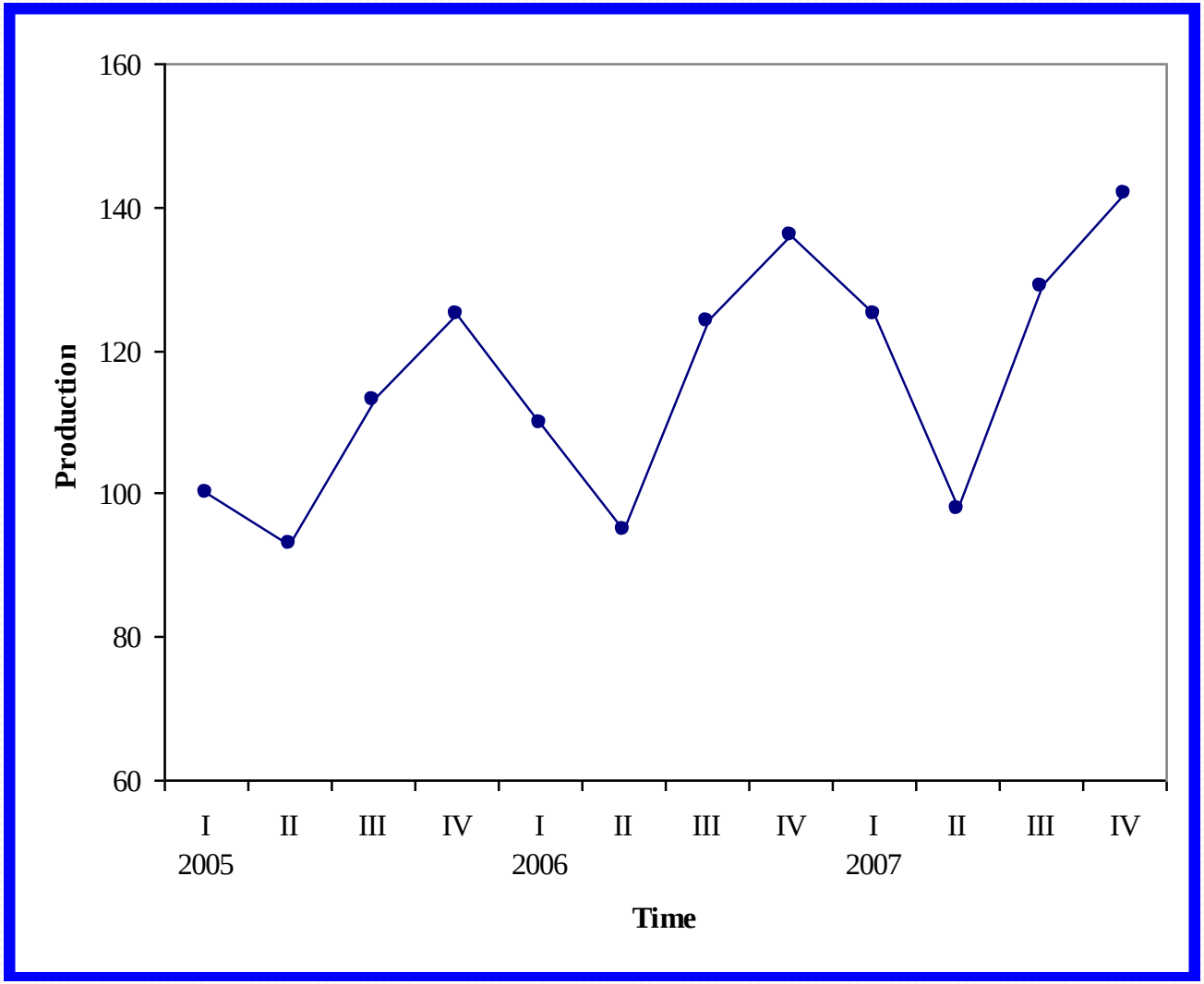
Period	*Year*	*Quarter*	*Output*
1	2005	I	100
2		II	93
3		III	113
4		IV	125
5	2006	I	110
6		II	95
7		III	124
8		IV	136
9	2007	I	125
10		II	98
11		III	129
12		IV	142

Example

Step 1:

Graph the data to see what observations can be made from the scatter plot.

Example


160
140
120
100
80
60
Production
I
II
III
IV
I
II
III
IV
I
II
III
IV
2005
2006
2007
Time

Example

Step 2:

Select the weight. Given that we have quarterly data, the weight will be:

$1/n = 0.25$ for each quarter.

Step 3:

Since there is seasonality in the data, we may want to give more weight to the quarter prior to the one for which the forecast is being made.

Example

Suppose we arbitrarily give the following weights for each quarter:

Q1 = 0.2

Q2 = 0.2

Q3 = 0.2

Q4 = 0.4

Example

Step 4:

The forecast for the first quarter of 2006 will be:

$$\hat{Y}_5 = (0.2)(125) + (0.2)(113) + (0.2)(93) + (0.4)(102) = 107$$

Step 5:

The error associated with this forecast will be:

Error = Observed value in period 5 – Forecast in period 5

= 110–107= 3.0

Example

Step 6:

Compute a new adjusted (or optimized) set of weights.

To do this, we have to know the learning constant (k).

We can set k to equal $1/p$, which in this case would be 0.25, since we have used four weights.

Example

Step 7:

Compute a new adjusted set of weights:

$$w_1^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]125 = 0.2120$$

$$w_2^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]113 = 0.2108$$

$$w_3^{'} = 0.2 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]93 = 0.1999$$

$$w_4^{'} = 0.4 + 2(0.25)\left[\left(110 - 107/125^2\right)\right]102 = 0.4098$$

Example

Step 8:

The forecast for period 6, the second quarter of 2006, is now based on the new weights that we have just computed.

$$\hat{Y}_6 = (0.2120)(110) + (0.2108)(125) + (0.1999)(113) + (0.4098)(93) = 110$$

Example

Step 9:

This process of using the newly adjusted weights is used to compute the forecasts for the subsequent quarters.

Example

Table 6.4 Forecast of Quarterly Production and Adjusted Weights for the 12 Periods

Period t	*Year/Quarter*		*Output* Y_t	*Forecast* F_t	W_1	W_2	W_3	W_4
1	2005:	I	102					
2		II	93					
3		III	113					
4		IV	125		0.2	0.2	0.2	0.4
5	2006:	I	110	107	0.2120	0.2108	0.1999	0.4098
6		II	95	110	0.1579	0.1493	0.1443	0.3641
7		III	124	91	0.2594	0.2669	0.2779	0.4849
8		IV	136	149	0.2090	0.2283	0.2332	0.4341
9	2007	I	125	127	0.2030	0.2228	0.2327	0.4336
10		II	98	126	0.1093	0.1209	0.1398	0.3624
11		III	129	90	0.2132	0.2534	0.2840	0.4939
12		IV	142	155	0.1678	0.2189	0.2400	0.4461

Example

Step 10:

Refine the weights by substituting those weights that are generated at the end of the training period:

$$w_1^{'} = 0.1678$$

$$w_2^{'} = 0.2189$$

$$w_3^{'} = 0.2400$$

$$w_4^{'} = 0.4461$$

Example

Step 11:

Using the computer program provided with this book, this process is continued until we have minimized the standard error and no more reduction is noted with repeated iterations.

Example

Adjusted Weights and the Standard Error after 200 Iterations

Iteration Number	*Standard Error*	W_1	W_2	W_3	W_4
1	**22.4013**	**0.1682**	**0.2188**	**0.2454**	**0.4419**
2	**20.8818**	**0.1213**	**0.2179**	**0.2771**	**0.4712**
3	**20.2727**	**0.0766**	**0.2121**	**0.3063**	**0.5023**
4	**19.7485**	**0.0344**	**0.2021**	**0.3331**	**0.5353**
5	**19.2626**	**-0.0051**	**0.1886**	**0.3572**	**0.5698**
……	**…….**	**……**	**….**	**……**	**…..**
120	**4.6367**	**−0.0990**	**0.1435**	**−0.3307**	**1.3484**
130	**4.4662**	**−0.1082**	**0.1694**	**−0.3328**	**1.3451**
140	**4.4153**	**−0.1227**	**0.1804**	**−0.3274**	**1.3507**
150	**4.4179**	**−0.1321**	**0.1785**	**−0.3250**	**1.3613**

Example

Step 11:

The forecast for period 13 will be:

$$\hat{Y}_{13} = (-0.1227)(142) + (0.1804)(129) + (-0.3274)(98) + (1.3507)(125) = 142.60$$

Summary

- The adaptive filtering approach depends heavily on historical observations.
- But, in this technique more complicated data patterns such as those with cycles are easily accommodated.
- Additionally, adaptive filtering makes it possible to learn from past errors and correct for it before making a final forecast.

Summary

- In comparison with the moving average and the exponential smoothing models, the adaptive filtering model seeks to determine the “best” set of weights that needs to be used in making a forecast.
- The model is capable of generating information about past inaccuracy and corrects itself.

Summary

- The technique has two distinct phases. The first phase is the adapting or training of a set of weights with historical data, and the second is to use these weights to make a forecast.
- We discussed how the weights are selected at the beginning and how finally the revised weights are used in making a forecast.

Summary

- Two important elements of the technique are the selection of the weights and the learning constant (k).
- Use of the computer program specially designed for this session makes the process of forecasting very easy.

Validation of Time Series Analysis

Validation of Time Series Analysis

- Using a basic Naïve model retrospectively will validate the usefulness of the forecast being used.

DAY 3

Approaches to Budget Development

- Zero Base Budgeting
- Activity based Budgeting
- Rolling Budgets
- Operational Unit Budgeting
- Programme budgeting
- Developing the Cash Budget

Q1: Budgets & Strategic Management Process

- A budget is
  - A formalized financial plan.
  - A translation of an organization's strategies.
  - A method of communicating.
  - A way to define areas of responsibility and decision rights.

- The budget cycle is the series of sequential steps followed to create and use budgets.

Q1: Budgets & Strategic Management Process

- Budgeting process begins with the organizational vision, core competencies, and risk appetite
- Organizational strategies designed to achieve the vision will drive the capital expenditures and long term financing plans
- Operating plans are then created in line with the organizational strategies
- Actual results must be monitored, measured, and analyzed compared to budgeted plans

Q1: Budgets & Levers of Control

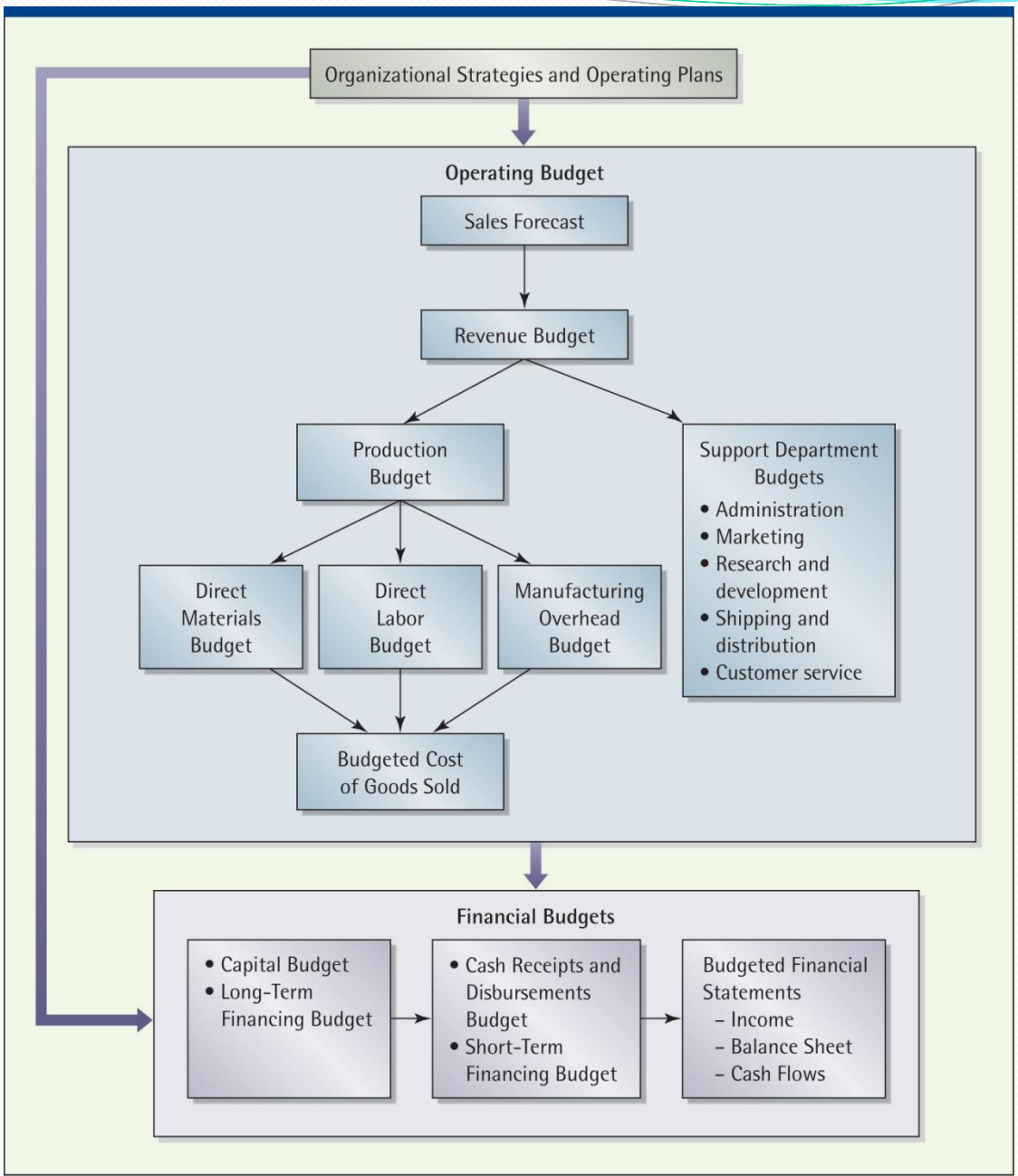
Belief Systems	Boundary Systems	Interactive Control Systems	Diagnostic Control Systems
• Communicates organizational strategies and goals • Motivates managers to plan in advance and coordinate activities	• Authorizes employees to engage in planned activities and spend within budget limits • Ensures sufficient cash flow for financial viability	• Utilize variances to identify opportunities and threats to the business • Revaluate strategies and operating plans as conditions changes	• Assign responsibility and reward employees for achieving budget targets • Motivate managers to provide good estimates and use resources appropriately

Q2: Master Budgets

- A master budget is
  - A comprehensive plan for the upcoming accounting period.
  - Usually prepared for a one-year period.
  - Is based on a series of budget assumptions.

- The master budget consists of several subsidiary budgets, in two categories:
  - Operating budgets.
  - Financial budgets.

Q2: Operating Budgets



The operating budget is created by preparing the following individual budgets, in this order:

- Revenue budget
- Production budget
- Direct materials budget
- Direct labor budget
- Manufacturing overhead budget
- Inventory and cost of goods sold budget
- Support department budgets
- Budgeted income statement

The financial budget is created by preparing the following individual budgets, in this order:

- Capital budget
- Long-term financing budget
- Cash budget
- Budgeted balance sheet
- Budgeted statement of cash flows

Q2: Operating Budget Example

Stanley J, Inc., makes a tool used by auto mechanics that sells for $68/unit. It expects to sell 6,000 units in April and 7,000 units in May. Stanley J prefers to end each period with a finished goods inventory equal to 10% of the next period's sales in units and a direct materials inventory equal to 20% of the direct materials required for the next period's production. The company never has any beginning or ending work-in-process inventories. There were 400 units in finished goods inventory on April 1. Prepare the revenue and production budgets for April.

Revenue budget	
Budgeted sales in units in April	6,000
Budgeted selling price per unit	$68.00
Budgeted revenues	$408,000

Production budget	
Budgeted sales in units in April	6,000
Desired ending FG inventory	700
Total units required	6,700
Less: beginning FG inventory	(400)
Required production in units	6,300

Q2: Operating Budget Example

Stanley J's product uses 0.3 pounds of direct material per unit, at a cost of $4/lb. There were 220 lbs. of direct material on hand on April 1. Assume that budgeted production for May is 6,500 units. Prepare the direct materials purchases and usage budget for April.

Direct materials budget	
Required production in units	6,300
DM required per unit, in pounds	0.3
Total DM required, in pounds	1,890
Less: Beginning DM inventory	(220)
Plus: Desired ending DM inventory	390
Required DM purchases in pounds	2,060
Budgeted DM cost per pound	$4.00
Budgeted cost of DM	$8,240

Usage Budget = 1,890 pounds * $4 per pound = $7,560

Q2: Operating Budget Example

Stanley J's product uses 0.2 hours of direct labor at a cost of $12/hr. Prepare the direct labor budget for April.

Direct labor budget	
Required production in units	6,300
DL required per unit, in hours	0.2
Total DL hours required	1,260
Budgeted cost per DL hour	$12.00
Budgeted cost of DL	$15,120

Q2: Operating Budget Example

Stanley J's budgeted fixed manufacturing overhead for April is $167,000, and variable manufacturing overhead is budgeted at $6 per direct labor hour. Prepare the manufacturing overhead budget for April.

Manufacturing overhead budget	
Total DL hours required	1,260
Budgeted variable overhead per DL hour	$6.00
Total budgeted variable overhead	$7,560
Budgeted fixed overhead	$167,000
Total budgeted overhead	$174,560

Q2: Operating Budget Example

Assume that Stanley J's April 1 direct materials inventory had a cost of $1,560. Prepare the April ending inventories budget for direct materials.

Ending inventories budgets	
Budgeted cost of DM purchases	$8,240
Beginning DM inventory	$854
DM available for use	$9,094
Budgeted cost of desired ending DM inventory:	
[6,500 units x 0.3 lbs/unit] x 20% x $4/lb	$1,560
Budgeted cost of DM to be used	$7,534

Q2: Operating Budget Example

Prepare the April ending inventories budget for finished goods.

Budgeted cost of DM to be used	$7,534
Budgeted cost of DL	$15,120
Total budgeted overhead	$174,560
Total budgeted manufacturing costs	$197,214
Required production in units	6,300
Budgeted manufacturing cost per unit	$31.3037
Budgeted ending FG inventory in units	700
Budgeted cost of ending FG inventory	$21,913

Q2: Operating Budget Example

Assume that Stanley J's April 1 finished goods inventory had a cost of $12,146. Prepare the cost of goods sold budget for April.

Cost of goods sold budget	
Beginning FG inventory	$12,146
Total budgeted manufacturing costs	$197,214
Cost of goods available for sale	$209,359
Less: budgeted ending FG inventory	$21,913
Budgeted cost of goods sold	$187,447

Q2: Operating Budget Example

Stanley J's budget for April includes $22,000 for administrative costs, $34,000 for fixed distribution costs, $18,000 for research and development, and $13,000 for fixed marketing costs. Additionally, the budgeted variable costs for distribution are $0.75/unit sold and the budgeted variable costs for marketing are 4% of sales revenue. Prepare the support department budget for April.

Support department budget		
Administration		$22,000
Distribution: Fixed costs	$34,000	
Variable costs	$4,500	$38,500
Research & development		$18,000
Marketing: Fixed costs	$13,000	
Variable costs	$16,320	$29,320
Total budgeted support department costs		$107,820

Q2: Operating Budget Example

Suppose that Stanley J's income tax rate is 28%. Prepare the budgeted income statement for April.

Budgeted income statement		
Sales revenue		$408,000
Cost of goods sold		$187,447
Gross margin		$220,553
Operating costs:		
Administration	$22,000	
Distribution	$38,500	
Research & development	$18,000	
Marketing	$29,320	$107,820
Net income before taxes		$112,733
Income taxes		$31,565
Net income		$81,168

Q4: Budget Variances

- Managers compare actual results to budgeted results in order to
  - Monitor operations, and
  - Motivate appropriate performance.

- Differences between budgeted and actual results are called budget variances.
  - Variances are stated in absolute value terms, and labeled as Favorable or Unfavorable.

Q4: Budget Variances

- Reasons for budget variances are investigated.

- The investigation may find:
  - Inefficiencies in actual operations that can be corrected.
  - Efficiencies in actual operations that can be replicated in other areas of the organization.
  - Uncontrollable outside factors that require changes to the budgeting process.

Q3: Static Budgets

- A budget prepared for a single level of sales volume is called a static budget.
- Static budgets are prepared at the beginning of the year.
- Differences between actual results and the static budget are called static budget variances.

Q3: Flexible Budgets

- A budget prepared for a multiple levels of sales volume is called a flexible budget.
- Flexible budgets are prepared at the beginning of the year for planning purposes and at the end of the year for performance evaluation.
- Flexible budgets are also used for sensitivity analysis and to manage risk due to uncertainty.
- Differences between actual results and the flexible budget are called flexible budget variances.

Q3, Q4: Flexible Budget Example

Tina's Trinkets is preparing a budget for 2006. The budgeted selling price per unit is $10, and total fixed costs for 2006 are estimated to be $5,000. Variable costs are budgeted at $3/unit. Prepare a flexible budget for the volume levels 1,000, 1,100, and 1,200 units.

	Volume Levels		
Sales in units	1,000	1,100	1,200
Revenues	$10,000	$11,000	$12,000
Variable costs	$3,000	$3,300	$3,600
Contribution margin	$7,000	$7,700	$8,400
Fixed costs	$5,000	$5,000	$5,000
Operating income	$2,000	$2,700	$3,400

Q3, Q4: Static Budget Variances Example

Suppose that Tina's 2006 static budget was for 1,100 units of sales. The actual results are given below. Compute the static budget variances for each row and discuss.

	Static Budget	Actual Results	Static Budget Variance	
Sales in units	1,100	980		
Revenues	$11,000	$9,604	$1,396	Unfavorable
Variable costs	$3,300	$2,989	$311	Favorable
Contribution margin	$7,700	$6,615	$1,085	Unfavorable
Fixed costs	$5,000	$4,520	$480	Favorable
Operating income	$2,700	$2,095	$605	Unfavorable

Q3, Q4: Flexible Budget Variances Example

Compute the flexible budget variances for Tina and discuss the results. Compare the flexible budget variances to the static budget variances on the prior page.

	Year-end Flexible Budget	Actual Results	Flexible Budget Variance	
Sales in units	980	980		
Revenues	$9,800	$9,604	$196	Unfavorable
Variable costs	$2,940	$2,989	$49	Unfavorable
Contribution margin	$6,860	$6,615	$245	Unfavorable
Fixed costs	$5,000	$4,520	$480	Favorable
Operating income	$1,860	$2,095	$235	Unfavorable

Q3, Q4: Performance Evaluation

- A static budget variance includes effects from output volume.
- A flexible budget variance removes these output volume effects.
- Other adjustments to the year-end flexible budget may be made for a fair performance evaluation, such as
  - Input price changes outside the control of the manager under evaluation
  - Fixed cost increases outside the control of the manager under evaluation

Q5: Behavior Tensions in Budgeting

- Budgets used to evaluate performance and compensation can create behavioral tension
- Participative budgeting – when managers who are responsible for the budgets prepare the budget forecasts
  - Can result in budgetary slack – when managers set targets so low that goals can be met easily (and bonuses achieved)
- Budget ratcheting – when top managers set targets
  - If targets unachievable, this can result in employees having little motivation to meet targets
- Organizations must watch for budget manipulation

Q6: Other Budgeting Approaches

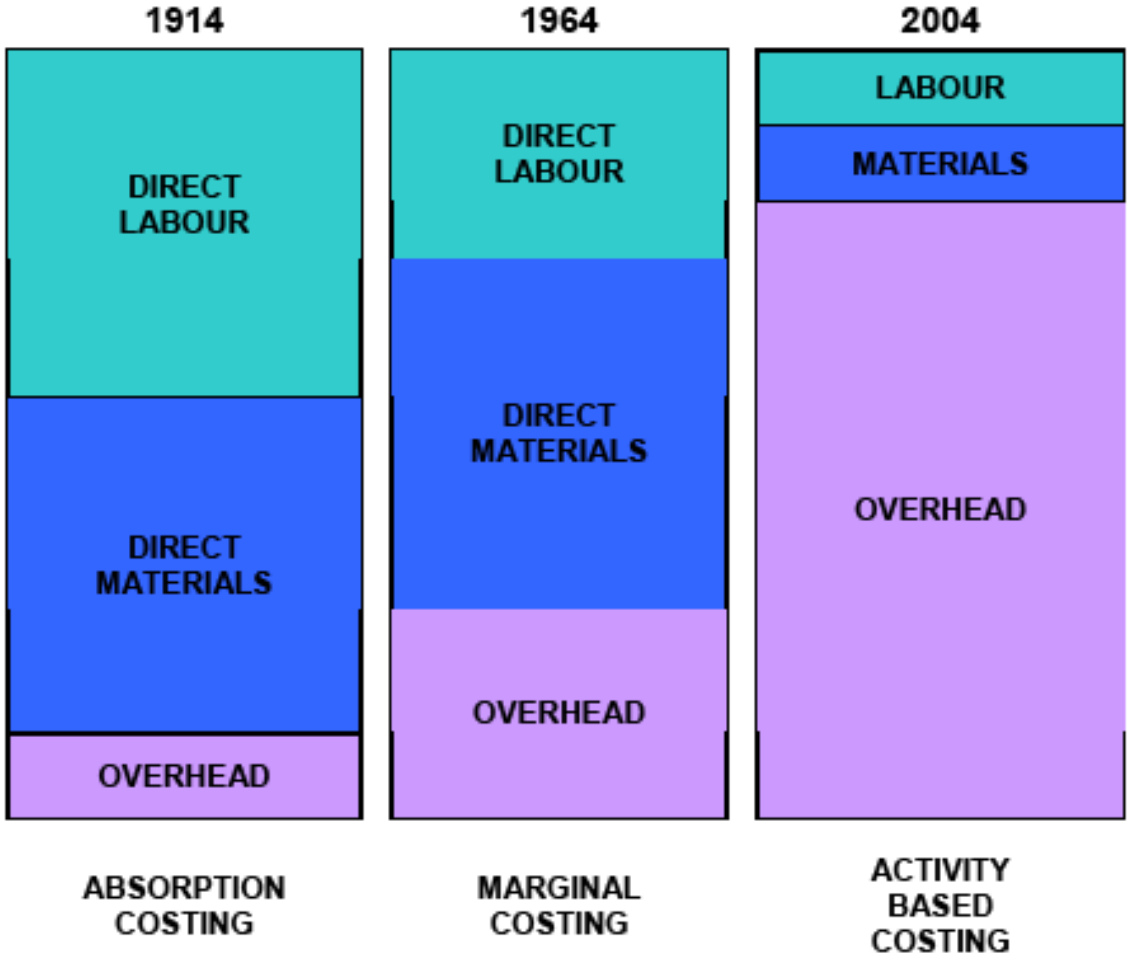
- Zero based budgets are prepared without using past information as justification.
- Rolling budgets are prepared frequently for overlapping time periods and actual results may be used to update the budget for the next period.
- Kaizen budgets plan cost reductions over time.
- Activity based budgets use more cost pools and cost drivers.
- GPK and RCA budgets identify fixed and variable cost functions at the resource center level.
- Beyond budgeting uses external benchmarks to evaluate managers' performance

ABC

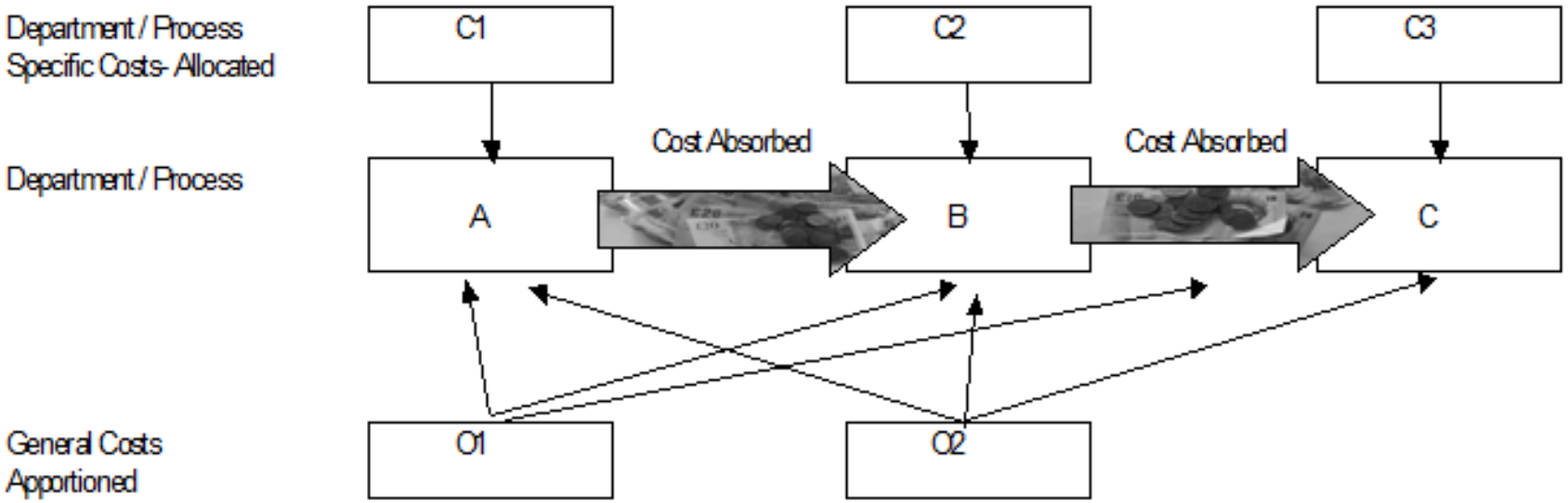


- Activity Based Costing
- Developed in the early 1980's
- Highlighted by Professor Robert Kaplan - *Relevance Lost: The Rise and Fall of Management Accounting*, with H. Thomas Johnson. Harvard Business School Press, 1987

Originals of ABC



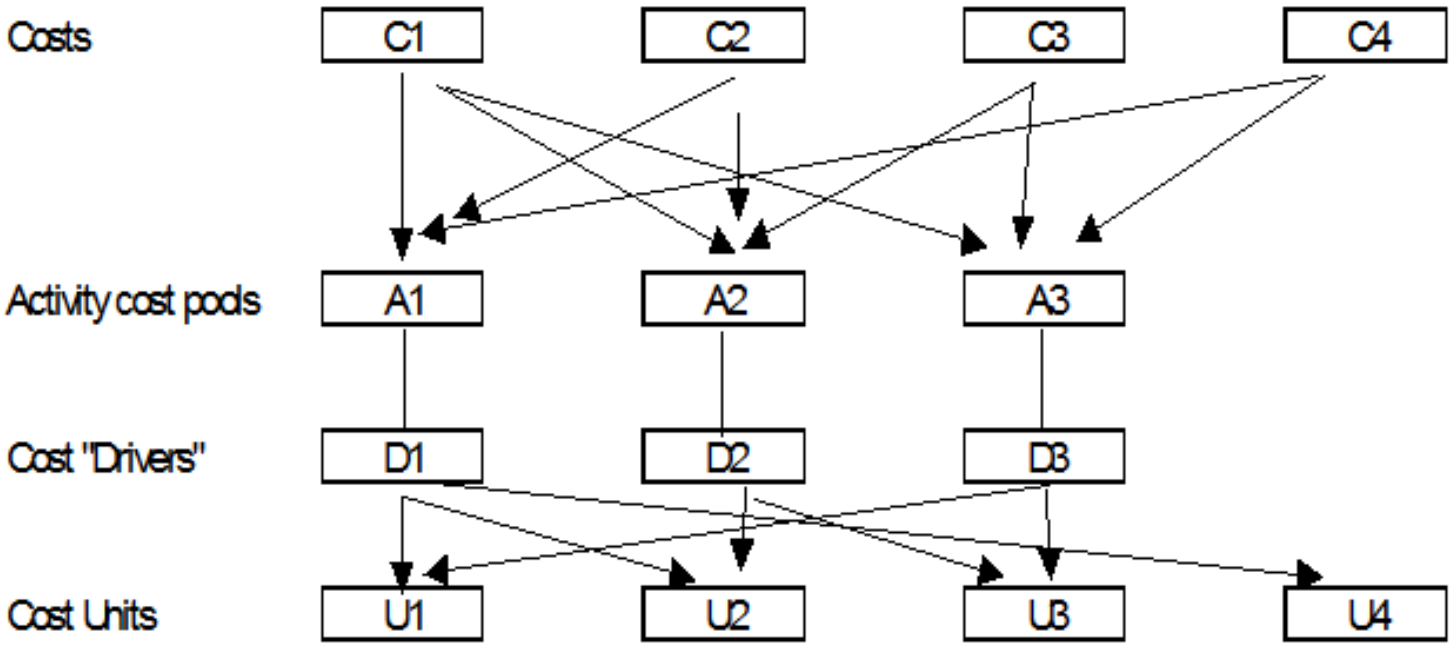
Absorption Costing Problems



Hours				
Labour	300	500	200	1000
Machine	100	50	50	200

	Product			
	A	B	C	
Sales	10000	4000	6000	20000
Direct Cost	3000	2000	3000	8000
Gross Profit	7000	2000	3000	12000
Less overheads				
Labour Hours	900	1500	600	3000
Machine Hours	1500	750	750	3000
Profit				
Labour Hours	6100	500	2400	9000
Machine Hours	5500	1250	2250	9000

Activity Based Costing



Traditional Absorption Costing v ABC

- "Traditional"
- OHR – typically based on labour
- Arbitrary cost allocation and absorption
- Simple
- Proven?
- Irrelevant
- Misleading

- ABC
- Allocate and apportion costs to activity pools
- Use Drivers to charge activity costs to costs units
- More Systematic?
- More Complex
- More Expensive
- Absorption Costing Re-invented

Invoices	30	40	30	100
Orders	10	20	20	50

	Product			
	A	B	C	
Sales	10000	4000	6000	20000
Direct Cost	3000	2000	3000	8000
Gross Profit	7000	2000	3000	12000
Less overheads				
Invoicing	600	800	600	2000
Orders	200	400	400	1000
Profit				
ABC	6200	800	2000	9000

					Cost per
Invoices		20	40	40	100	20
Orders		10	20	20	50	20

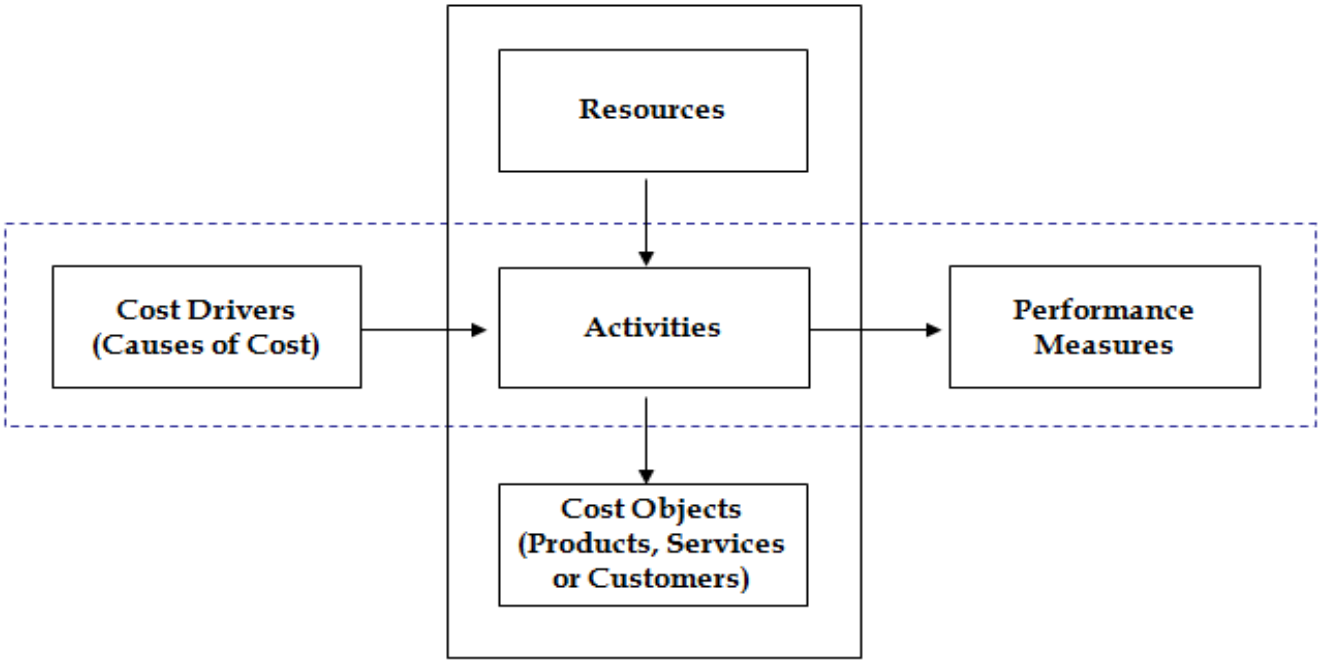
	Customer			
	X	Y	Z	
Sales	10000	2500	7500	20000
Direct Cost	4000	1500	2500	8000
Gross Profit	6000	1000	5000	12000
Less overheads				
Invoicing	400	800	800	2000
Orders	200	400	400	1000
Profit				
ABC	5400	-200	3800	9000

Cost Reduction under ABC

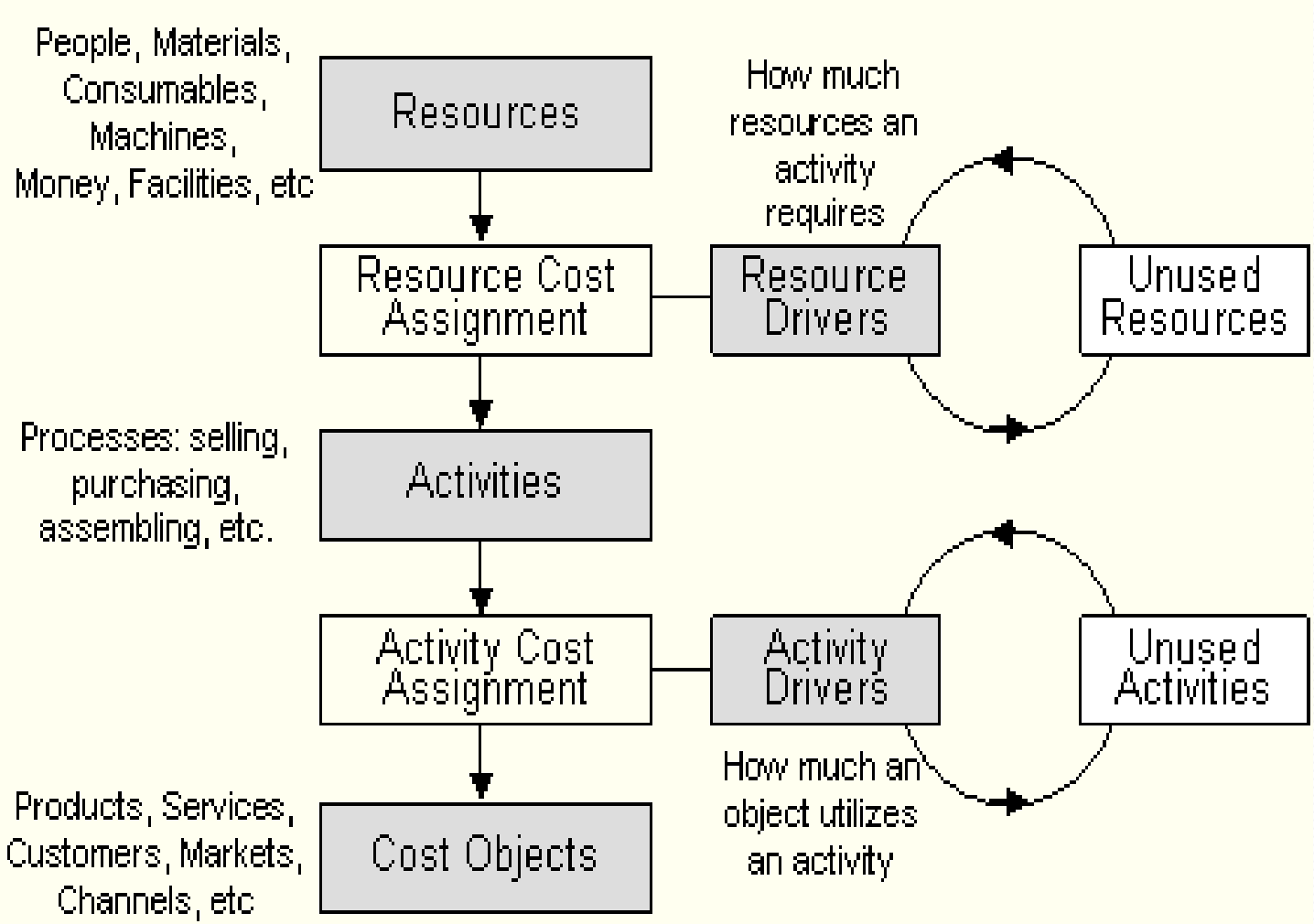
- Understand & Manage Costs
- Reduce Non Value Adding Cost
- Reduce Activity Cost
- Reduce (Needless) Activity

Over Three Decades of Industry-led Collaborative Research

Activity-Based Costing
The CAM-I Cross



CAM-I (Consortium for Advanced Management-International)


People, Materials, Consumables, Machines, Money, Facilities, etc
Resources
How much resources an activity requires
Resource Cost Assignment
Resource Drivers
Unused Resources
Processes: selling, purchasing, assembling, etc.
Activities
Activity Cost Assignment
Activity Drivers
Unused Activities
How much an object utilizes an activity
Products, Services, Customers, Markets, Channels, etc
Cost Objects

Reduce Needless..
(needless = non value adding)

- Complexity
- Variety
- Choice – “Any colour, so long as it is black”
- Activity

Opportunities to “Rationalise”

- Product
- Customers
- Supplies
- Processes
- Places
- People – less work – less people – less cost

Product

- Complexity –range / options / components
- Variety
- 80/20 Rule – most sales (and perhaps profits from a few products?)
- Standardise
- If you cannot standardise – Use “Late differentiation”

Customers

- Are small customers / jobs profitable?
- Are some sectors' customers' requirements too onerous to be profitable?
- Can we measure customers' profitability?
- Can we serve unprofitable customers differently?
- 80/20 Rule – most sales (and perhaps profits from a few customers?)

Suppliers

- Do we have too many suppliers?
- How much does it cost us working with our suppliers?

Place - Location

- Fewer places?
- Cheaper place?

Process

- Can we make processes simpler?
- Reduce processes
- Can we outsource work to others who do it better?

Fewer Purchase Orders & Invoices

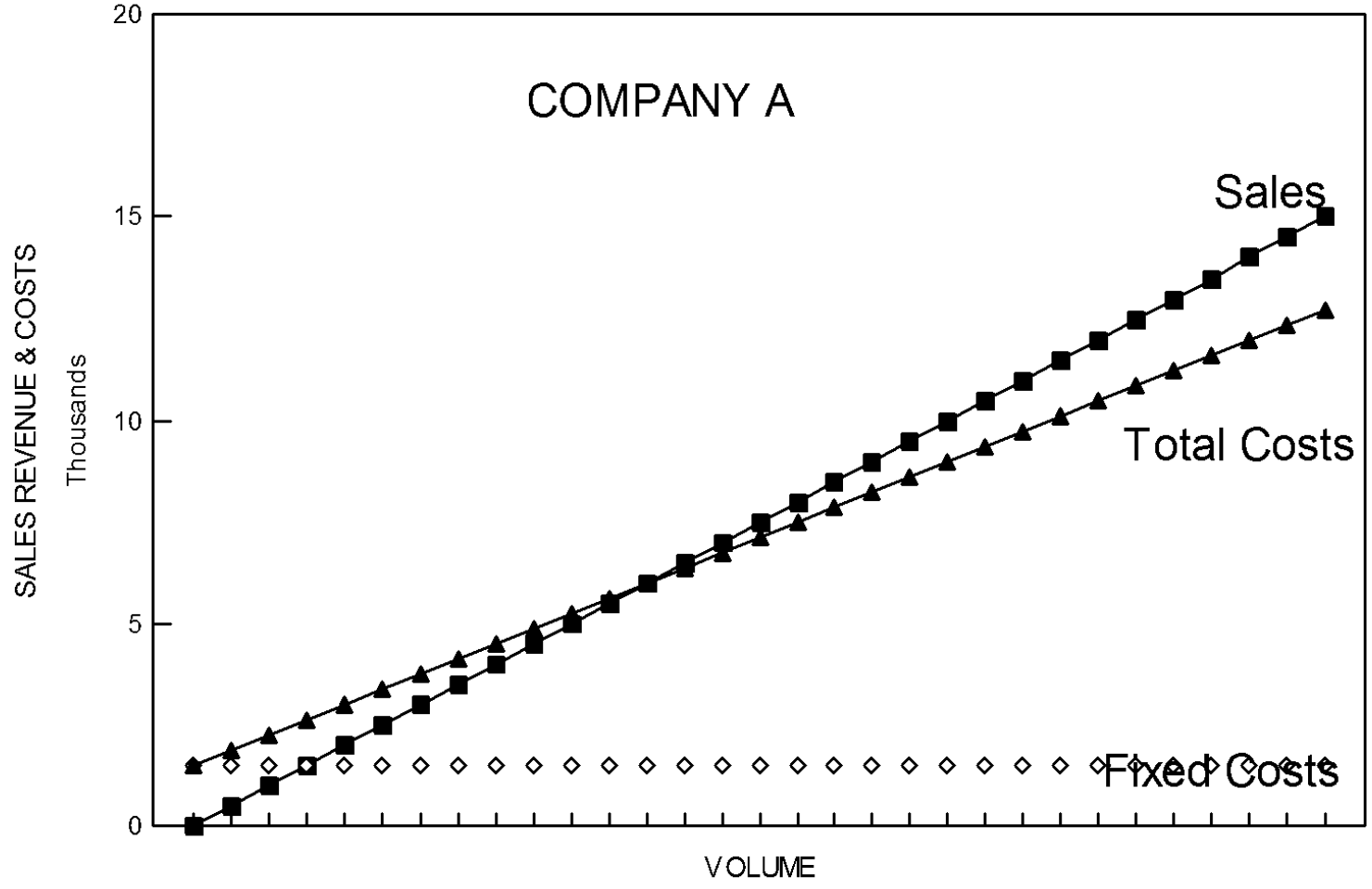
- Cost to raise an invoice?
- Cost to raise a purchase order?

Cost Structure

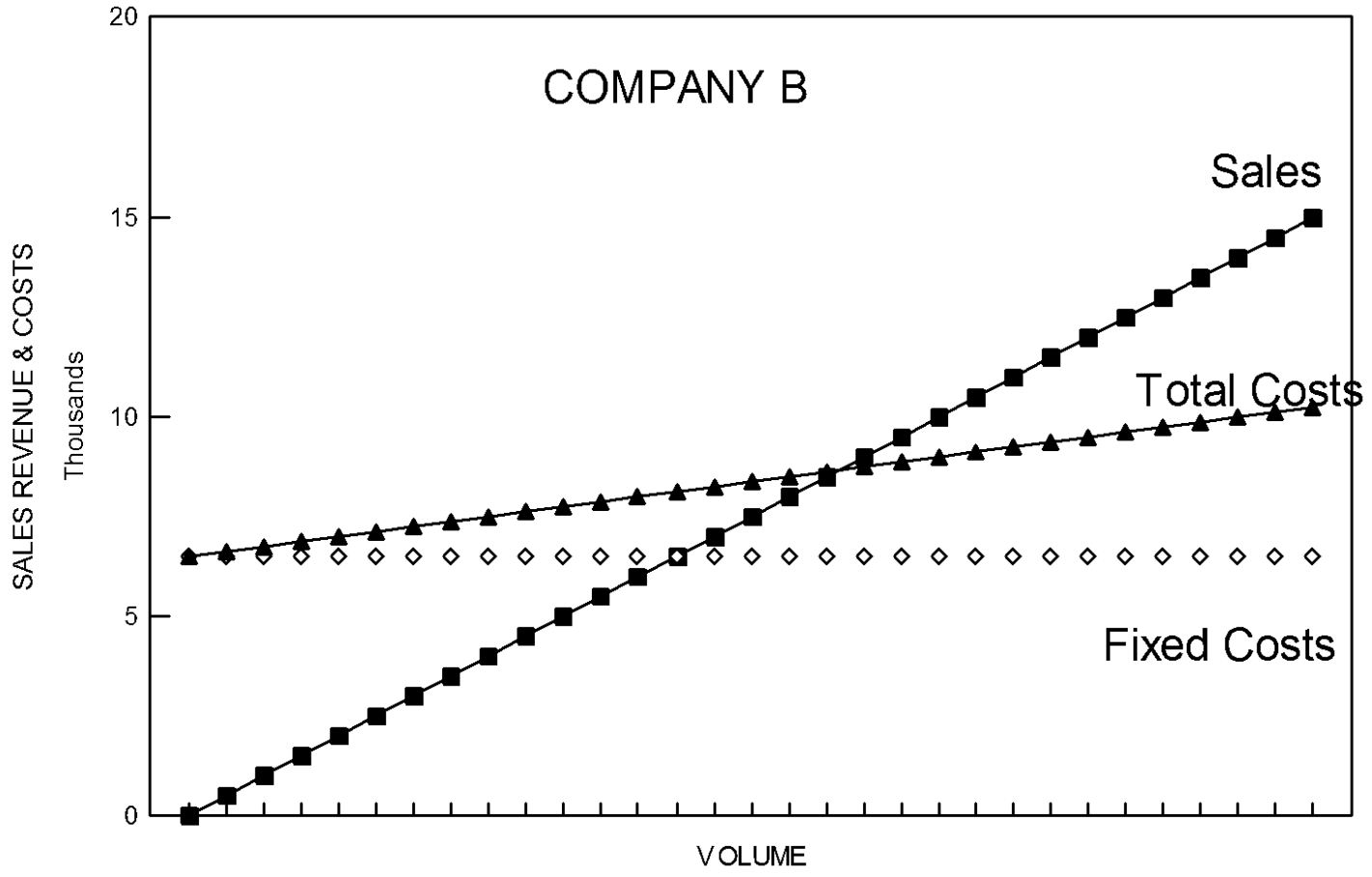
Operational Gearing

- Fixed v Variable Cost
- Cost structure and strategy
- Trends in changes in cost structure
- Alternative cost drivers to volume - ABC

Cost Structure



Cost Structure



	A	B
Company A Low contribution rate High variable cost percentage	✓	
Company B High contribution rate High fixed costs Percentage		✓
1. Hotel Chain		
2. Airline		
3. Tour Operator		
4. Supermarket		
5. Motor Manufacturer		
6. Mobile Telecoms		
7. Cinema Chain		
8. Car rental firm		
9. Power Generator (coal)		
10. Power Generator (gas)		
11. Power Generator (nuclear)		
12. Management Consultants		
13. Training Company		

Rethinking (Changing) Cost Structures

- Less Fixed
- More Variable

- More Fixed
- Less Variable

Lean Manufacturing

- Toyota Production System (TPS)
- Kaizen
- 5S
- Kanban
- Six Sigma
- Visual Factory
- Design v Delivery

Toyota Production System (TPS)

- Best Quality – Right first time
- Lowest Cost
- Shortest lead time
- JIT – Just in Time
- Standardise
- Eliminate Waste
- Motivate people to care



Toyota Production System (TPS)

Reduce

Overburden Muri,

Inconsistency - Mura

Eliminate waste - Muda.



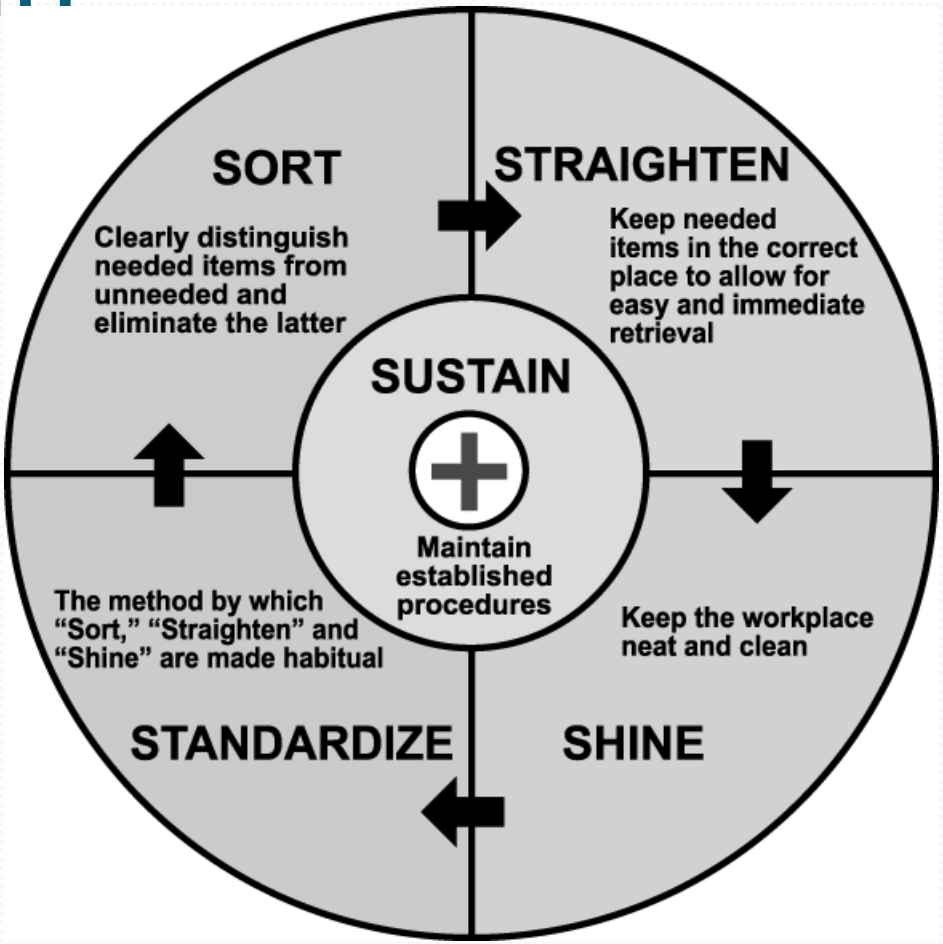
Eliminate Waste – Not Just Scrap
7 Wastes (Muda) under TPS



Kaizen

- Traditional Western Approach – If it isn't broke – don’t fix it
- Japanese Kaizen Approach – all can contribute, all the time to continuous improvement – do it better, improve it – however small

5 S - Lean


SORT
Clearly distinguish needed items from unneeded and eliminate the latter
STRAIGHTEN
Keep needed items in the correct place to allow for easy and immediate retrieval
SUSTAIN
Maintain established procedures
STANDARDIZE
The method by which "Sort," "Straighten" and "Shine" are made habitual
SHINE
Keep the workplace neat and clean

Ford - CANDO

- CANDO program (Cleaning up, Arranging, Neatness, Discipline, Ongoing Improvement),

Kanban

Kan – Visual Ban - Board

- JIT maintained by a signalling system
- Supply is “pulled” by demand

Six Sigma

- *Developed By Motorola*
- *Then GE*

Six Sigma

- "...Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services
- To achieve Six Sigma Quality, a process must produce no more than 3.4 defects per million opportunities."

From GE

Visual Factory

- Visual factory is a term to describe how data and information is conveyed in a lean manufacturing environment. In a lean manufacturing environment time and resources dedicated to conveying information, although necessary, are a form of waste. By using visual methods to convey information such as signs and charts, information is easily accessible to those who need it. The current status of all processes is immediately apparent

Design v Delivery

Cheaper & Better by Design

- More and more costs are set at the design stage rather than at delivery (Manufacture)
- Cost Reduction should be included in design – Target Costing

Failure Costs!

- Right first time
- Poka-Yoke – zero defects objective



Alliance / Partnering

A **Strategic Alliance** is a mutually beneficial long-term formal relationship formed between two or more parties to pursue a set of agreed upon goals or to meet a critical business need while remaining independent organizations.

Alliance / Partnering

Example of Strategic Alliances

Airlines
Code Sharing
Integrated schedules

Mobile Phones
Roaming
Infrastructure sharing
Example – T-Mobile – Virgin Mobile



Getting your team to deliver more for less

Developing a cost conscious culture

Cost – Outcome Impact Model

Economy
Efficiency
Effectiveness
Capacity and Risk

"Quicker Faster Better Cheaper" Motivating and encouraging people to effectively manage cost and value

Internal service level and internal markets agreements – Pros and Cons

Mini Case Study – "Doctors; Orders" – delivering savings in a hospital

Exercise / Toolbox 4 –VFM & Getting the Team onboard and improving performance

VFM - Value For Money 3 Es

A Public Sector Model / But Good for Cost Centres?

- Economy
- Efficiency
- Effectiveness



VFM - Value For Money

- Cost – Input
- Resources
- Output
- Outcomes



VALUE FOR MONEY

ECONOMY

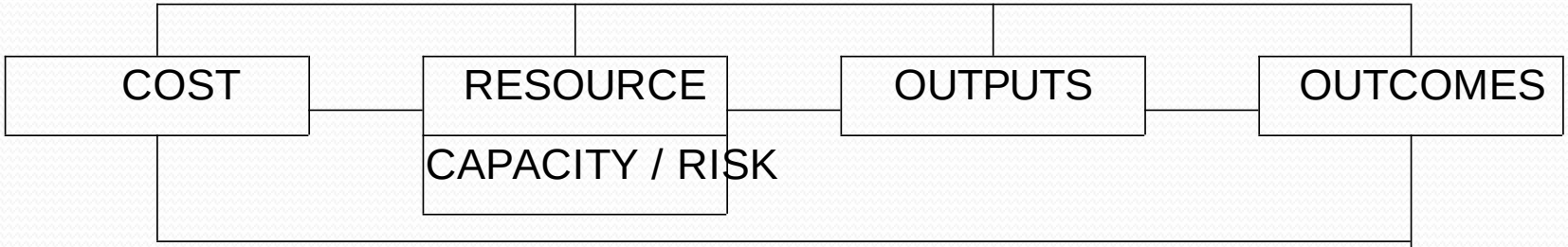
RESOURCE / COST

EFFICIENCY

OUTPUT / RESOURCE

EFFECTIVENESS

OUTCOME / OUTPUT



VFM - VALUE FOR MONEY

OUTPUT / COST

DOES IT ADD VALUE?

$$\text{VFM} = \frac{\text{RESOURCE}}{\text{COST}} \times \frac{\text{OUTPUT}}{\text{RESOURCE}} \times \frac{\text{OUTCOME}}{\text{OUTPUT}} = \frac{\text{OUTCOME}}{\text{COST}}$$

ECONOMY **EFFICIENCY** **EFFECTIVENESS**

OBJECTIVES

Economy

- Minimising the costs of resources used within the public sector, but having regard to quality.
- Better Prices!

Efficiency

- The relationship between output, in terms of goods, services or other results, and the resources used to produce them.
- Example - Get staff to be more productive – deliver more

Effectiveness

- The extent to which objectives have been achieved. The relationship between the intended impacts and actual impacts of an activity
- Delivering the required result!

Exercise

- 3 Es

VFM – Value For Money

4th E

EVIDENCE

Cost Reduction ideas In your business

Cost Control (Management Ideas) In your business

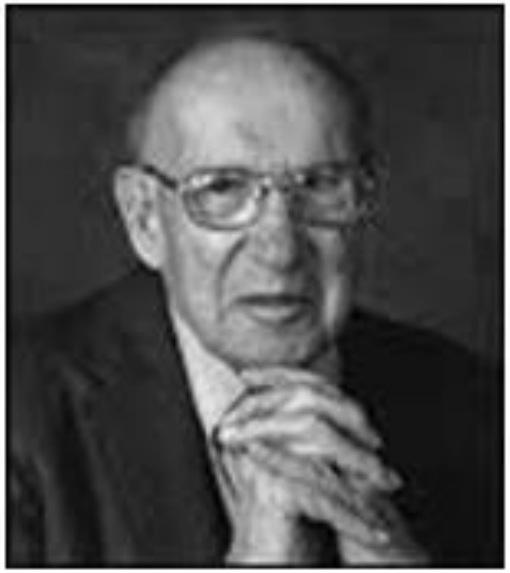
- Budgeting is the bane of corporate America'
-
  - Jack Welch, ex-CEO, General Electric



- 'The process of management is not about administering fixed budgets, it is about the dynamic allocation of resources'
-
  - Lord Browne, ex-CEO, BP



- 'Uncertainty…has become so great as to render futile, if not counterproductive, the kind of planning most companies still practice; forecasting based on probabilities'
-
  - Peter Drucker



Budgeting

The Purpose of Budgets

Meeting organization's objectives

Planning

Monitor & Control

Co-ordination

Evaluating Performance

Motivation for Managers

Management Contract

Communication

Provide a basis for authorising expenditure

Identify scarce resources

Delegation of responsibility

The smallest problem…



73% of companies need more than 3 months to complete the annual budget.

Hackett Group 2008

Budgets are bad for business?

Main criticisms of budgets are

- *Too resource and time consuming*
- *Slow to detect problems*
- *Not reliable for performance evaluation*
- *Quickly out of date*
- *Game Playing (Agency Problem)*
- *Financial targets overwhelming what is good for the business and ultimately shareholders*
- *Over emphasis on short term financial measures*
- *Departmental budgets may encourage "silo" thinking*
- *Disrupts cooperation*
- *Discourages innovation and adaption to changing conditions and opportunities*
- *Process lacks rigor*

VALUE FOR MONEY

ECONOMY

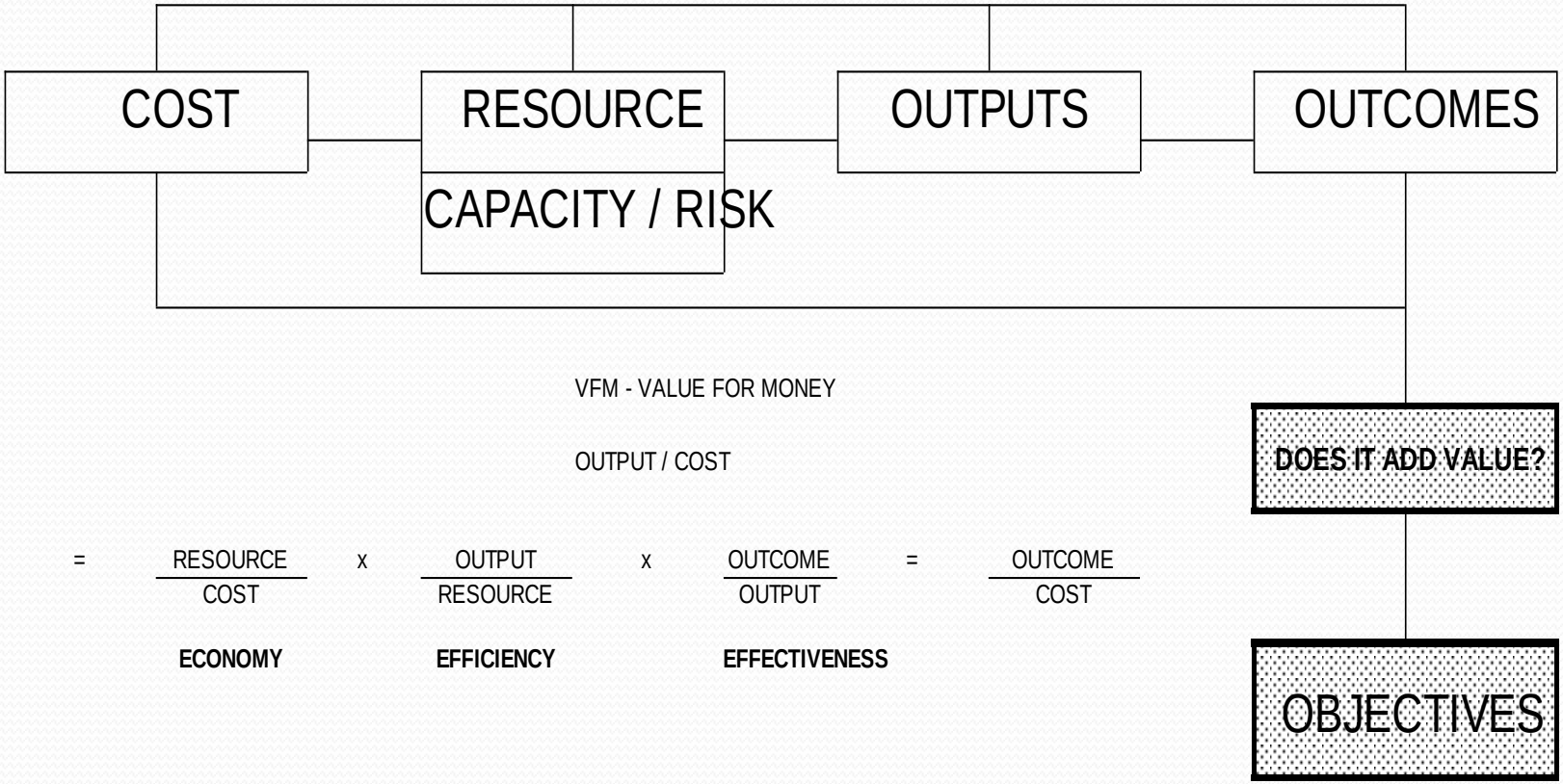
RESOURCE / COST

EFFICIENCY

OUTPUT / RESOURCE

EFFECTIVENESS

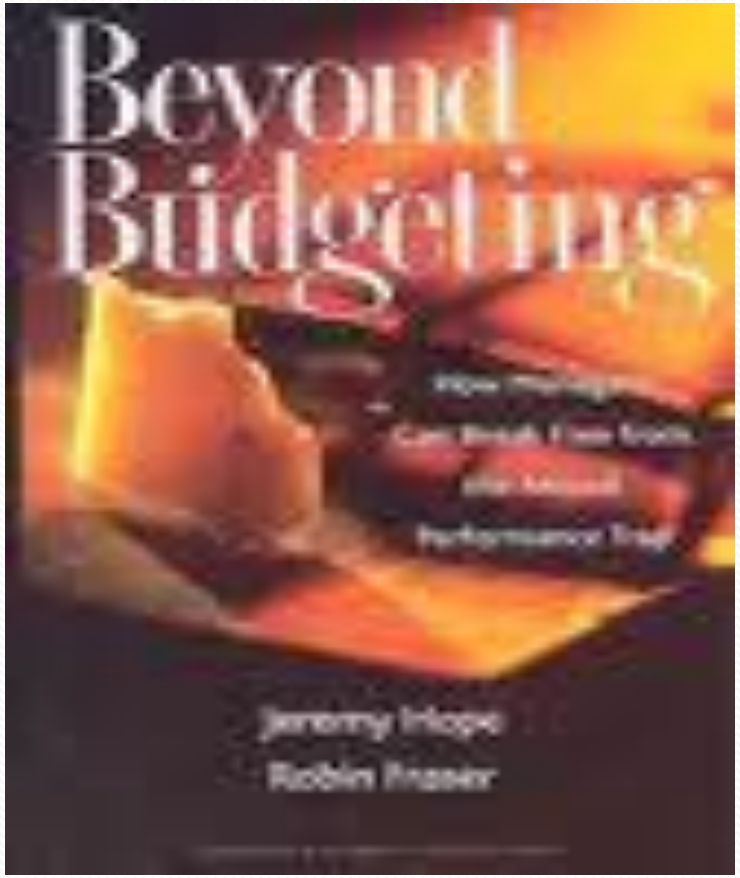
OUTCOME / OUTPUT



$$\text{VFM} = \frac{\text{RESOURCE}}{\text{COST}} \times \frac{\text{OUTPUT}}{\text{RESOURCE}} \times \frac{\text{OUTCOME}}{\text{OUTPUT}} = \frac{\text{OUTCOME}}{\text{COST}}$$

ECONOMY **EFFICIENCY** **EFFECTIVENESS**

Beyond Budgeting



Beyond Budgeting – Key Cases



Svenska Handelsbanken 1972

Statoil

BOREALIS

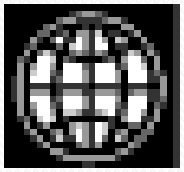
Borealis 1995

Beyond Budgeters?



































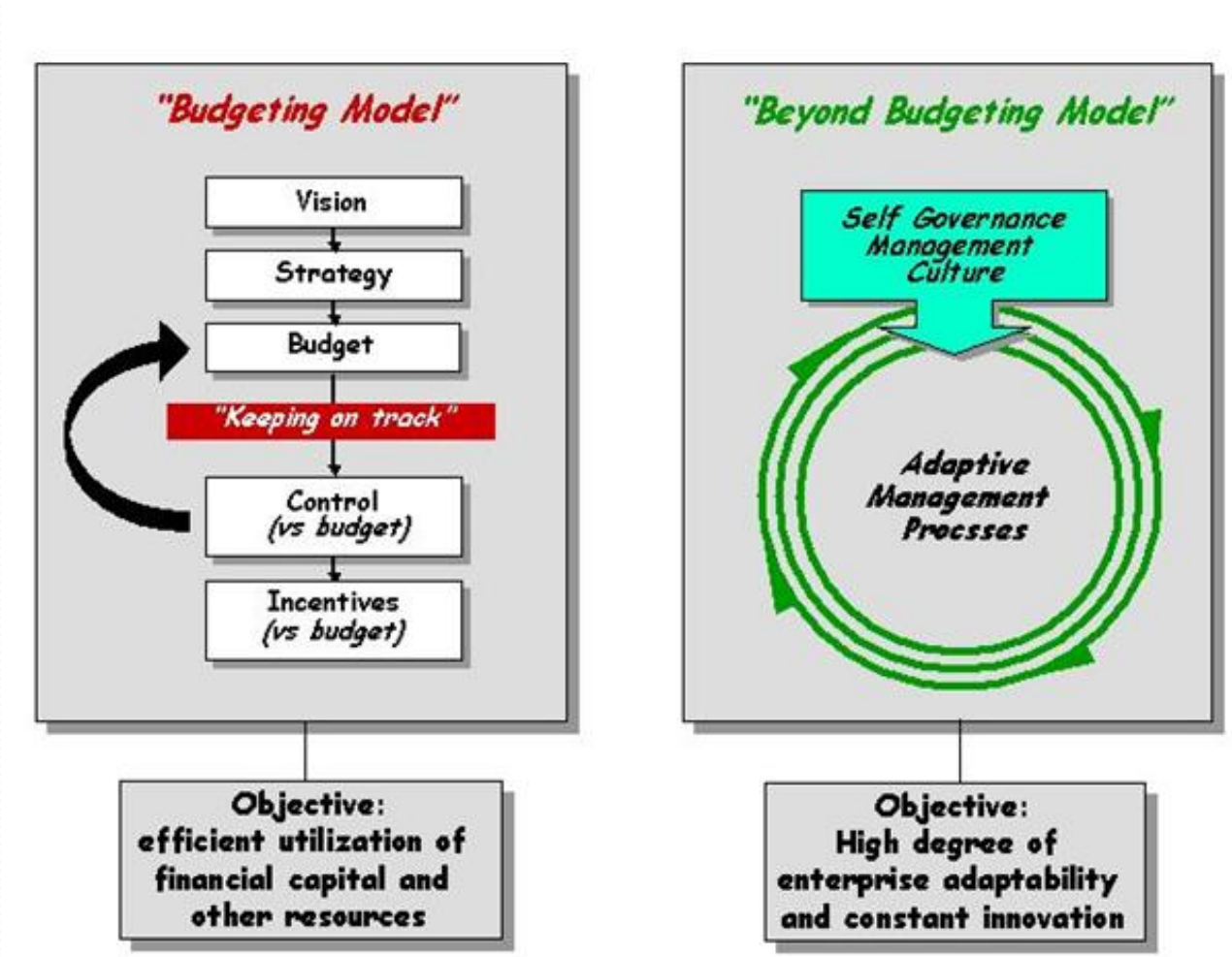






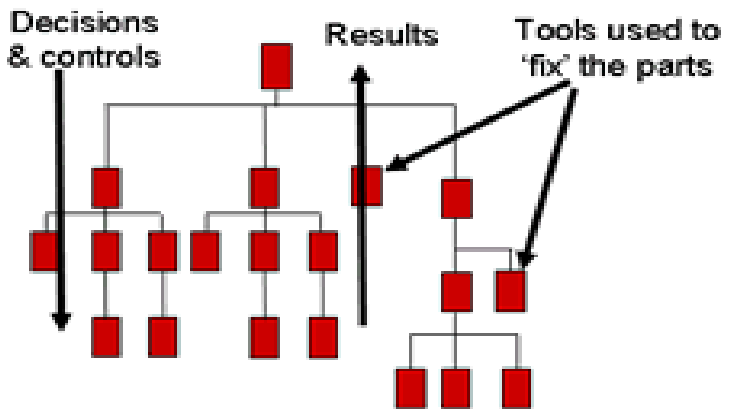


Traditional v Beyond Budgeting



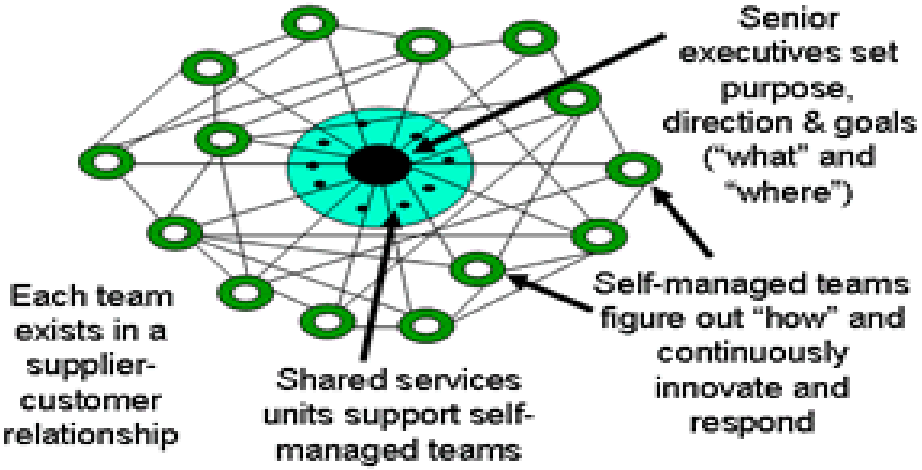
Alternative Management Models

The 'Command and Control' Model



- Organizations are obedient machines
- Organizations are a collection of replaceable parts (parts determine performance of the whole)
- Organizations comprise of 'cause-and-effect' relationships that are predictable
- Organization need central planning, coordination and control
- Change is reactive and project-driven

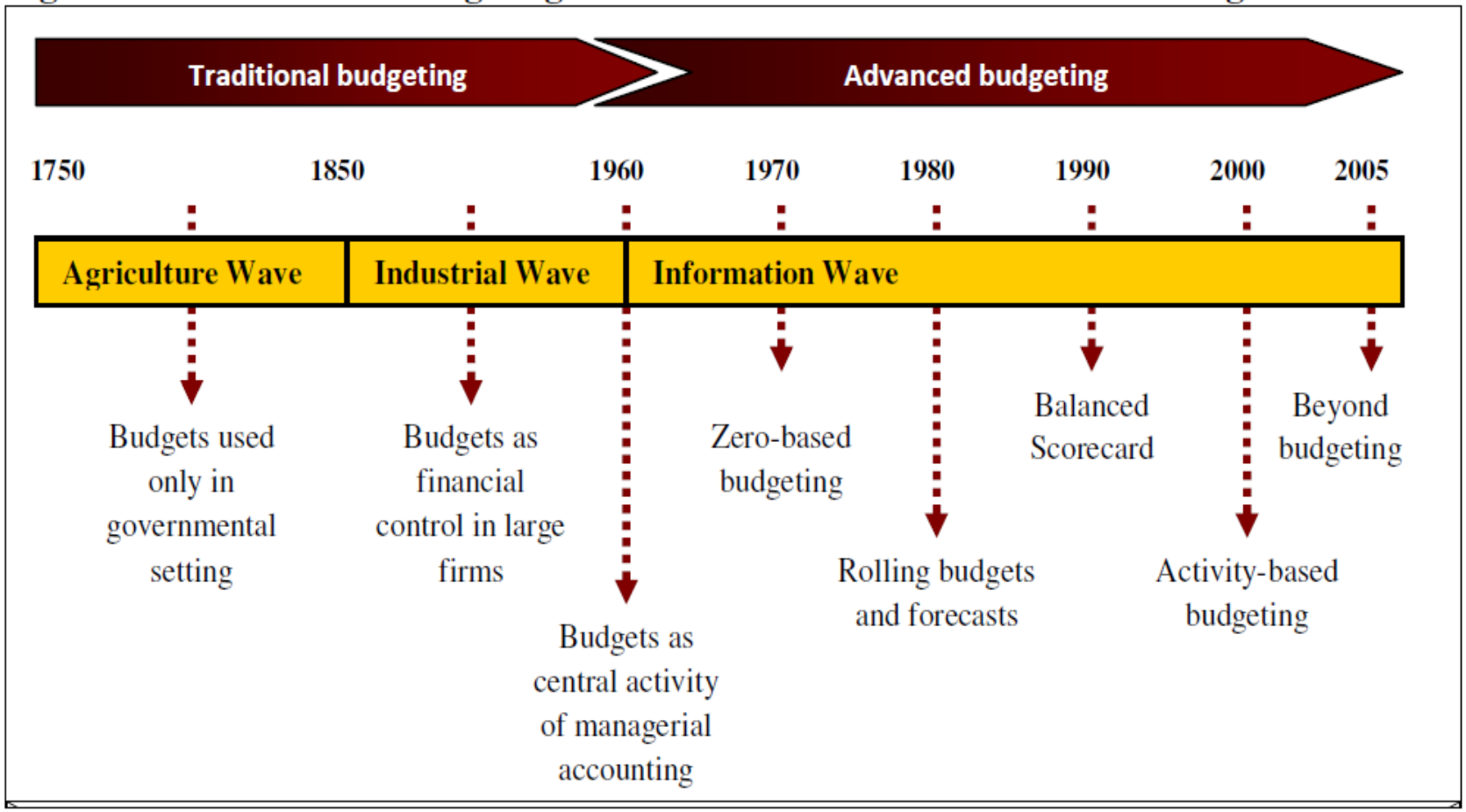
The 'Beyond Budgeting' Model



- Organizations are adaptive systems
- Organizations are holistic systems (whole system determines performance)
- Organizations are webs of relationships that are unpredictable
- Organization are self-organizing and self-regulating
- Change is integrative and adaptive

The 12 'beyond budgeting' (or 'adaptive') model principles	
Process principles	
1. Goals	Set aspirational goals aimed at continuous relative improvement, ***not*** *fixed annual targets*
2. Rewards	Reward shared success based on relative performance, ***not*** *on meeting fixed targets*
3. Planning	Make planning a continuous and inclusive process, ***not*** *an annual event*
4. Controls	Base controls on relative KPIs and performance trends, ***not*** *variances against plan*
5. Resources	Make resources available as needed, ***not*** *through annual budget allocations*
6. Coordination	Coordinate cross organisation interactions dynamically, ***not*** *through annual planning cycles*
Leadership principles	
1. Customers	Focus everyone on improving customer outcomes, ***not*** *on meeting internal targets*
2. Accountability	Create a network of teams accountable for results, ***not*** *centralized hierarchies*
3. Performance	Champion success as winning in the marketplace, ***not*** *on meeting internal targets*
4. Freedom to act	Give teams the freedom and capability to act, ***don't*** *merely require adherence to plan*
5. Governance	Base governance on clear values and boundaries, ***not*** *detailed rules and budgets*
6. Information	Promote open and shared information, ***don't*** *restrict it to those who 'need to know'*

Figure 3.1: Evolution of budgeting within the three waves of economic change



Source: Hope and Hope, 1997; Banovic, 2005.



"Managing the Numbers"

"Managing the Drivers of Business Performance"

But are - Are all decentralised organisations necessarily successful?

	Traditional (budget based) Mgmt. Model	BBM Model
Target & rewards	• Incremental targets • Fixed incentives	• Stretch goals • Relative rewards
Planning & controls	• Fixed annual plans • Variance controls	• Cont. planning • KPI's & rolling forecasts
Resources & coordination	• Pre-allocated resources • Central coordination	• Resources on demand • Dynamic coordination
Organ. & culture	• Central control • Focus on managing #s	• Local control of goals/plans • Focus on value creation

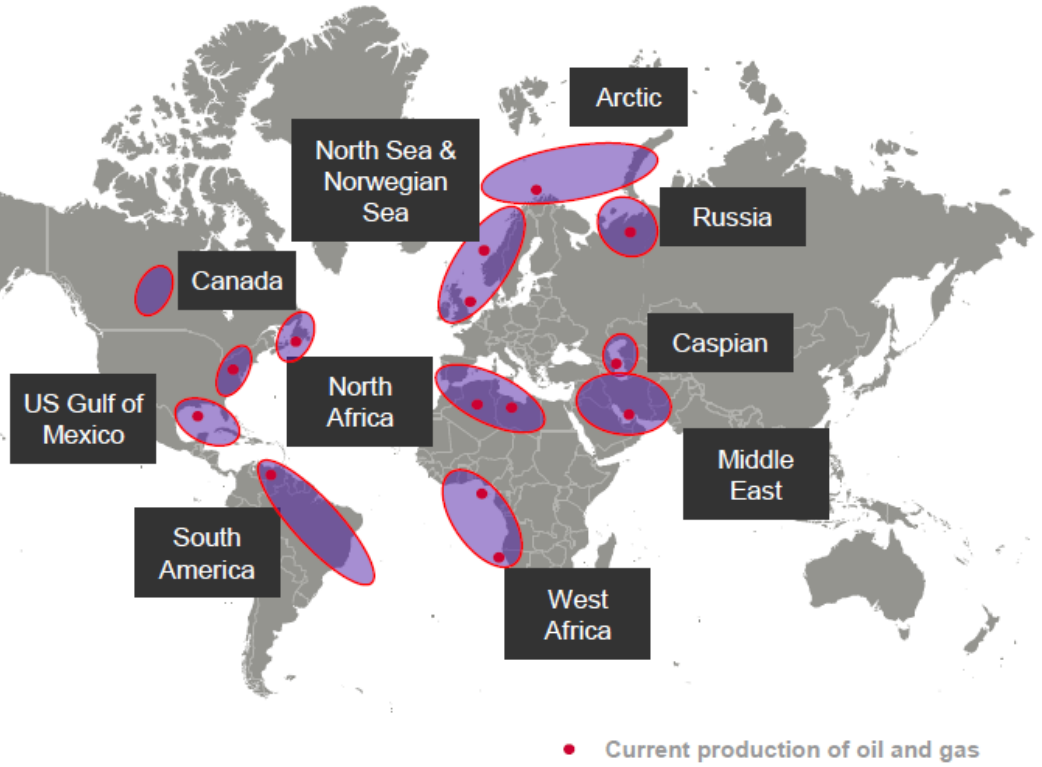
Beyond Budgeting Example - StatOil

- Model about people and behaviour more than P & L?

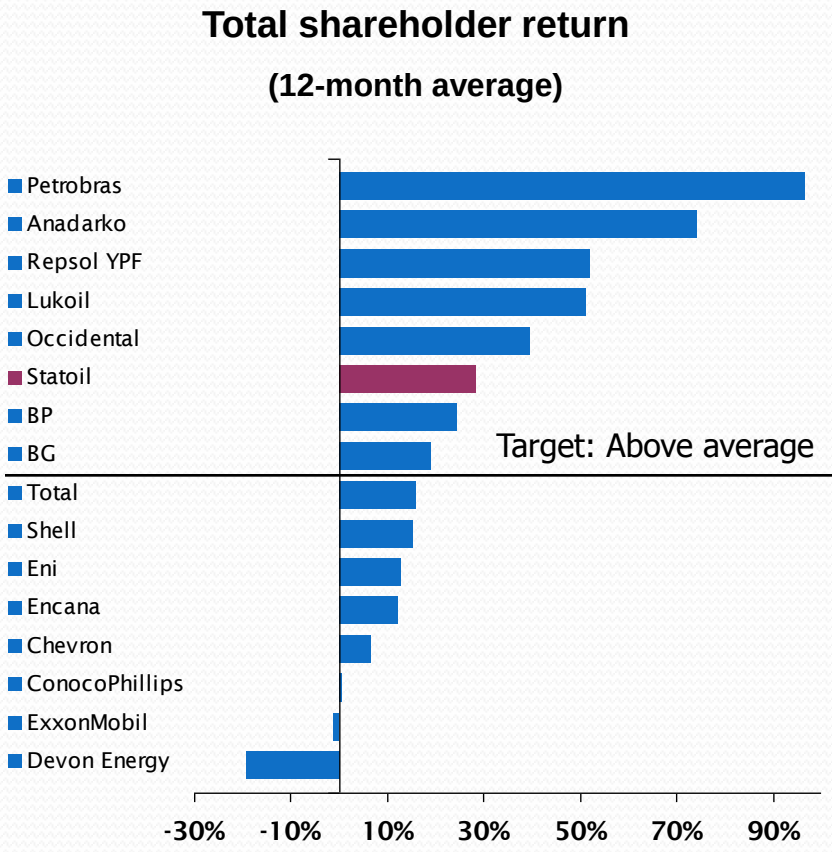
Stat Oil

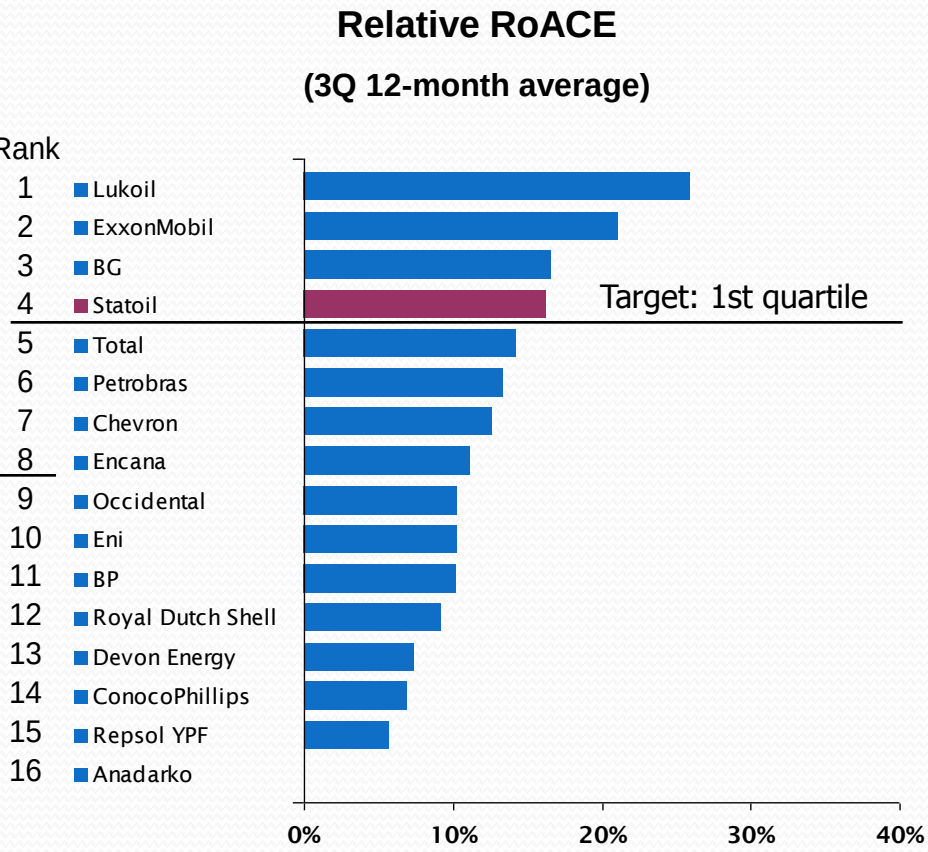
Statoil in brief

- Turnover and market cap approx. 80 bn. USD
- 20.000 employees in 34 countries
- World's largest offshore operator
- Europe's second largest gas supplier
- The world's third largest crude oil seller
- Listed in New York and Oslo



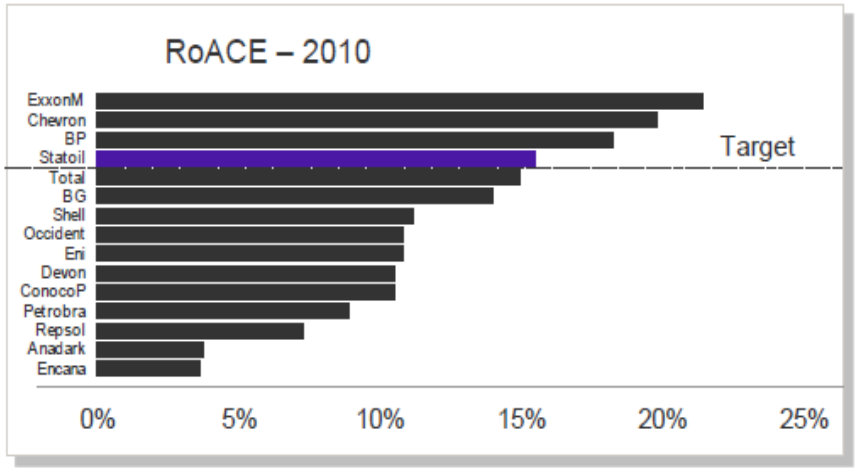
Relative Statoil performance

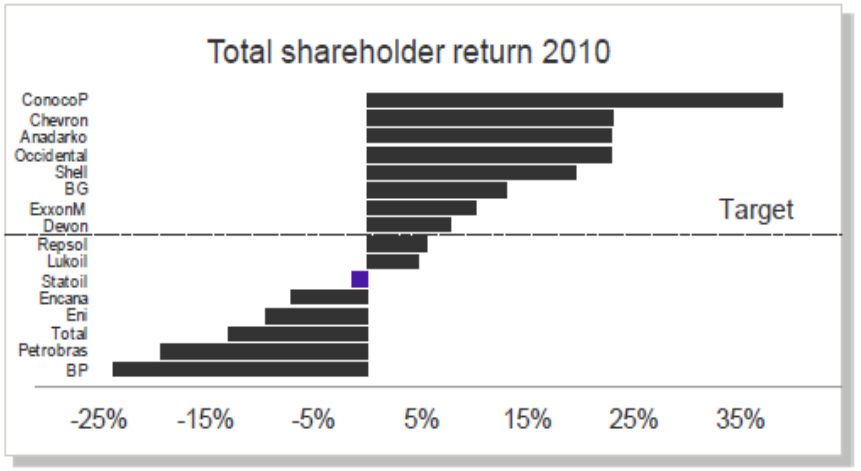


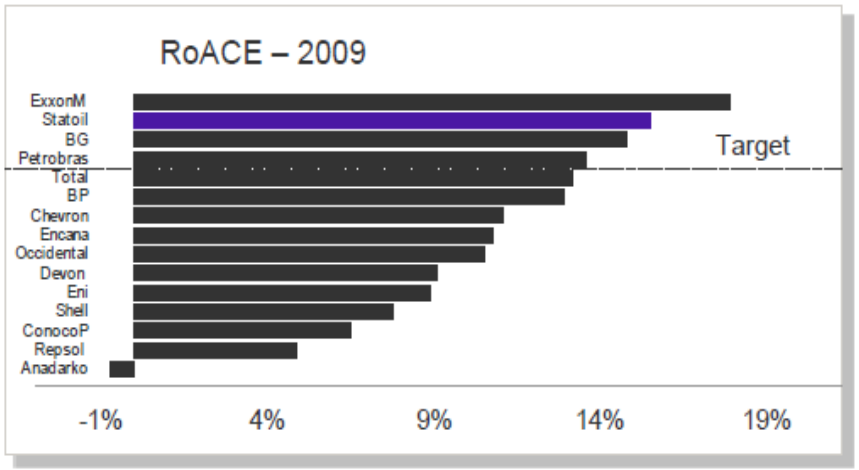


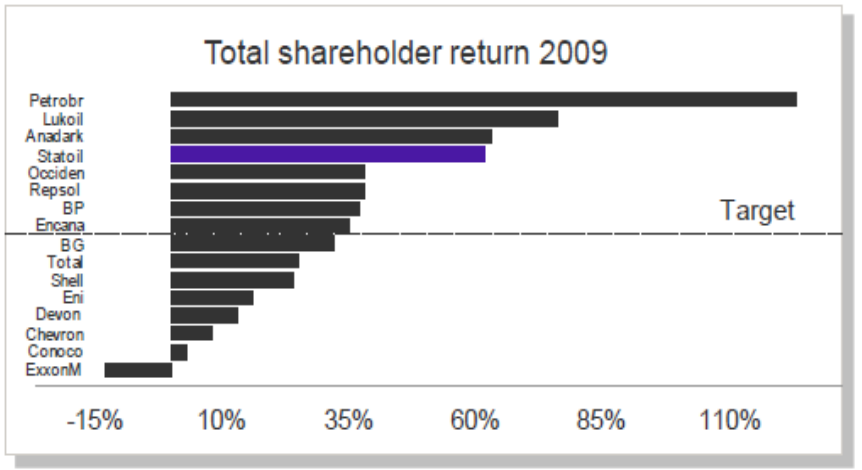
Classification: Internal
Status: Draft

Relative Statoil performance









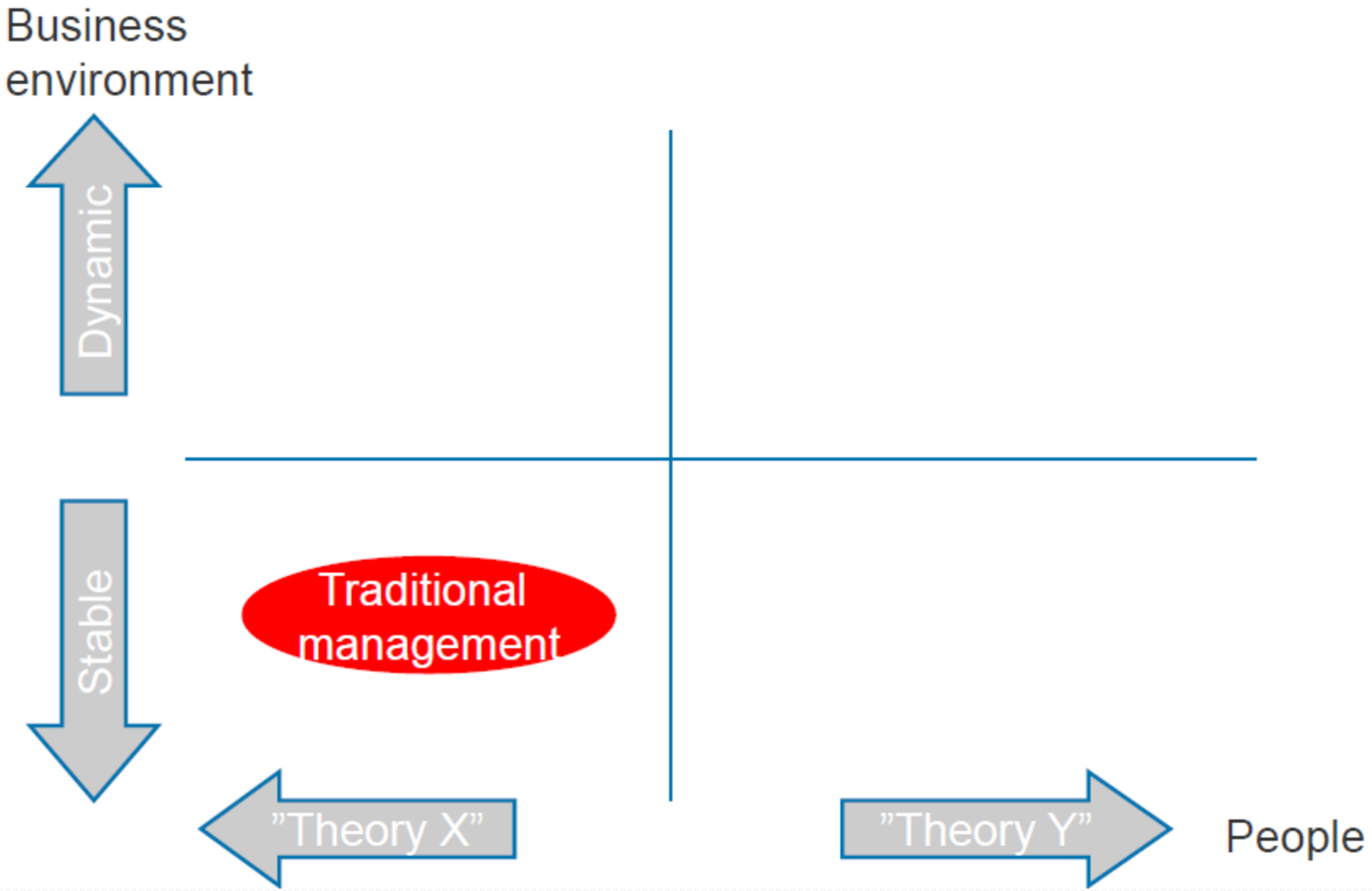
What is your view on people?

- **Theory X?**
- People prefer to be directed, do not want responsibility, and have little or no ambition.
- People have an inherent dislike for work and will avoid it whenever possible.
- People must be coerced, controlled, directed, or threatened with punishment in order to get them to achieve the organizational objectives.
- People seek security above all else.

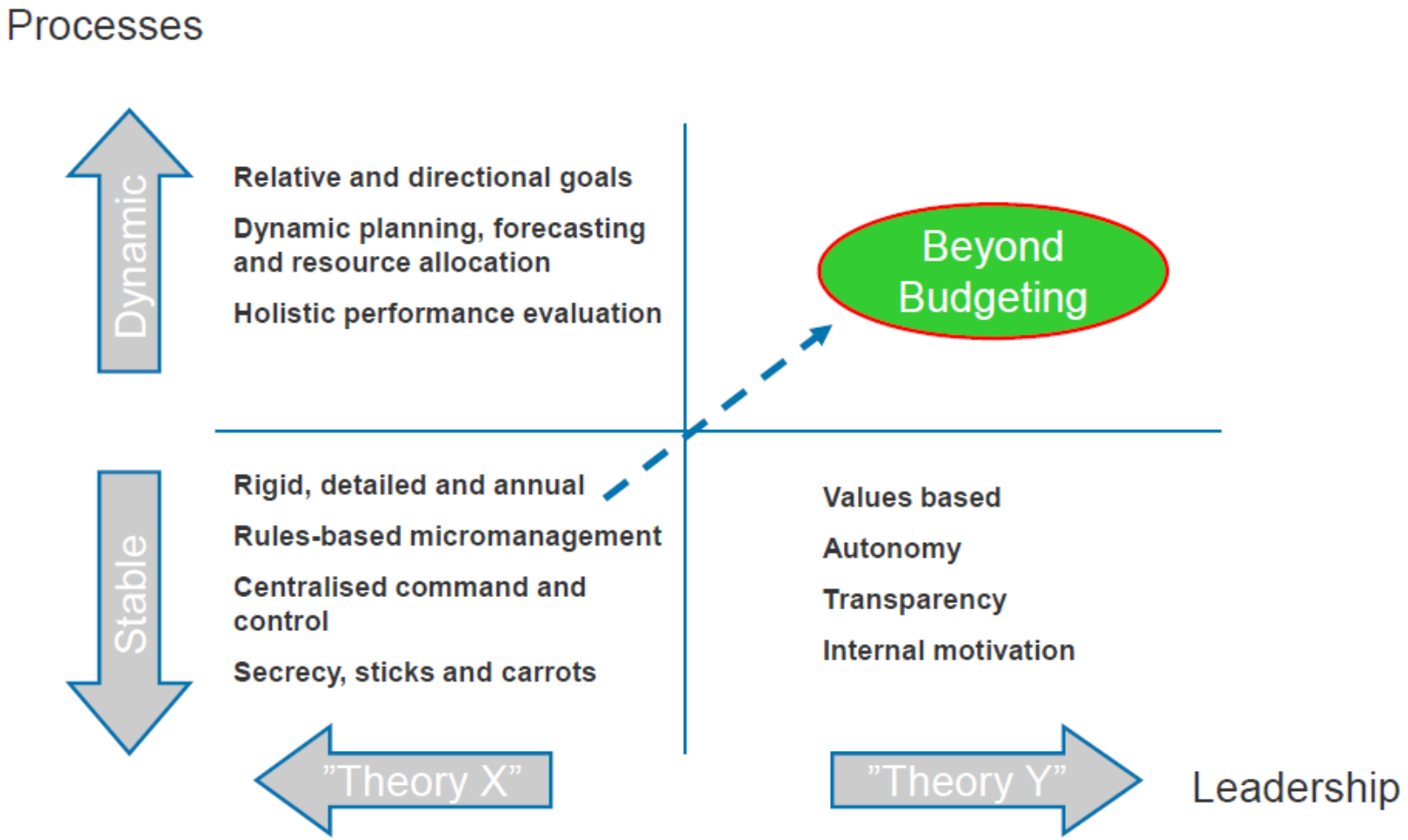
- **Theory Y?**
- Work is as natural as play and rest.
- People will exercise self-direction if they are committed to the objectives (they are not lazy).
- Creativity, ingenuity, and imagination are widely distributed among the population. People are capable of using these abilities to solve an organizational problem.
- People learn to accept and seek responsibility
- People have potential.

Douglas McGregor – ”The human side of enterprise” (1960)

The world has changed
- what about the way we lead and manage?



We must address both processes and leadership



The Beyond Budgeting principles

Change in *leadership*

1. Values - Govern through a few clear values, goals and boundaries, **not** detailed rules and budgets
2. Performance - Create a high performance climate based on relative success, **not** on meeting fixed targets
3. Transparency - Promote open information for self management, **don't** restrict it hierarchically
4. Organization - Organize as a network of lean, accountable teams, **not** around centralized functions
5. Autonomy - Give teams the freedom and capability to act; **don't** micro-manage them
6. Customers - Focus everyone on improving customer outcomes, **not** on hierarchical relationships

Change in *processes*

7. Goals - Set relative goals for continuous improvement, **don't** negotiate fixed performance contracts
8. Rewards - Reward shared success based on relative performance, **not** on meeting fixed targets
9. Planning - Make planning a continuous and inclusive process, **not** a top-down annual event
10. Coordination - Coordinate interactions dynamically, **not** through annual planning cycles
11. Resources - Make resources available as needed, **not** through annual budget allocations
12. Controls - Base controls on relative indicators and trends, **not** on variances against plan

StatOil Model – "Ambition to Action

Key principles – Ambition to action

- Performance is ultimately about **performing better** than those we **compare** ourselves with
- **Do the right thing** in the actual situation, guided by the Statoil Book, your Ambition to action, decision criteria & authorities and sound business judgement
- Within this framework, **resources** are made available or allocated case-by-case
- Business follow up is **forward looking** and **action** oriented
- Performance evaluation is a **holistic** assessment of delivery and behaviour

The CEO on Ambition to action



CEO Helge Lund

"We have a management model which is very well-suited to dealing with turbulence and rapid change. It enables us to act and reprioritise quickly so that we can fend off threats or seize opportunities. This is much more difficult in a traditional «budget world».

"One of the main principles in our Ambition to action concept is that Statoil consists of mature, professional and able people who both can and want to accept responsibility."

Ambition to action - a process which…

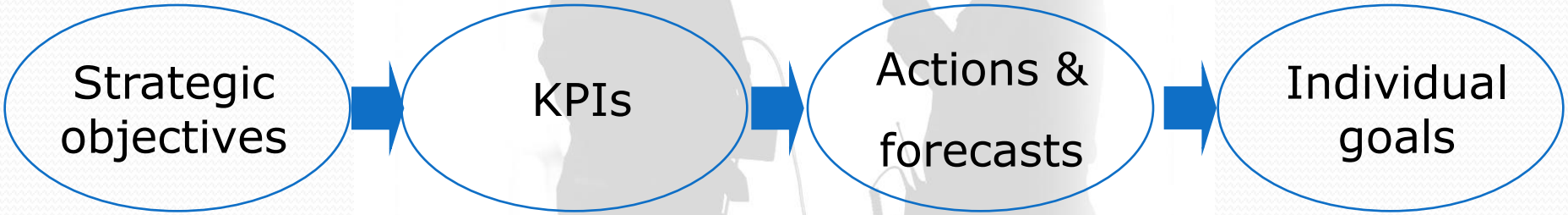
…is integrated - from strategy to people

…but provides sufficient freedom and flexibility

…and activates our values and leadership principles

Strong performance

Sustainable results



Where are we going - what does success look like?

- Most important strategic change areas
- Medium term horizon

How do we measure progress?

- Indicative measure of strategic delivery
- 10-12 KPIs, annual/ longer term targets

How do we get there?

- Concrete actions and expected delivery (forecast)
- Clear deadlines and accountabilities

What is my contribution?

- **My Performance Goals (MPG)**
- Delivery
- Behaviour

Classification: Internal
Status: Draft

Ambition to action example



Globally competitive – an exceptional place to perform and develop

Strategic objectives	Performance indicators	Actions (top 5)
People and organisation		
A value based and performance driven organisation.	Living the values Progress PO action plan	Complete the integration and ensure a successful post-merger process (31.12.2010) Ensure right capacity and competence (31.12.2010) Consistent execution of the Statoil Hydro book ensuring alignment and compliance (31.12.2010) Simplify and improve the People@StatoilHydro process and strengthen [illegible] (31.12.2010) Strengthen capability and diversity in leadership pipeline, and build strong leadership teams (31.12.2010)
Health, safety and environment		
Industry leader in HSE No integrity violations Remain an industry leader in terms of having a low climate impact [illegible] where we are engaged	Serious incident frequency Climate [illegible] TTS Observations and actions	Improve HSE leadership and compliance to our management system (31.12.2010) Increased focus on technical integrity and barriers (31.01.2010) Implement optimisation of HSE requirements (31.12.2010) Operationalise climate policy and technology [illegible] (31.12.2010)
Operation		
Optimise performance [illegible] value chains	PE EPN Product [illegible] Product [illegible] Finding cost exploration (USD/boe)	Secure optimal scope of CCS and handle communication challenge (20.12.2009) Ensure successful deliveries from corporate initiatives on IOR, IO and exploration (20.12.2009) Forcefully execute programs to improve production efficiency and drilling performance (20.12.2009) Improve execution abilities through quality in the CVP decision process (20.12.2009)
Market		
Exploration success outperforming peers Maximise value creation through our value chains A balanced portfolio set to grow long-term value in line with the first quartile of our peers	NCS resources (quality marker) Reserves [illegible] Downstream NOI (NOK bn)	Secure access to quality acreage on NCS (20.12.2009) Improve downstream profitability and portfolio robustness (31.12.2009) Optimise strategic rig capacity (20.12.2009) Execute the technology strategy (20/12/2009) Utilize market conditions to continuously secure StatoilHydro competitive prices from our suppliers (20.12.2009)
Finance		
Competitive shareholder return Realise the full potential from the merger Maintain financial robustness through cycles	Relative RoACE Relative Shareholder Return Merger value capture (NOK bn)	Continuously monitor and build flexibility in the portfolio (20.12.2009) Improve compliance within intellectual service and maintain focus on SOX (20.12.2009) Improve the cost mindset in the organisation and deliver on cost improvements (20.12.2009)

Where are we going?

”Strategic objectives”

How do we measure progress?

”Key Performance Indicators”

How do we get there?

”Actions”

More than 1100 "Ambition to actions" across the company



Classification: Internal
Status: Draft

Solving a serious budget conflict

Traditional budget / plan

Step 1: Separate

Step 2: Improve

Budget / plan =
- Target
- Forecast
- Resource allocation

"Same number – conflicting purposes"



Target
- Front-loaded
- Ambitious
- Relative if possible



Forecast
- Business driven not calendar driven
- Expected outcome – early warning
- Frequency and time horizon – lead time and target horizon driven
- Limited detail



Resource allocation
- Dynamic - no pre-allocation
- Projects - decision gates & criteria
- Operations - relative KPIs etc.
- Monitoring - intervention if needed only

"Different numbers"

Classification: Internal
Status: Draft

A forecast is not a promise or a target …





…nor is it an application for resources

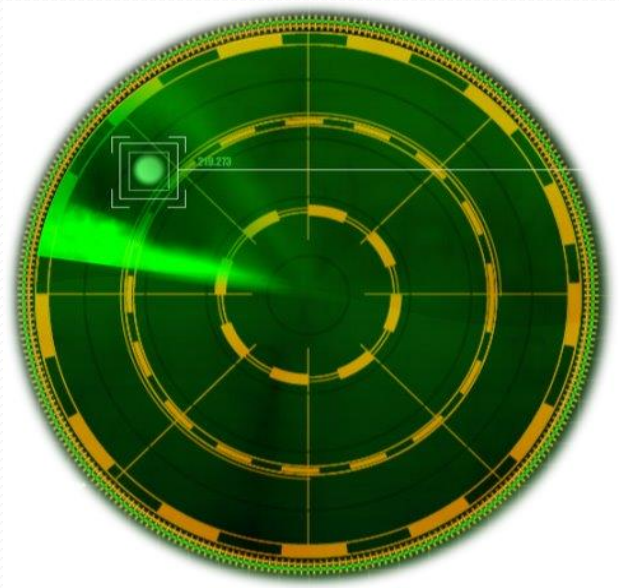
Classification: Internal
Status: Draft

A forecast is a call to action

Get issues on the radar screen early enough…

…..to be able to take corrective actions



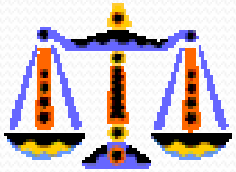


A forecast should:

- be brutally honest and unbiased
- be done for yourself more than for others
- be actionable
- have the right time horizon and detail level
- include an uncertainty analysis where relevant

Relative performance

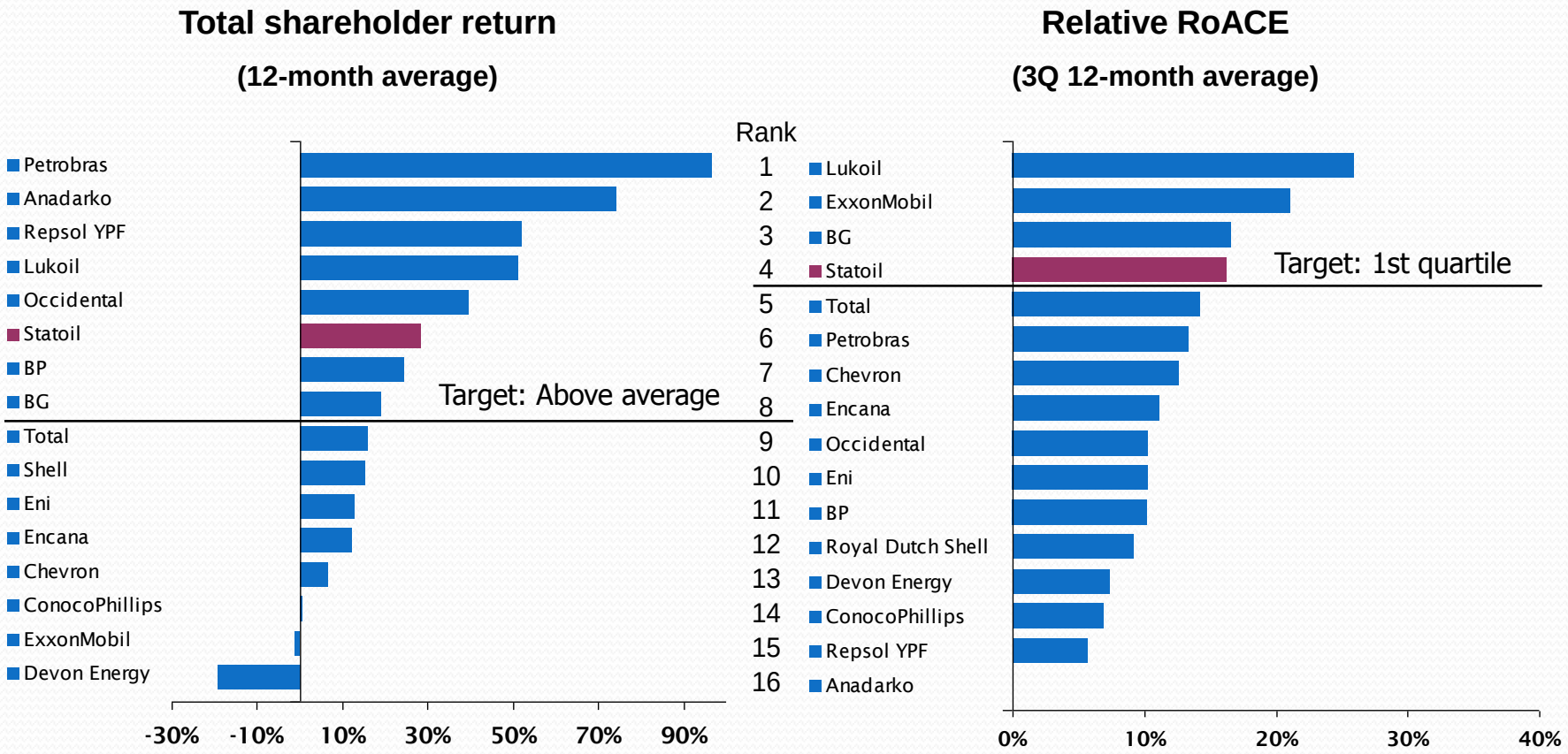
- Connect input with output



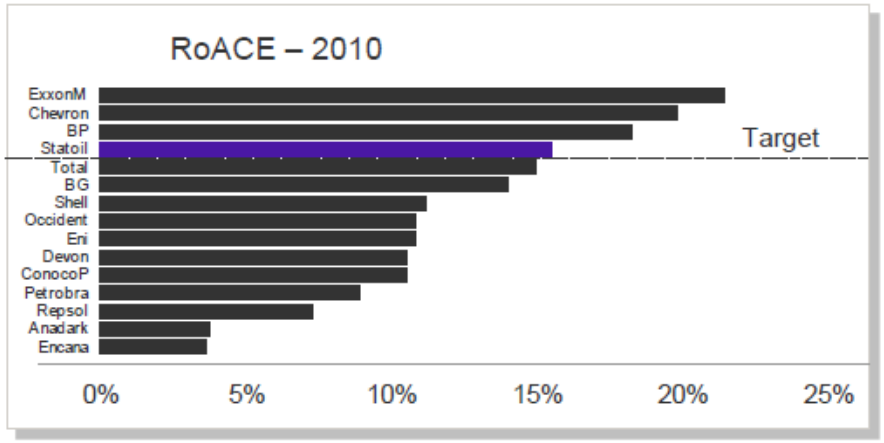
- Compare with others

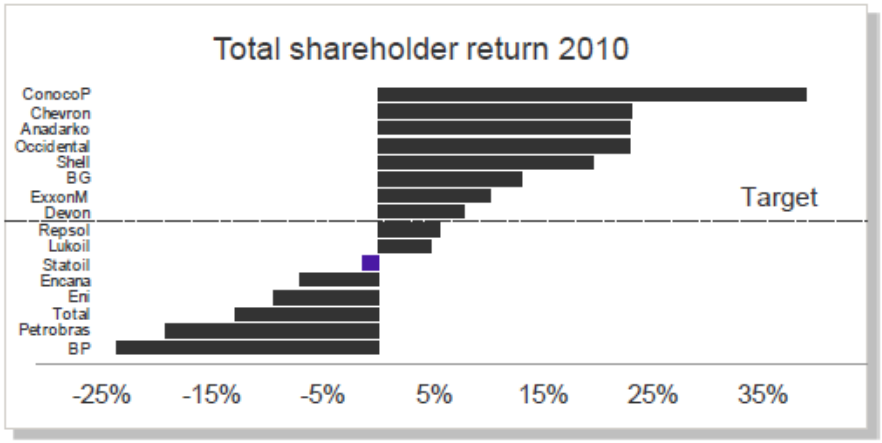


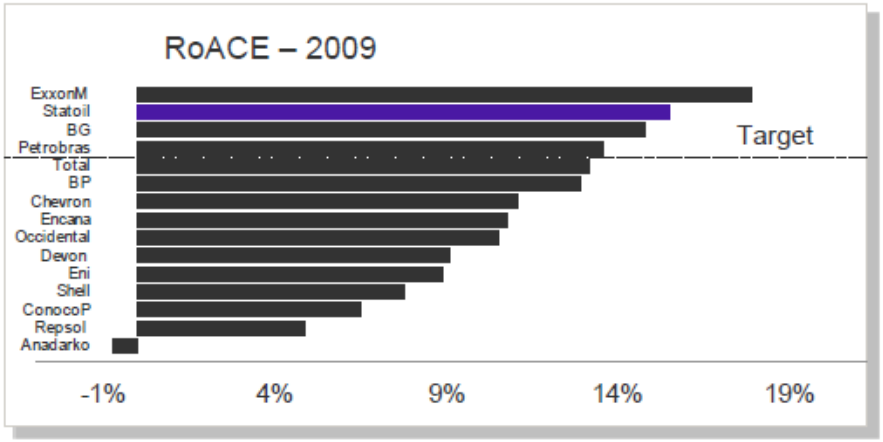
Relative Statoil performance

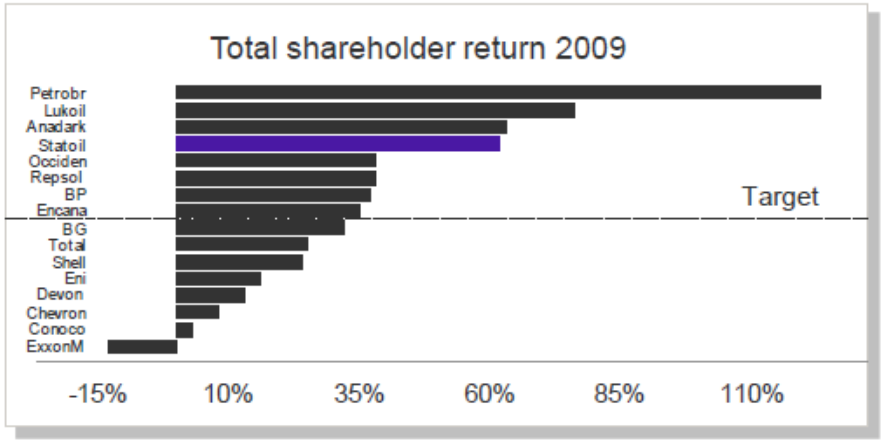


Relative Statoil performance





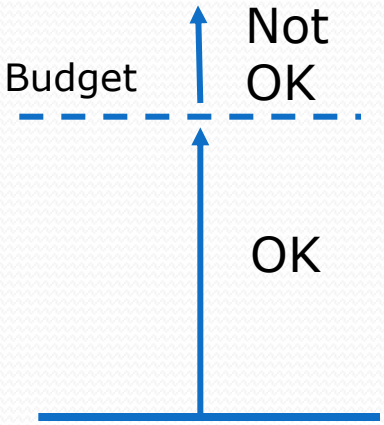


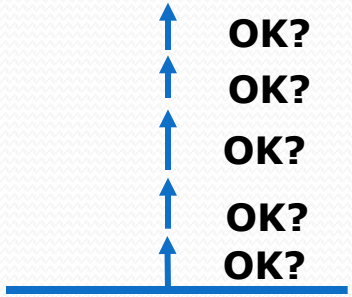


Dynamic resource allocation:
A different mindset - cost conscious from the first penny









Dynamic resource allocation – other costs

Absolute KPIs		Relative KPIs			No KPIs
Traditional cost budget	Absolute cost KPI	Unit cost input/output	Unit cost vs peers	Bottom line focus only	Strategic objectives or actions only
Xx Xx Xx Xx Xx Xx Xx Xx 1000	1000	 ”USD/bbl” ”USD/customer” ”USD/employee”	 ”1. quartile” ”Above average”	EBIT ROCE (abs/rel)	”Cost effective and competitive operations” ”More video –less travel” ”Reduce consultancy spending”

Increasing freedom and flexibility

Increasing need for strong values and clear direction

Monitoring of actual development, intervention if needed only

Select based on what is right and works for your organisation

A new performance language
- from mechanical measurement to a holistic assessment

(Previously only KPI targets)

"Ambition to Action"

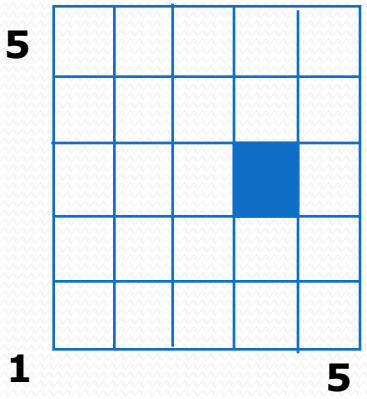
- Strategic objectives
- KPI targets
- Actions



Pressure testing KPI results:

- Deliver towards the strategic objectives?
- How ambitious KPI targets?
- Changed assumptions, with positive or negative effect?
- Agreed actions implemented, or corrective actions initiated as needed?
- Delivered results sustainable?





50/50

Behaviour

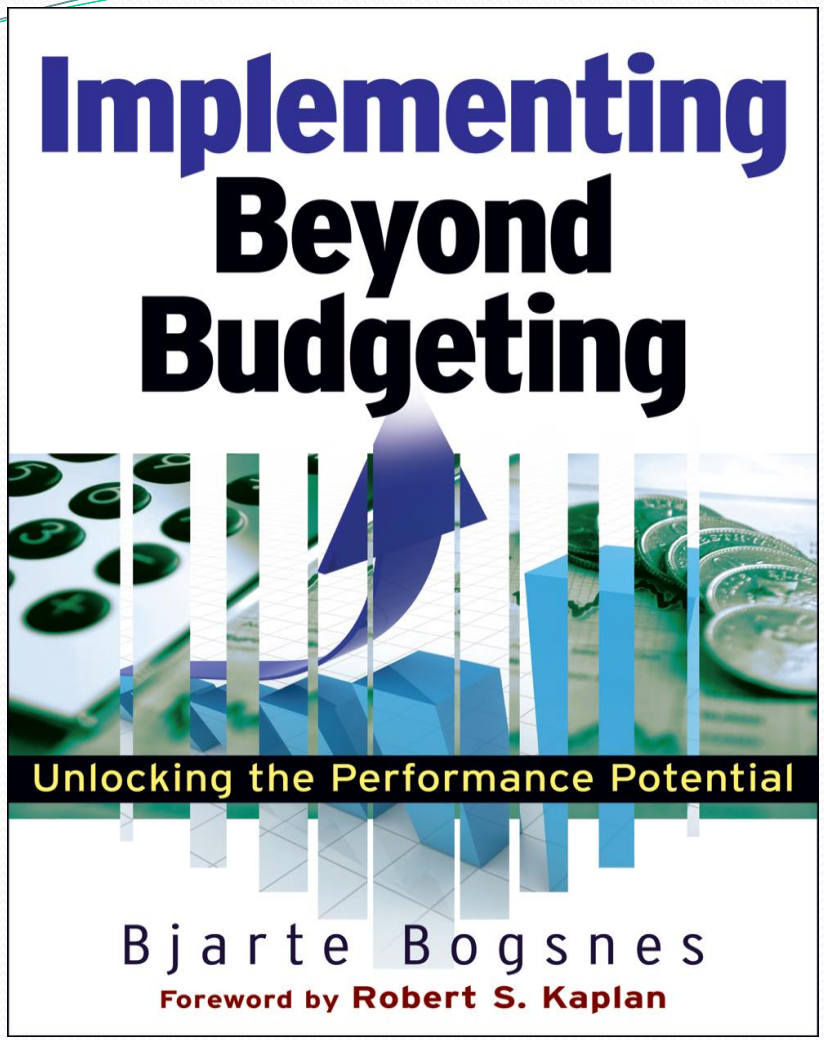
Living the values

- Day-to day-observations
- 360°/ 180°/ 90° surveys
- People survey
- Individual development plan

Classification: Internal
Status: Draft

A systematic change of the whole process

	”Annual command and control”	More dynamic & flexible A new performance language
Target setting	· Equal to plan – ”what we can deliver” · KPI targets · Absolute targets	· Aspiration driven –”what we must deliver”. Targets before plan. · ” Ambition to action” · Relative targets
Planning	· Plan = target, forecast and resource allocation · Gaps vs targets hidden · One outcome only · Very detailed	· Plan = forecast only (actions and expected performance) · Gaps vs. targets visible · Main uncertainty spans · Less detailed
Resource allocation	· Annual pre-allocation through budgets · Budgets ”an entitlement – my money”	· Resources available when needed, but within KPI targets + mandates + decision criteria. Monitoring of development
Business reporting	· Backward looking · Variance vs. YTD budget	· Forward looking · Forecast vs. targets, and actions to close gaps
Evaluation/ rewards	· Only based on budgets and KPIs	· A broader evaluation: ”Ambition to action” + Behaviour

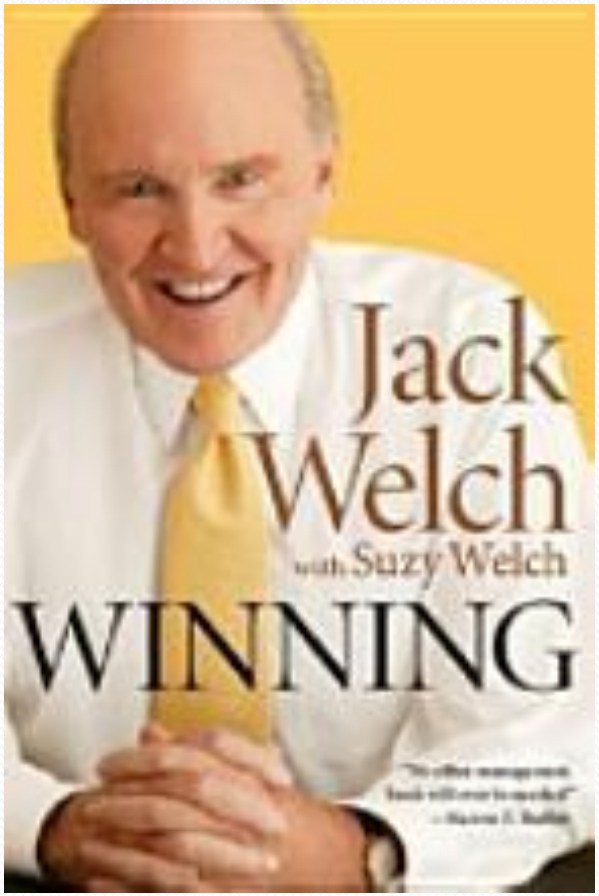

Implementing
Beyond
Budgeting
Unlocking the Performance Potential
Bjarte Bogsnes
Foreword by Robert S. Kaplan

Beyond Budgeting Tools



Balanced Scorecards
KPIs
Activity Based Management
Rolling Forecasts
"Real" costs v Standard cost
Relative (and continuous) improvement
External comparison & benchmarking
Delegation of Ownership of OUTCOMES not just INPUTS
Understand how the organisation is going to be successful
Understanding of people and motivation

Jack Welch - STRETCH



STRETCH - The fundamental part of Stretch came down to a focus on performance against the competition. Under the old system, if you met your budget you were a hero and got your bonus. Under Welch's new system the important measurement was your performance against that of your competitors

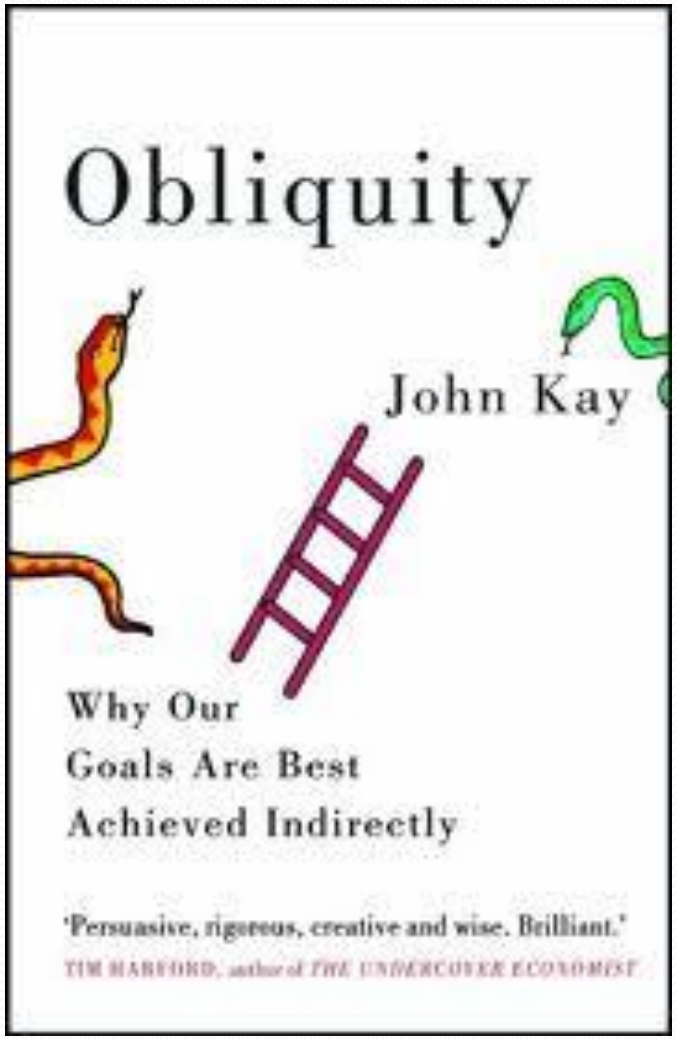
DON'T BEAT THE BUDGET – BEAT THE COMPETITION

USE RELATIVE PERFORMANCE MEASURES

Beyond Budgeting – Stretch Targets Advantages

- **VARIANCE CONTROLS**
  - **Lead to an "excuse" culture**
- **RELATIVE KPI CONTROLS**
  - **Lead to an "improvement" culture**

Obliquity – Indirect Routes Get You There Fastest John Kay





MONTHLY BUDGETARY REPORTING

MONTH		
ACTUAL	BUDGET	VARIANCE

YEAR TO DATE		
ACTUAL	BUDGET	VARIANCE

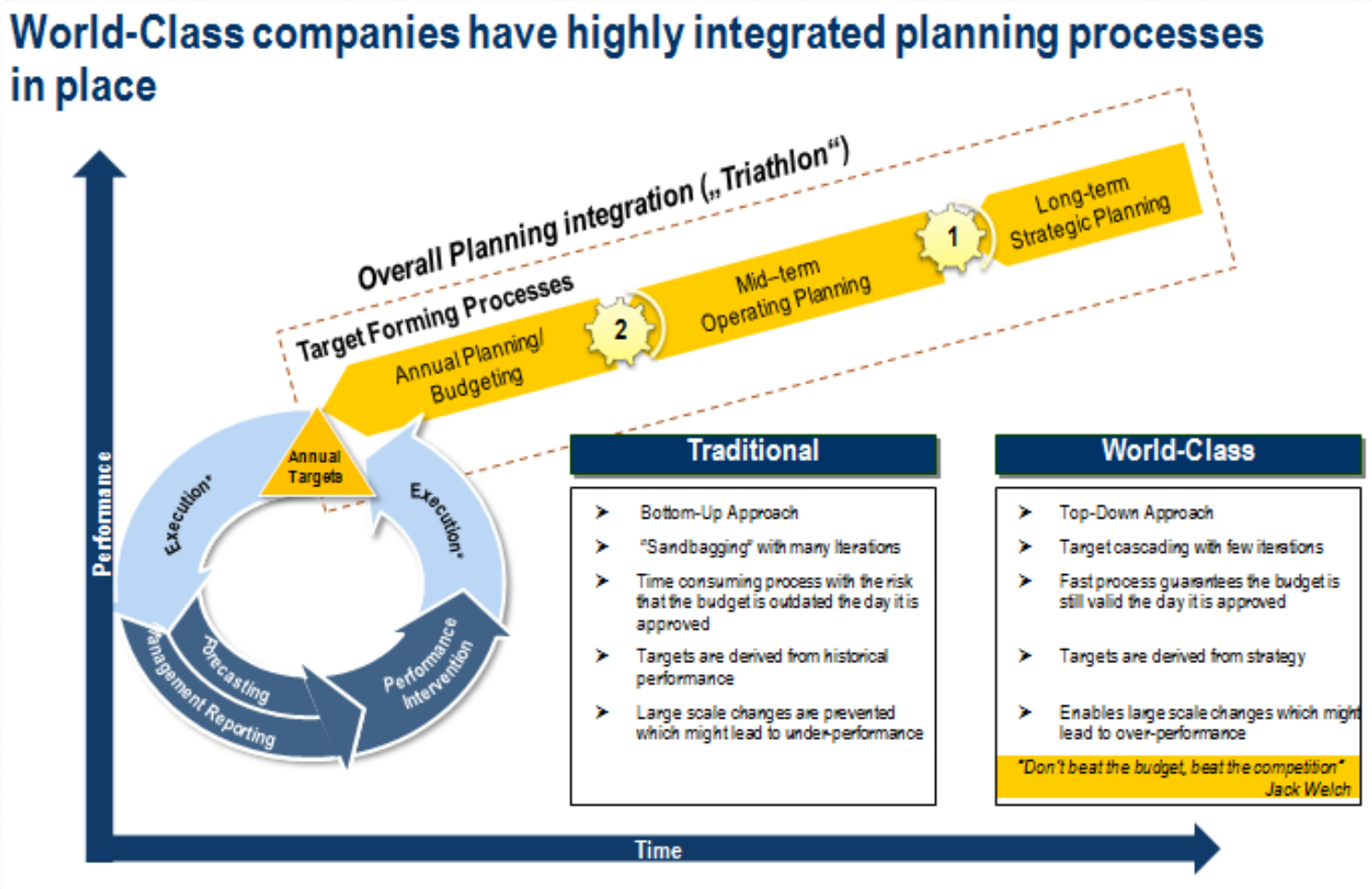
YEAR		
FORECAST	BUDGET	VARIANCE

COMMENTARY
REVIEW
ANALYSIS
ACTION

COMMENTARY
REVIEW
ANALYSIS
ACTION

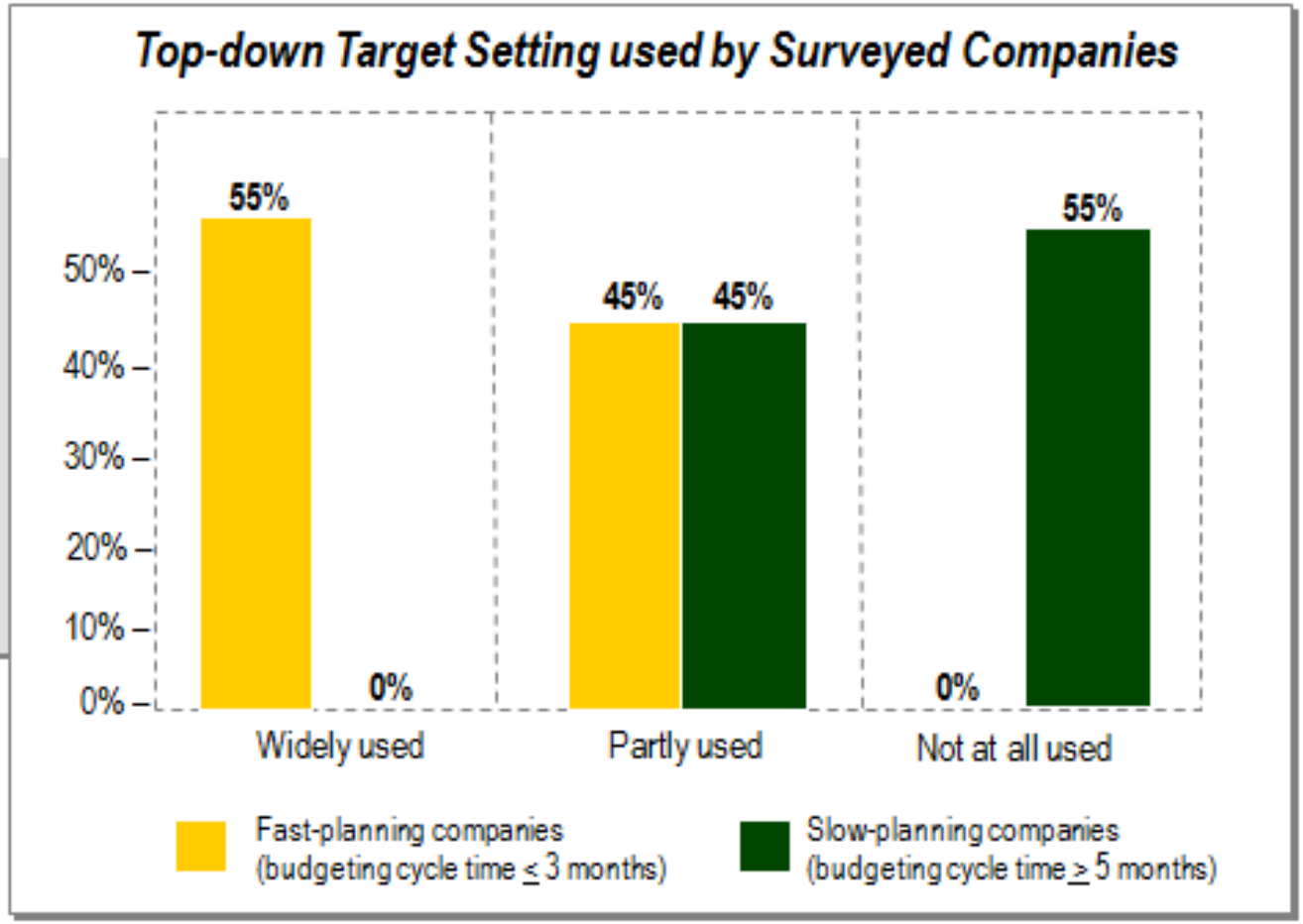
COMMENTARY
REVIEW
ANALYSIS
ACTION

“World Class” - Hackett



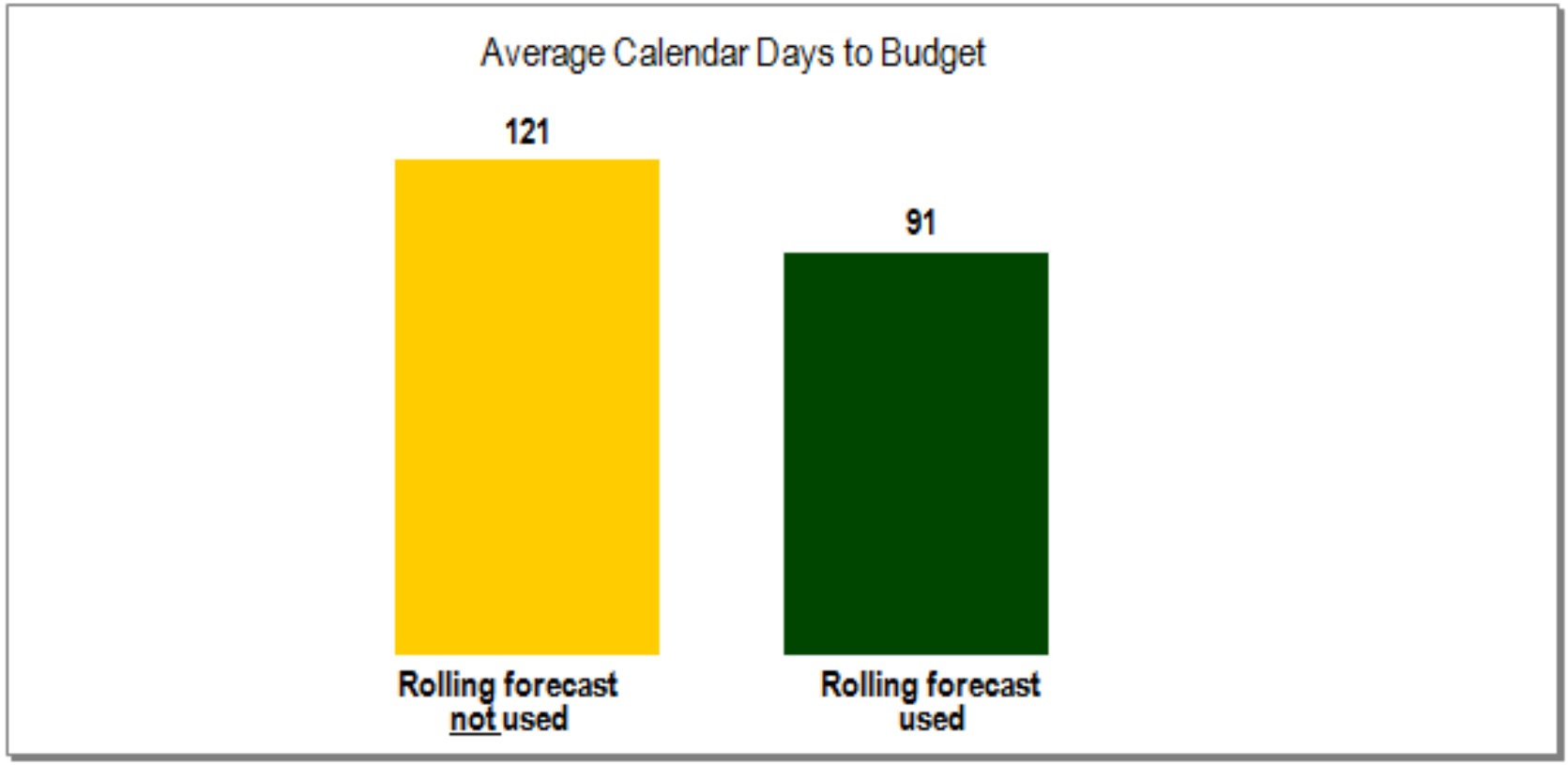
Top-down target setting is the key differentiator

The majority of fast-planning companies use top-down target setting; the remaining fast-planning companies use that best practice at least in part.

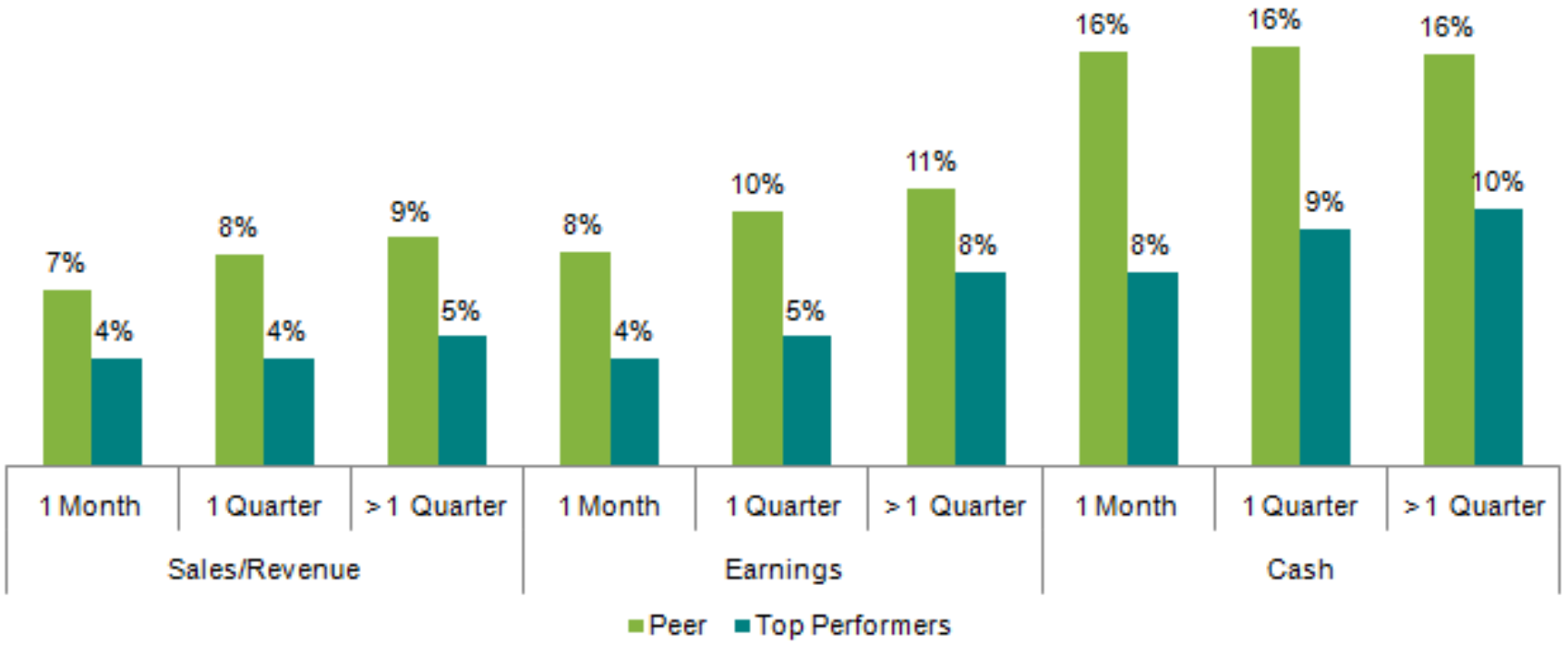


Fast-planning companies utilize a Rolling Forecast to reduce efforts and improve quality in budgeting

Utilization of a Rolling Forecast * and impact on cycle time



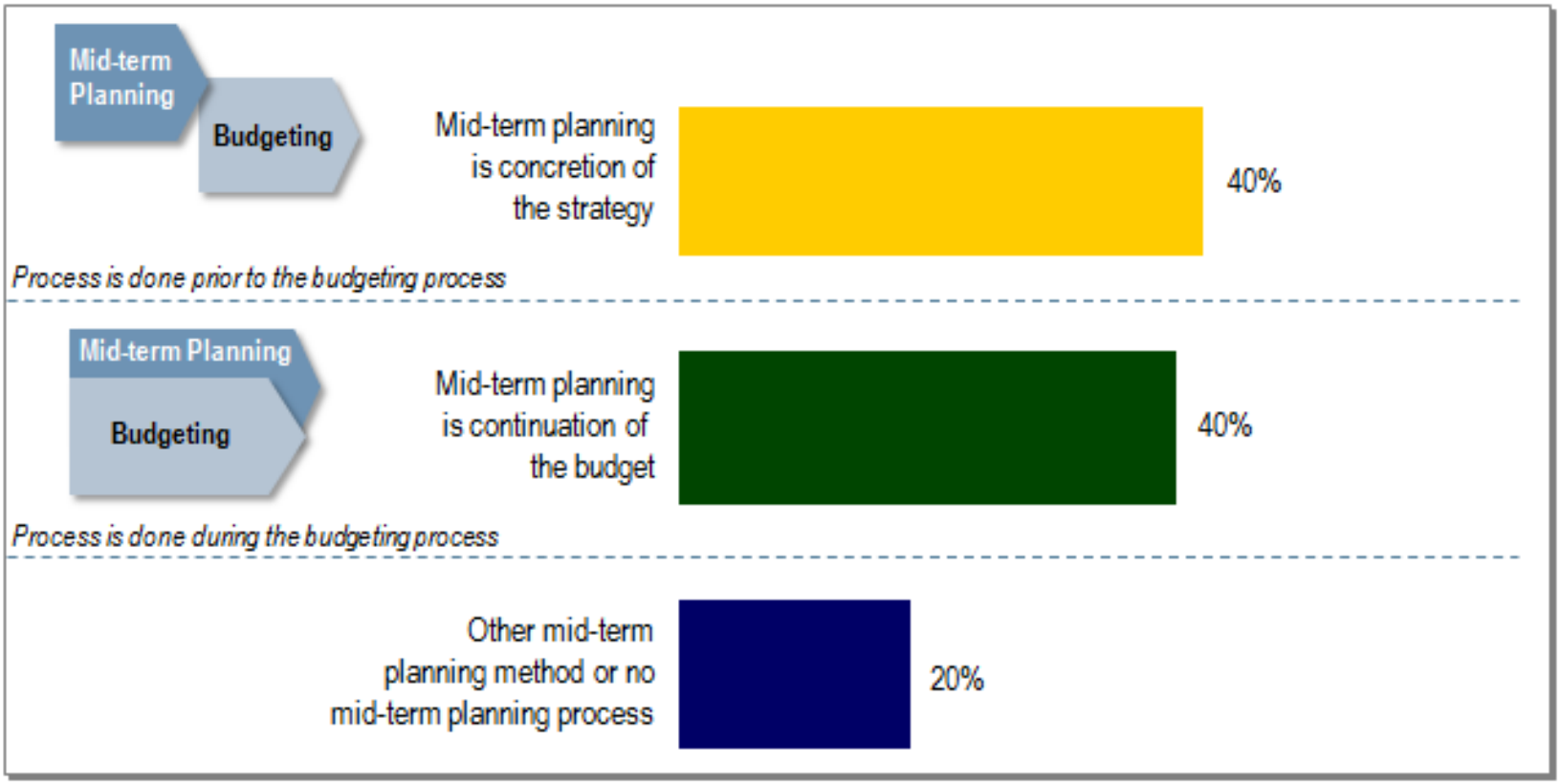
Top Performers have shorter cycle times and are almost twice as accurate that Peers according to Hackett 2011 – Global EPM Study



- Accuracy of forecasts of top performers is about twice higher than of peers
- Cash is by far the least accurately forecasted financial parameter, sales / revenue the most, and earnings in between
- Difference between short term and longer term forecasting accuracy is relatively small, with the exception of earnings

Two different approaches are widely used in mid-term operating planning

Mid-term Operating Planning Approaches used by Surveyed Companies



Tools

- Analytical Tools
- Excel
- Access
- SAP – Business Warehouse

Investment Decisions

Evaluating Capital Expenditure Options

The following are based on projected CASH FLOWS, **NOT** Costs:

	Option A	**Option B**
	£	£
Now	(10,000)	(10,000)
Year 1	5,000	1,000
Year 2	4,000	2,000
Year 3	2,000	3,000
Year 4	2,000	4,000
Year 5	1,000	5,000
Net Saving	**4,000**	**5,000**

Discount table - Present Value of £1

YEAR	8%	9%	10%	20%	21%	22%
0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.9259	0.9174	0.9091	0.8333	0.8264	0.8197
2	0.8573	0.8417	0.8264	0.6944	0.6830	0.6719
3	0.7938	0.7722	0.7513	0.5787	0.5645	0.5507
4	0.7350	0.7084	0.6830	0.4823	0.4665	0.4514
5	0.6806	0.6499	0.6209	0.4019	0.3855	0.3700
6	0.6302	0.5963	0.5645	0.3349	0.3186	0.3033
7	0.5835	0.5470	0.5132	0.2791	0.2633	0.2486
8	0.5403	0.5019	0.4665	0.2326	0.2176	0.2038
9	0.5002	0.4604	0.4241	0.1938	0.1799	0.1670
10	0.4632	0.4224	0.3855	0.1615	0.1486	0.1369

INVEST IN WHICH ?

YEAR	Project A	Project B	Discount Factor 10%		Project A DCF (10%)	Project B DCF (10%)
0	-10000	-10000	1.0000		-10000	-10000
1	5000	1000	0.9091		4545	909
2	4000	2000	0.8264		3306	1653
3	2000	3000	0.7513		1503	2254
4	2000	4000	0.6830		1366	2732
5	1000	5000	0.6209		621	3105
Net	4000	5000		**NPV**	1341	653

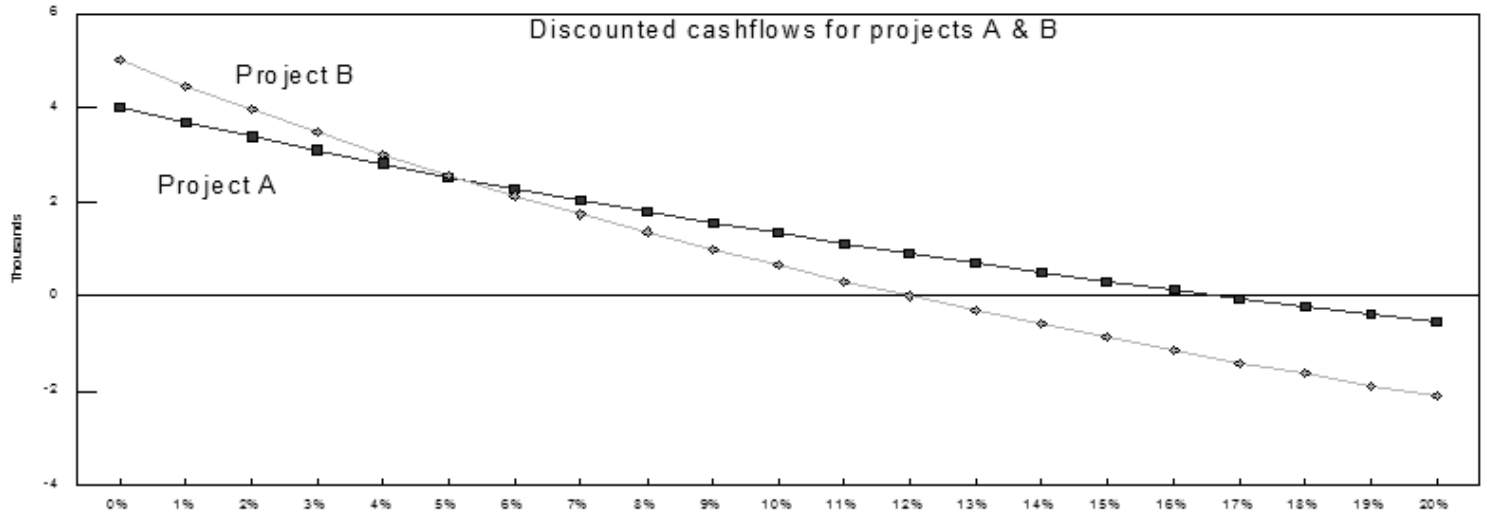
YEAR	Project A	Project B	Discount Factor 20%		Project A DCF (20%)	Project B DCF (20%)
0	-10000	-10000	1.0000		-10000	-10000
1	5000	1000	0.8333		4167	833
2	4000	2000	0.6944		2778	1389
3	2000	3000	0.5787		1157	1736
4	2000	4000	0.4823		965	1929
5	1000	5000	0.4019		402	2009
Net	4000	5000		**NPV**	-532	-2103

Internal Rate of Return

CAPITAL INVESTMENT APPRAISAL - EXAMPLE

NPV

	0%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
ProjectA	4000	3888	3385	3095	2815	2547	2288	2038	1797	1565	1341	1124	915.1	712.9	517.3	328.1	145	-32.3	-204	-370	-532
ProjectB	5000	4484	3954	3488	3008	2588	2147	1747	1385	1001	652.8	319.9	1.792	-303	-594	-873	-1140	-1398	-1642	-1877	-2103



Cost of Capital

Cost of Capital Calculations

Example from E.on published accounts 07

Cost of Equity

		A	Beta B	A x B
Risk Free Rate	5.10%	5.10%	1.0	5.10%
Market Premium		5.00%	0.7	3.50%
Required rate	Market	10.10%	E.on	8.60%

Cost of Debt

Cost of Debt before tax		5.60%
Tax shield - interest reduces tax	35.00%	-1.96%
After tax cost of debt		3.64%

WACC

	Mix M	Cost C	M x C	
Share of Equity	45%	8.60%	3.87%	
Share of Debt	55%	3.64%	2.00%	
WACC - weighted average cost of capital			5.87%	After tax rate
Tax	35%		3.16%	
	100%		9.03%	Before tax rate

Improving Financial Justification for Decisions 11 Ideas

1. Check the decision against objectives / policy
   - for major or long term decision demonstrate the *'strategic fit'*

2. Start with specifications / problems not solutions
   - avoid being enticed by the technology!

3. Learn from experience

4. Review previous decisions
   - use post investment / decision appraisal

5. State and document assumptions

6. Identify 'milestones' for monitoring projects/proposal progress

7. Identify critical success factors
   - what will cause the project/proposal to fail and therefore what needs to be managed

8. Recognise and try to quantify risks

9. Include sensitivity analysis

10. Consider relevant costs – ignore previous sunk cost

11. Gain commitment to the figures

Example

Buy Truck A or Truck B

	Year	Truck A	Truck B	DF 10%	Annuity Factor	Truck A	Truck B	EAC Truck A	EAC Truck B	EAC Discounted Truck A	EAC Discounted Truck B
Purchase Cost	0	-10,000.00	-16,000.00	1.00		-10,000.00	-16,000.00				
Running Cost	1	-2,000.00	-2,000.00	0.91	0.91	-1,818.18	-1,818.18	-6,021.15	-6,220.76	-5,473.77	-5,655.24
	2	-2,000.00	-2,000.00	0.83	1.74	-1,652.89	-1,652.89	-6,021.15	-6,220.76	-4,976.16	-5,141.12
	3	-2,000.00	-2,000.00	0.75	2.49	-1,502.63	-1,502.63	-6,021.15	-6,220.76	-4,523.78	-4,673.75
	4		-2,000.00	0.68	3.17	0.00	-1,366.03		-6,220.76	0.00	-4,248.86
	5		-2,000.00	0.62	3.79	0.00	-1,241.84		-6,220.76	0.00	-3,862.60
	Total	-16,000.00	-26,000.00			-14,973.70	-23,581.57			-14,973.70	-23,581.57
	Years	3.00	5.00		Annuity Factor	2.49	3.79				
	Average	-5,333.33	**-5,200.00**		EAC	**-6,021.15**	-6,220.76				

Programe & Project Budget Management

Budget Management

Budget Development

- ***Good scheduling skills and abilities***
- ***Understanding of the project scope***
- ***Well developed WBS and project schedule***

Budget Management

Key reasons for overspending…

- ***Bad Luck***
- ***Overly optimistic initial estimates***
- ***Poor communication***
- ***Poor cost/time estimating practices***

Budget Management

Three methods of estimating

1. Analogous Estimating

Uses values from previous, similar projects as the basis for estimating the same values for future activities or projects. Also called "Top-down" estimating.

Budget Management

Three methods of estimating

2. Parametric Estimating

Uses statistical relationship between historical data and other variables to calculate an estimate for an activity or project.

Budget Management

Three methods of estimating

3. Bottom-up Estimating

Decomposition of the work into smaller packages or more detail. Estimates are made at the lowest level and then summarizes, or aggregated, into the higher level activities.

Budget Management

Cost Budgeting

- ***The planning process that involves summarizing, or aggregating, the estimated costs for individual activities to establish a total cost baseline for the project.***

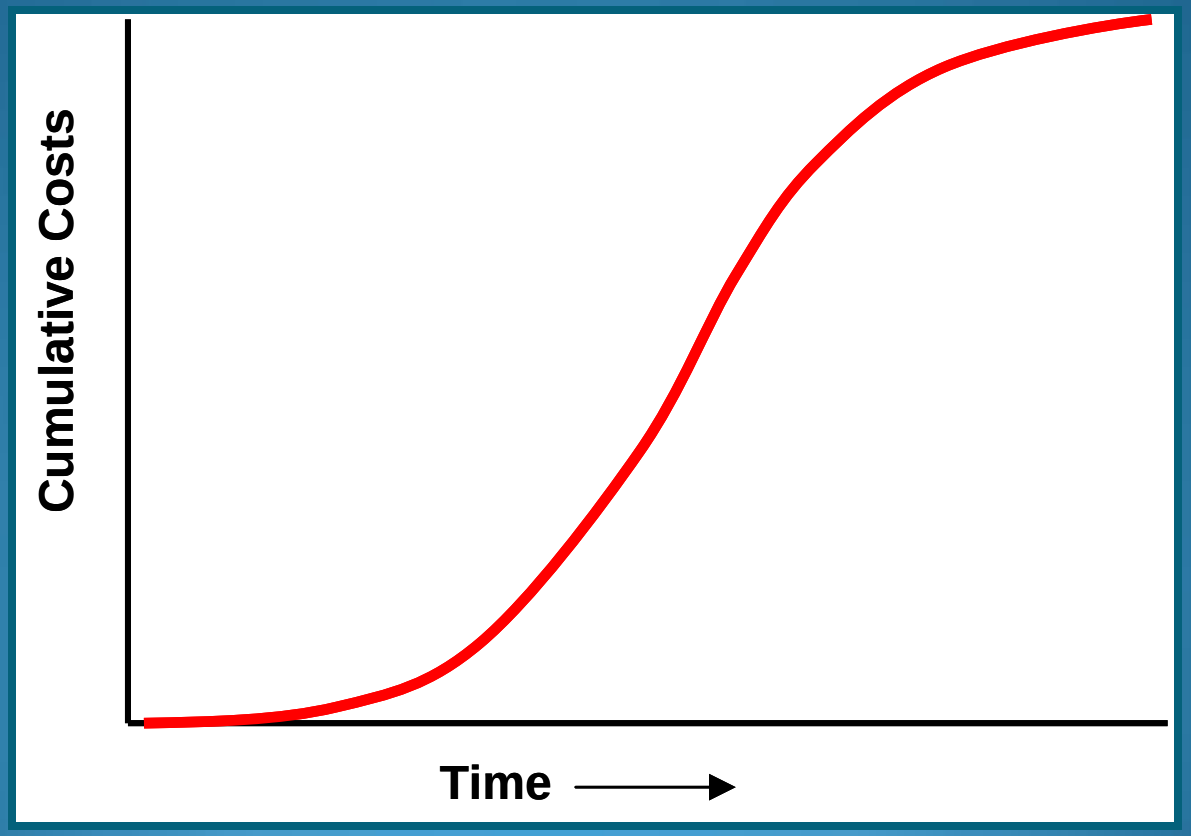
Budget Management

Cost Baseline

- ***Time based budget that is used as a basis for measuring, monitoring, and controlling the overall cost performance of the project.***
- ***Also represents "Planned Value"***

Budget Management

Cost Baseline



Budget Management

Cost Control

- ***The process of influencing factors that create variances, and controlling changes to the project budget.***

Budget Management

Project cost control includes:

- ***Ensuring changes are agreed upon***
- ***Managing changes when they occur***
- ***Assure potential cost overruns do not exceed authorized funding***
- ***Monitor cost performance and understand variances***

Budget Management

Project cost control includes:

- ***Recording all appropriate changes against the cost baseline***
- ***Preventing incorrect, inappropriate, or unapproved changes***
- ***Inform stakeholders of approved changes***
- ***Acting to bring overruns within limits***

Budget Management

Cost Change Control System

- ***Defines the procedures by which the cost baseline can be changed.***
- ***WSDOT policy found in the Project Control & Reporting Guide***
- ***Also documented in the Project Management Plan***

Earned Value Management

What is Earned Value Management (EVM)?

- ***A method of integrating scope, schedule, and resources, and for measuring project performance.***
- ***It compares the amount of work that was planned with what was actually earned with what was actually spent to determine if cost and schedule performance are as planned.***

Earned Value Management

What is needed for EVM?

- *A baseline plan*
- *A project budget (BAC – Budget at Completion)*
- *A project end date*
- *Tasks are identified & scheduled*
- *Each task has a budget or effort (resource loaded / weighting)*
- *Actuals tracked*

Earned Value Management

To perform EVM, three values need to be determined

- ***Planned Value (PV or BCWS)***
- ***Actual Costs (AC or ACWP)***
- ***Earned Value (EV or BCWP)***
- ***BCWS Budget cost work scheduled***
- ***BCWS Budget Cost work performed***
- ***ACWP Actual costs work performed***

Earned Value Management

Planned Value (PV)

What are the budgeted costs of the work scheduled?

- ***Time phased based on baseline budget***
- ***Only changes when baseline is changed***
- ***Also referred as "BCWS" & "BAC"***
- ***Budget at completion***

Earned Value Management

Actual Costs (AC)

What are the actual costs of the work performed?

- ***Based on the actual completion of work packages***
- ***Actual costs for reported work***
- ***Also referred as "ACWP"***

Earned Value Management

Earned Value (EV)

What are the budgeted costs of the work performed?

- ***Based on the actual completion of work packages***
- ***Baseline value of the reported work***
- ***Also referred as "BCWP"***

Earned Value Management Example

Task – Drill & install 10 piezometers

- ***Budget - $100,000 ($10K per piezometer)***
- ***Time – 10 weeks (1 piezometer per week)***

At week 5:

- ***4 piezometers drilled and installed***
- ***$47,500 spent to date***

PV = $50,000

AC = $47,500

EV = $40,000

Earned Value Management

Calculating Earned Value and interpreting results

- *to measure the progress of the project*
- *help identify trends*
- *forecast costs*
- *and identify ways to correct/mitigate project pitfalls.*

Earned Value Management

Cost Variance (CV)

$$CV = EV - AC$$

- **Good News**: If CV value is positive, the project is currently under budget (spending less than planned for the work)
- **Bad News**: If CV value is negative, the project is currently over budget (spending more than planned for the work)

Earned Value Management

Cost Performance Index (CPI)

$$CPI = EV / AC$$

- **Good News**: If CPI value is >1 or =1, the project cost trend is currently under or at planned budget
- **Bad News**: If CPI value <1, the project cost trend is currently over budget

Earned Value Management

Cost Variance % (CV%)

$$CV\% = CV / EV$$

- **Good News**: If CV% value is positive, the project is currently under budget by the CV%
- **Bad News**: If CV% value is negative, the project is currently over budget by the CV%

Earned Value Management

Schedule Variance (SV)

$$SV = EV - PV$$

- Good News*: If SV value is positive, the project is currently ahead of schedule
- Bad News: If SV value is negative, the project is currently behind schedule

** - not all positive SVs are good*

Earned Value Management

Schedule Performance Index (SPI)

$$SPI = EV / PV$$

- **Good News: If SPI value is >1 or =1, the project schedule trend is currently ahead or on planned schedule**
- **Bad News: If SPI value <1, the project schedule trend is currently behind schedule**

Earned Value Management

Schedule Variance % (SV%)

$$SV\% = SV / PV$$

- **Good News**: If SV value is positive, the project is currently ahead of schedule
- **Bad News**: If SV value is negative, the project is currently behind schedule

Earned Value Management

Estimate at Completion (EAC)

#1

Actual costs to date plus a new estimate for all remaining work (original plan no longer valid)

$$EAC = AC + ETC$$

(ETC → Estimate to Complete)

Earned Value Management

Estimate at Completion (EAC)

#2

Actual costs to date plus remaining budget (current variances are viewed as atypical of future variances)

$$EAC = AC + BAC - EV$$

Earned Value Management

Estimate at Completion (EAC)

#3 & #4

Actual costs to date plus remaining budget modified by a performance factor (CPI) (current variances are viewed as typical of future variances).

$$EAC = AC + [(BAC - EV) / CPI]$$

$$EAC = BAC / CPI$$

Earned Value Management Example

Task – Drill & install 10 piezometers

- *Budget - $100,000 ($10K per piezometer)*
- *Time – 10 weeks (1 piezometer per week)*

At week 5:

- *4 piezometers drilled and installed*
- *$47,500 spent to date*

PV = $50,000	*CV = -$7,500*	*SV = -$10,000*
AC = $47,500	*CPI = 0.82*	*SPI = 0.80*
EV = $40,000	*CV% = -19%*	*SV% = -20%*

Earned Value Scenario

Washington State Department of Transportation

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Dear Boss,

As of 5/30/04, we are 42% complete and have spent $48,000.

Respectfully submitted,

John Doe, Project Manager

Earned Value Scenario

Washington State
Department of Transportation

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Dear Boss,

As of 5/30/04, we estimate that this project will be complete on 8/1/04, at a cost of $100,000.

Respectfully submitted,

John Doe, Project Manager

Earned Value Scenario

Washington State Department of Transportation

Program Management Status Report

SR999, Main Street Intersection Signal & Channelization

Status as of 5/30/04

Planned expenditures to date are $56,000
This is 56% of the project budget
Actual expenditures to date are $48,000
This is 48% of the project budget
We estimate cost at completion of $100,000

Respectfully Submitted,
Jane Smith, Program Management

Earned Value Scenario

Washington State Department of Transportation

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Schedule:

Current completion is 42%

We estimate project completion on 8/1/04

Budget:

Expenditures to date are $48,000

We estimate cost at completion of $100,000

Respectfully submitted,

John Doe, Project Manager

Earned Value Scenario

BAC = $100,000 (current project budget)

EV = $42,000 (42% of project completed, $100,000 planned)

PV = $56,000 (56% of project planned $100,000 completed – initial aging report)

AC = $48,000 (from actual expenditures reporting)

Is this project on schedule / budget? Or is it in trouble?

Earned Value Scenario

Cost Variance (CV):

CV = EV – AC

= $42,000 - $48,000

= - $6,000

Cost Performance Index (CPI):

CPI = EV / AC

= $42,000 / $48,000

= 0.875

Cost Variance % (CV%):

CV% = CV / EV

= - $6,000 / $42,000

= 14% OVER BUDGET

Earned Value Scenario

Schedule Variance (SV):

SV = EV – PV

= $42,000 - $56,000

= - $14,000

Schedule Performance Index (SPI):

SPI = EV / PV

= $42,000 / $56,000

= 0.750

Schedule Variance % (SV%):

SV% = SV / PV

= - $14,000 / $56,000

= **25% BEHIND SCHEDULE**

Earned Value Scenario

Estimate at Completion (EAC):

Method #1:

EAC = AC + ETC (say $68,000)

= $48,000 + $68,000

= $116,000

(Change Management for $16,000 funds request)

Method #2:

EAC = AC + BAC – EV

= $48,000 + $100,000 - $42,000

= $106,000

(Change Management for $6,000 funds request)

Earned Value Scenario

Estimate to Complete (ETC):

Method #3

EAC = AC + [(BAC – EV) / CPI]

= $48,000 + [($100,000 - $42,000) / 0.875]

= $48,000 + $66,285

= $114,285

(Change Management for $14,285 funds request)

Method #4

EAC = BAC / CPI

= $100,000 / 0.875

= $114,285

(Change Management for $14,285 funds request)

Earned Value Scenario

Washington State Department of Transportation

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Status as of 5/30/04:

Planned Expenditures:	$56,000	56%
Progress (EV):	$42,000	42%
Actual Expenditures:	$48,000	48%

SPI = 0.75 CPI = 0.875

Budgeted Cost at Completion:	$100,000
Estimated Cost at Completion:	$116,000*
Estimated Project Completion Date:	8/1/04

*(Change Management for the additional funds needed)

Respectfully submitted, John Doe, Project Manager

Budget Management

Graphing Earned Value exercise

- ***Gantt chart baseline (report)***
- ***EVM graph – earned value management***
- ***Task information***
- ***Cost distribution***
- ***EVM worksheets***

Budget Management

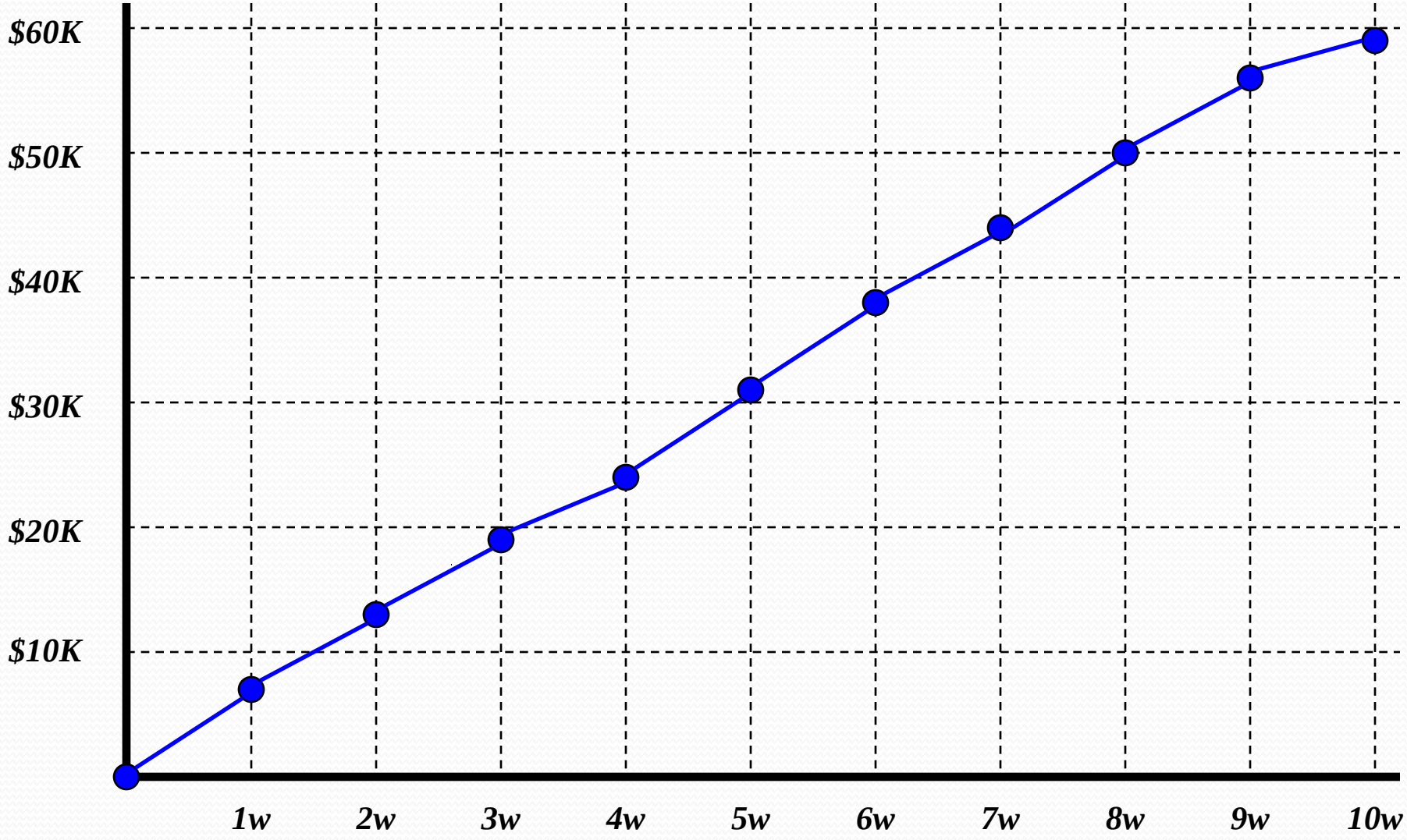
Graphing Earned Value exercise

- ***Planned Value (PV) is always shown in blue with circle nodes***
- ***Actual Cost (AC) is always shown in red with square nodes***
- ***Earned Value (EV) is always shown in green with triangle nodes***

Budget Management

Graphing Earned Value exercise

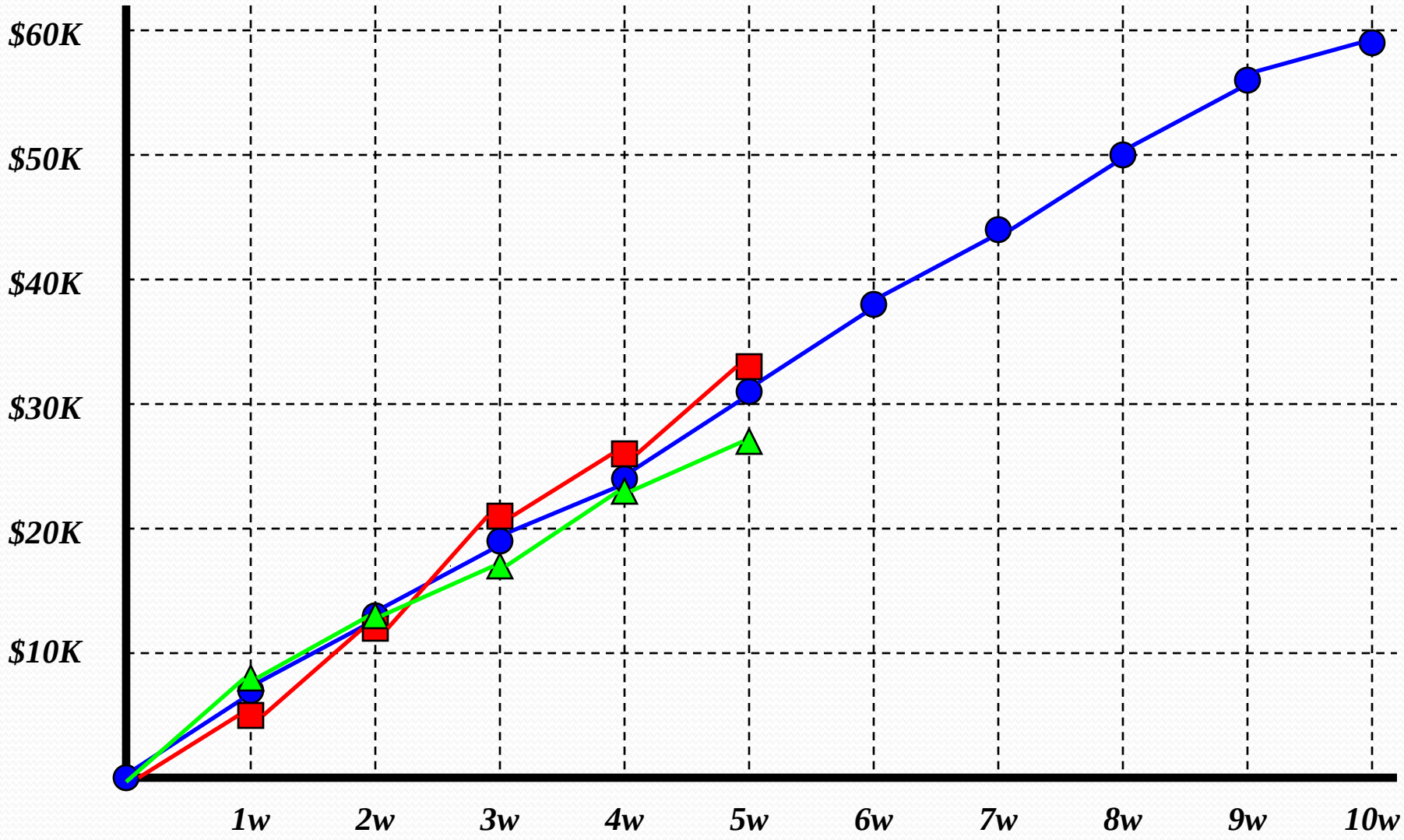
- ***Work together as a team to calculate the task cost (task budget) for each task***
- ***Record these values on the worksheet with the total (BAC) calculated***
- ***Warning: Wait to plot on the EVM graph as a class – we will use the Cost Distribution Report***

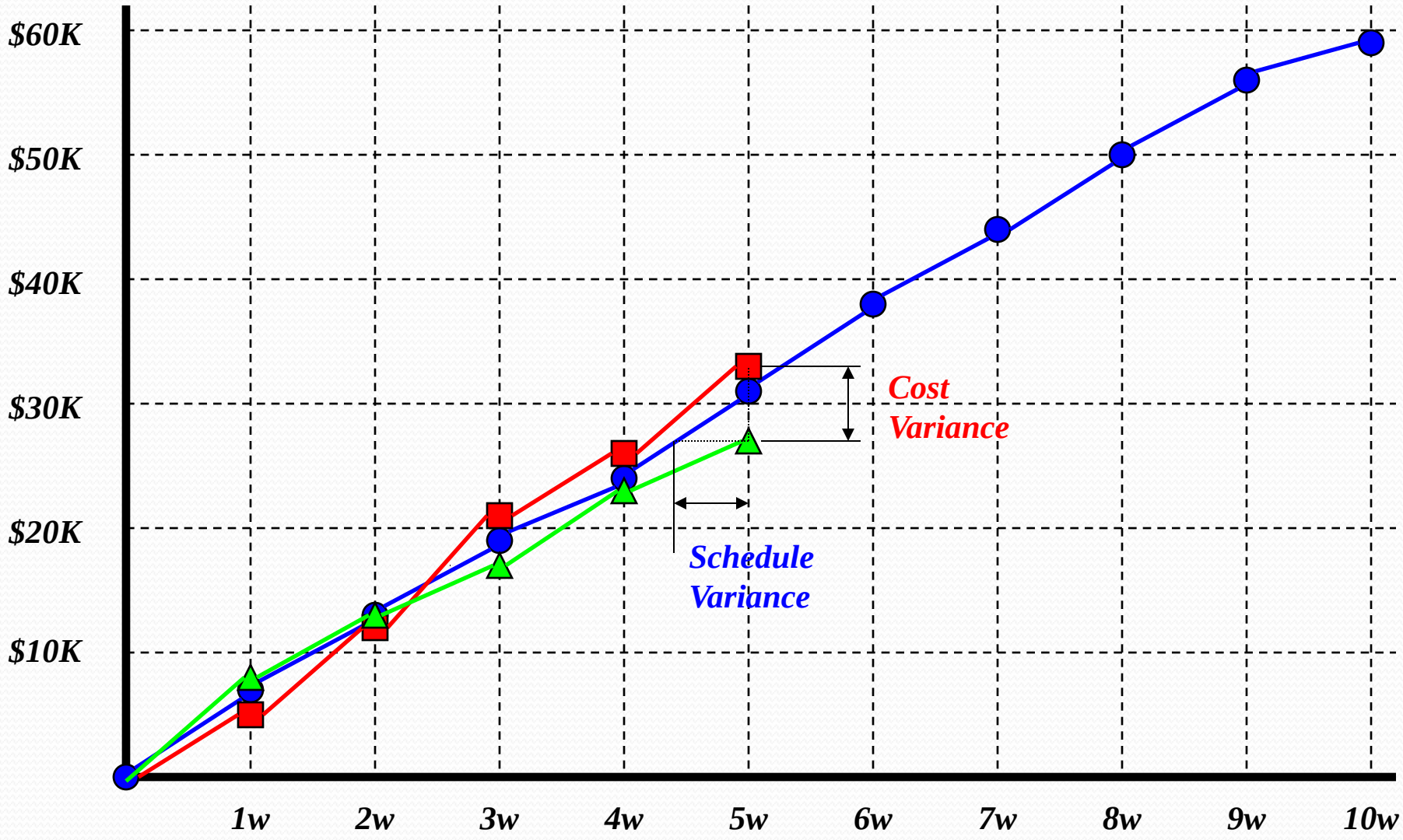

$60K
$50K
$40K
$30K
$20K
$10K
1w
2w
3w
4w
5w
6w
7w
8w
9w
10w

Budget Management

Graphing Earned Value – week 1

- ***Task A started on time – 30% complete***
- ***Task B started 2 days late – 30% complete***
- ***Task C started 1 day late – 25% complete***
- ***Tasks D, E, F, G, H, and J have not started***
- ***Project Management is on-going***
- ***Actual Costs reported for week 1 = $5000***

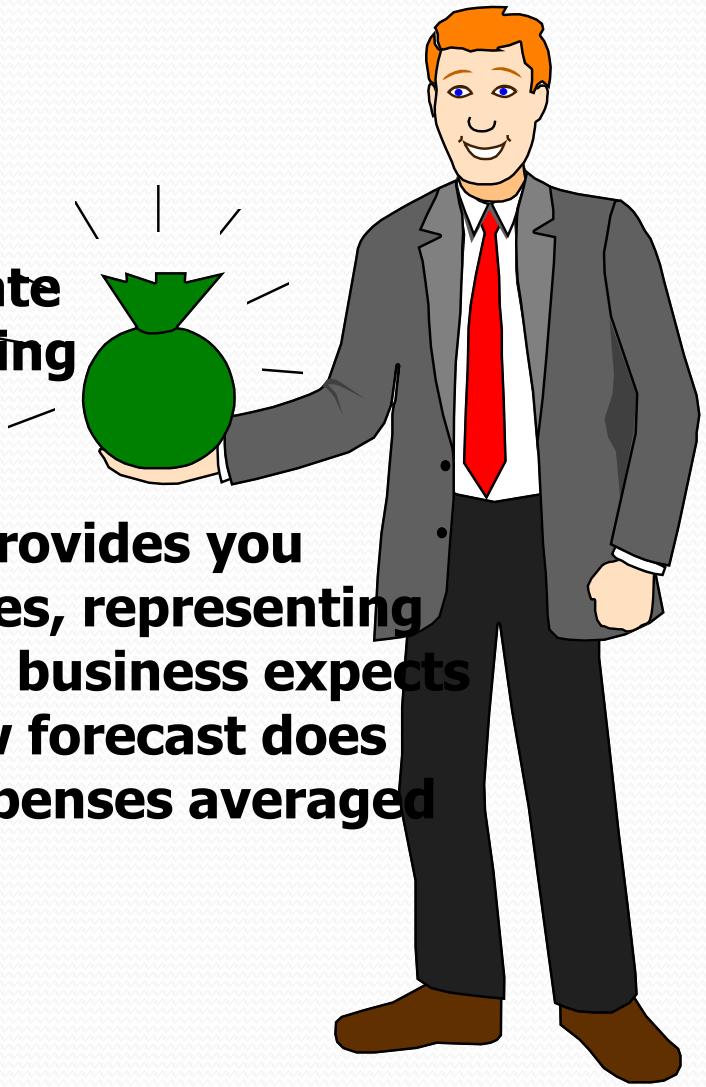

$60K
$50K
$40K
$30K
$20K
$10K
1w
2w
3w
4w
5w
6w
7w
8w
9w
10w


$60K
$50K
$40K
$30K
$20K
$10K
1w
2w
3w
4w
5w
6w
7w
8w
9w
10w
Cost
Variance
Schedule
Variance

Cashflow Forecast

Why Should You Prepare a Cash Flow Forecast?

A cash flow forecast shows the critical rate of cash coming in and cash going out during a certain month.



Preparing a monthly cash flow forecast provides you with the opportunity to show dollar figures, representing revenues and expenses, in the month the business expects to collect and spend the cash. A cash flow forecast does not show sales estimates or overhead expenses averaged across several months.

Why Should You Prepare a Cash Flow Forecast?

As the manager of your cash , you will have enough time to devise remedies for anticipated temporary cash shortfalls and ample opportunity to arrange short term investments for the business' temporary cash flow surpluses.

The completed cash flow forecast will clearly show a bank loans officer (or yourself) what additional working capital, if any, the business may need, and will offer proof that there will be sufficient cash on hand to make the interest payments to support a revolving line of credit (to cover the shortfalls). If the performance projections are realistic, they will also provide support for the feasibility of a term loan for an equipment purchase or for a master marketing campaign.

Why Should You Prepare a Cash Flow Forecast?

Computer spreadsheet programs such as Microsoft Excel, Lotus 123 or any of a variety of full-faceted business software (Bank-Plan) can be very useful for cash flow worksheet development.

Reliable cash flow projections can bring a sense of order and well-being to your business and more calm to your life. The most important tool owners/managers have available to control the financial aspects of their business is the cash flow worksheet .

Importance of Cash

When planning the short- or long-term funding requirements of a business, it is more important to forecast the likely cash requirements than to project profitability etc. Whilst profit, the difference between sales and costs within a specified period, is a vital indicator of the performance of a business, the generation of a profit does not necessarily guarantee its development, or even the survival. Bear in mind that more businesses fail for lack of cash than for want of profit.

Cash vs Profit

Sales and costs and, therefore, profits do not necessarily coincide with their associated cash inflows and outflows. While, a sale may have been secured and goods delivered, the related payment may be deferred as a result of giving credit to the customer. At the same time, payments must be made to suppliers, staff etc., cash must be invested in rebuilding depleted stocks, new equipment may have to be purchased etc.

The net result is that cash receipts often lag cash payments and, whilst profits may be reported, the business may experience a short-term cash shortfall. For this reason it is essential to forecast cashflows as well as project likely profits.

The following simplified example illustrates the timing differences between profits and cashflows:

Income Statement

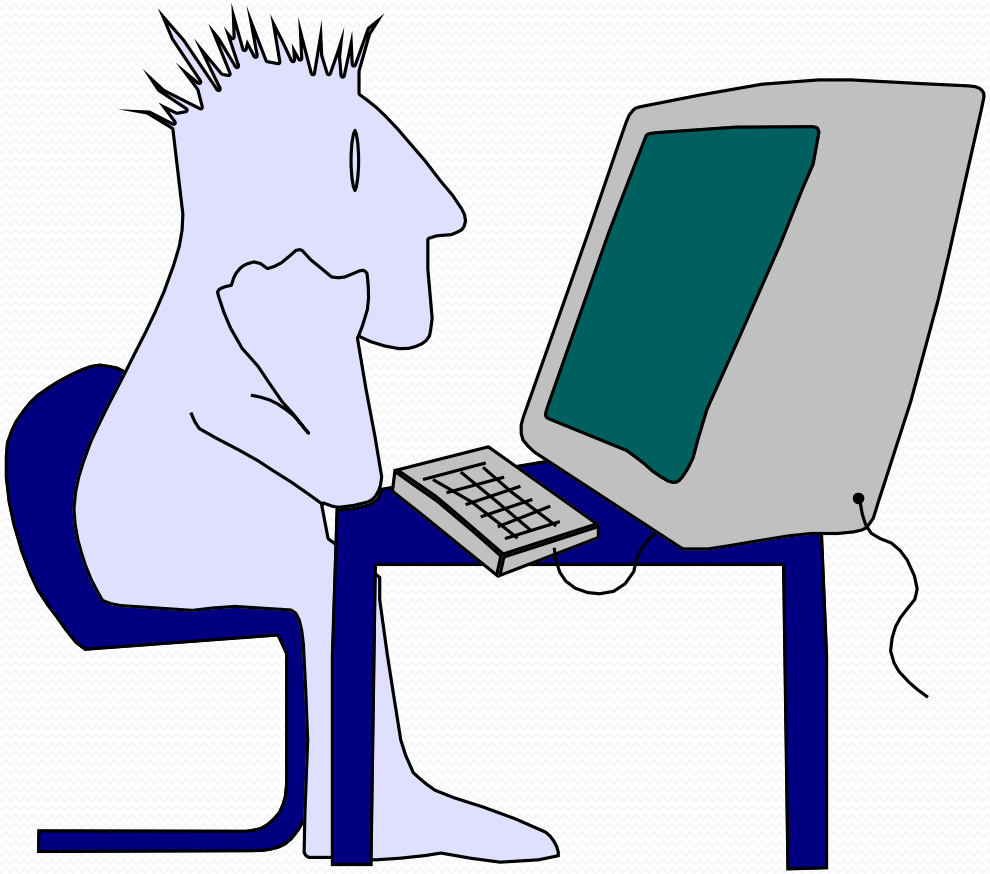
(£000)	Mth 1
Sales	75
Costs	65
Profit	10

Cashflows relating to Month 1:

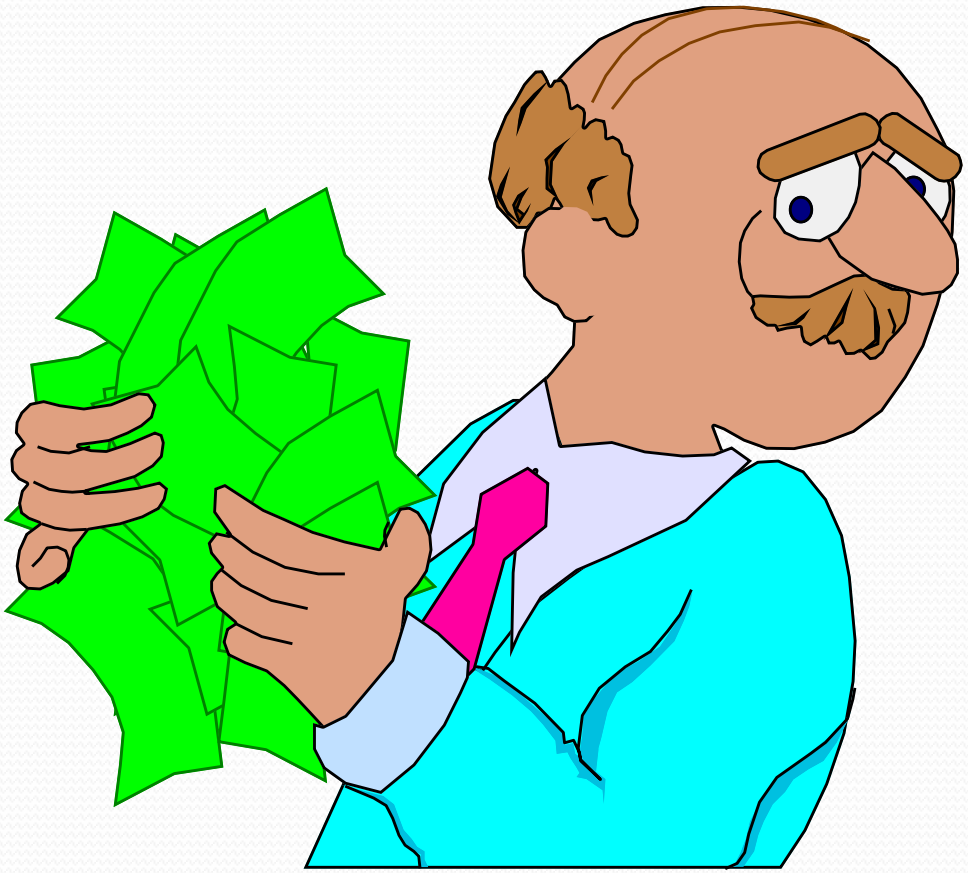
	Mth1	Mth2	Mth3	Mth4
Receipts from sales	20	35	20	75
Payments to suppliers etc.	40	20	5	65
Net Cashflow	(20)	15	15	10
Cumulative net cashflow	(20)	(5)	10	10

This shows that the cash associated with the reported profit for Month 1 will not fully materialise until Month 3 and that a serious cash short- fall will be experienced during Month 1 when receipts from sales will total only $20,000 as compared with cash payments to suppliers of $40,000.

How Do You Get Started?



Step One - Revenues



Step One: Consider Your Cashflow Revenues

Find a realistic basis for estimating your sales each month.

FOR NEW OPERATIONS, the basis can be the average monthly sales of a similar-sized competitor's operations who is operating in a similar market It is recommended that you make adjustments for this year's predicted trend for the industry. Be sure to reduce your figures by a start-up year factor of about 50% a month for the start-up months. There are also publications available in libraries and book stores that discuss methods of sales forecasting.

Step One: Consider Your Cashflow Revenues

FOR EXISTING OPERATIONS, sales revenues from the same month in the previous year make a good base for forecasting sales for that month in the succeeding year.

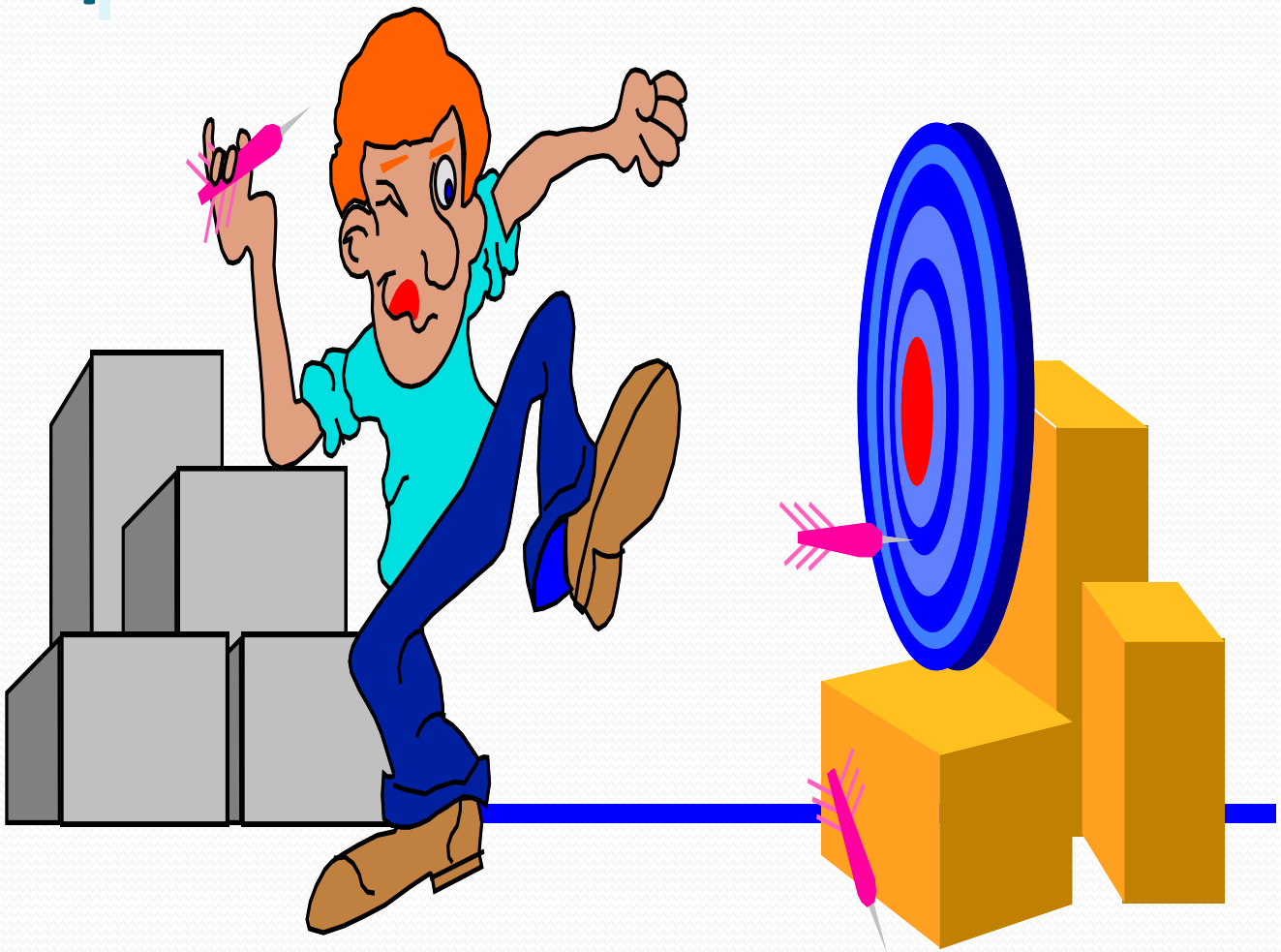
For example, if the trend readers in the economy and the industry predict a general growth of 4% for the next year, it will be entirely acceptable for you to show each month's projected sales at 4% higher than your actual sales the previous year. Include Notes to the Cashflow to explain any unusual variations from previous years' numbers.

Step One: Consider Your Cashflow Revenues

If you sell products on credit terms or with instalment payments, you must be careful to enter only the part of each sale that is collectible in cash in the specific month you are considering (realised accounts receivable). Any amount collected after 30 days will be termed Collections on Accounts Receivable and will be shown in the month in which it will be collected.

It is critical to the credibility of your plan that any sales made should only be entered ONCE THE CASH IS RECEIVED IN PAYMENT. This is the critical test principle of the cash flow and should be applied whenever you are in doubt as to what amount to enter and when.

Step Two - Disbursements



Step Two: Consider Your Cash Flow Disbursements

Project each of the various expense categories (that would normally be shown in your ledger) beginning with a summary for each month of the cash payments to trade suppliers (accounts payable). Again, follow the principle that there should not be any averaging or allocating of these inventory purchases (trade payables).

Each month must show only

THE CASH YOU EXPECT TO PAY OUT THAT MONTH

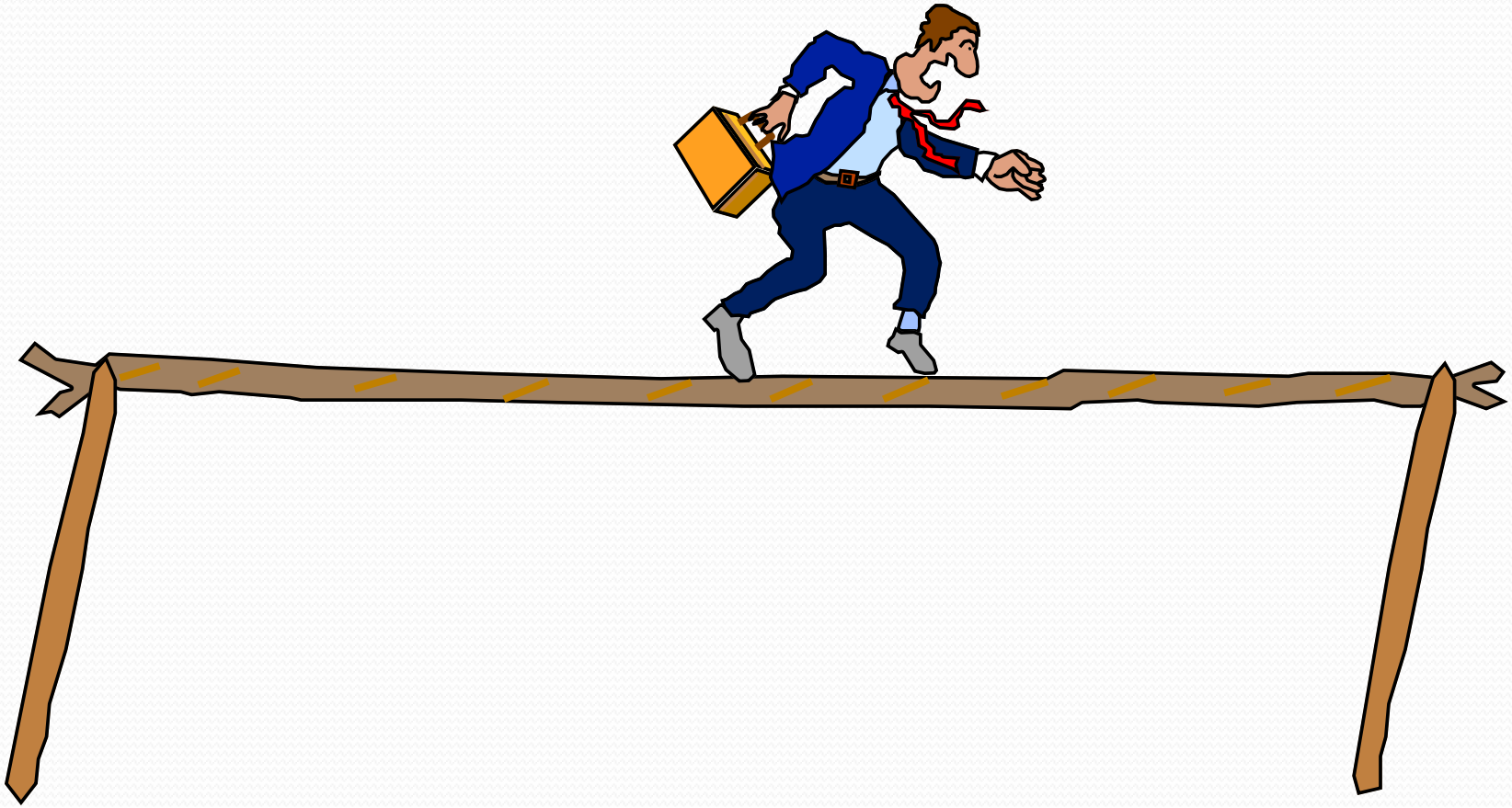
to your trade suppliers. For example, if you plan to pay your supplier invoices in 30 days, the cash payouts for January's purchases will be shown in February. If you can obtain trade credit for longer terms, then cash outlays will appear two or even three months after the stock purchase has been received and invoiced.

Step Two: Consider Your Cash Flow Disbursements

An example of a different type of expense is your insurance expenditure. Your commercial insurance premium may be £2400 annually. Normally, this would be treated as a £200 monthly expense. But the cash flow will not see it this way. The cash flow wants to know exactly how it will be paid. If it is to be paid in two instalments, £1200 in January and £1200 in July, then that is how it must be entered on the cash flow worksheet.

The exact same principle applies to all cashflow expense items. Once total cash collections, total cash payments on goods purchased, and any other expected expenses have been estimated for each individual month of operation, it is necessary to link the cashflow status of each month to the cash flow status and activity of the preceding and succeeding months (i.e. the reconciliation).

Step Three - Reconciliation



Step Three: Reconciliation Of The Cash Revenues To Cash Disbursements

The reconciliation section of the cashflow worksheet begins by showing the balance carried over from the previous months' operations. To this it will add the total of the current month's revenues and subtract the total of the current month's expenditures. This adjusted balance will be carried forward to the first line of the reconciliation portion of the next month to become the base to which the next month's cashflow activity will be added and/or subtracted.

Designing A Cash Flow Worksheet

A	N	O	P	Q	R	T
Financial year ending: Dec	1996 Aug	1996 Sep	1996 Oct	1996 Nov	1996 Dec	1996 Year
CASHFLOW PROJECTIONS	£000	£000	£000	£000	£000	£000
Cash Inflows						
Total trade debtor receipts (Note 1)	90.8	92.9	96.3	96.8	97.2	970.7
Total grants received (Note 2)	6.0	0.0	0.0	0.0	0.0	13.0
Proceeds of share issues	0.0	0.0	0.0	0.0	0.0	5.0
Increases in longterm debt	0.0	0.0	0.0	0.0	0.0	10.0
Increases in other loans	0.0	0.0	0.0	0.0	0.0	25.0
Proceeds from sale of fixed assets	0.0	0.0	0.0	0.0	10.0	15.0
VAT recovered from Revenue	0.0	0.0	0.0	0.0	11.0	12.0
Other income received	2.0	2.0	2.0	2.0	2.0	24.0
Interest received	0.0	0.0	0.0	0.0	0.0	0.1
Total cash inflow	98.8	94.9	98.3	98.8	120.2	1074.7
Cash Outflows						
Total material creditor payments (Note	37.3	37.4	38.8	38.1	39.1	361.6
Opening trade creditor payments	0.0	0.0	0.0	0.0	0.0	66.5
Total production cost payments (Note	21.7	21.7	21.7	23.2	23.7	208.7
Total overhead payments (Note 5)	22.4	22.5	22.6	22.6	22.6	247.1
Corporation tax payments	0.0	0.0	0.0	0.0	0.0	5.0
Dividends paid	0.0	0.0	0.0	0.0	0.0	10.0
Finance lease capital payments	3.3	2.0	0.4	1.3	0.0	23.1
Finance lease charges paid	2.0	1.0	0.5	1.0	0.0	13.5
Total capital expenditure payments (No	0.0	0.0	0.0	70.0	65.0	135.0
Opening capex creditor payments	0.0	0.0	0.0	0.0	0.0	9.0
Opening PAYE etc	0.0	0.0	0.0	0.0	0.0	0.4
Operating lease & HP payments	1.1	1.1	1.1	1.1	1.1	13.2
Longterm debt repayments	0.0	0.0	5.0	0.0	0.0	20.0
Other loan repayments	0.0	0.0	5.0	0.0	0.0	5.0
VAT paid on o/h expense, capex etc. inp	5.2	15.0	17.5	5.1	3.1	77.3
VAT paid to Revenue	0.0	10.0	0.0	0.0	0.0	30.4
Changes in prepayments	0.0	0.0	0.0	0.0	0.0	-2.0
Changes in accruals	0.0	0.0	0.0	0.0	0.0	4.0
Interest paid	1.0	1.1	1.2	1.6	2.2	13.5
Total cash outflow	94.1	111.9	113.9	164.2	156.8	1241.3
Net cashflow	4.8	-17.0	-15.6	-65.4	-36.6	-166.5

Designing A Cash Flow Worksheet

There are a variety of ways a cash flow forecast can be structured. To gain the optimum benefit, it is recommended that it be structured to show only revenues from operations, and the proceeds from sales of company assets, if appropriate, in the revenues portion of the worksheet.

Designing A Cash Flow Worksheet

On occasion a prepared format will show a slot for proceeds of a term loan in this section; this may, however, take away from the value of the cash flow as an indicator of the business' operating performance and of the cash flow's ability to clearly show the real amount of working capital needs.

If a fixed term loan amount is treated as revenue to the business, the balances carried forward each month cannot accurately reflect how the business is earning money (unless the reader takes the additional step of subtracting the loan proceeds from the equation).

GO

BANK-PLAN: For information on upgrading, select Upgrade in Main Menu READY

FILE: e:\bankplan\master.ass | TITLE: Press I & T to enter title here

Year ending: Dec	1996 Jan	1996 Feb	1996 Mar	1996 Apr	1996 May
CASHFLOW PROJECTIONS	£000	£000	£000	£000	£000
Cash Inflows					
Opening trade debtors (incl.VAT)	30.0	20.0	5.0	..	..
Receipts from sales (incl. VAT)	9.1	27.4	49.3	60.0	66.0
Total receipts from sales & trade debtors	39.1	47.4	54.3	60.0	66.0
Grants/subsidies received	3.0	14.0	..	6.0	..
Proceeds of share issues	..	5.0	..	..	..
Increases in longterm debt	10.0	..	10.0	..	..
Proceeds from disposals of fixed assets	..	..	..	..	..
VAT recovered from Revenue	..	5.0	..	..	..
Miscellaneous cash inflows	..	..	..	..	..
Total cash inflow	52.1	71.4	64.3	66.0	66.0
Cash outflows					

F1=Help | F2=Ass | F3=Cashflow | F4=Graphs | F5=Calc | F10=MainMenu | CTRL=More

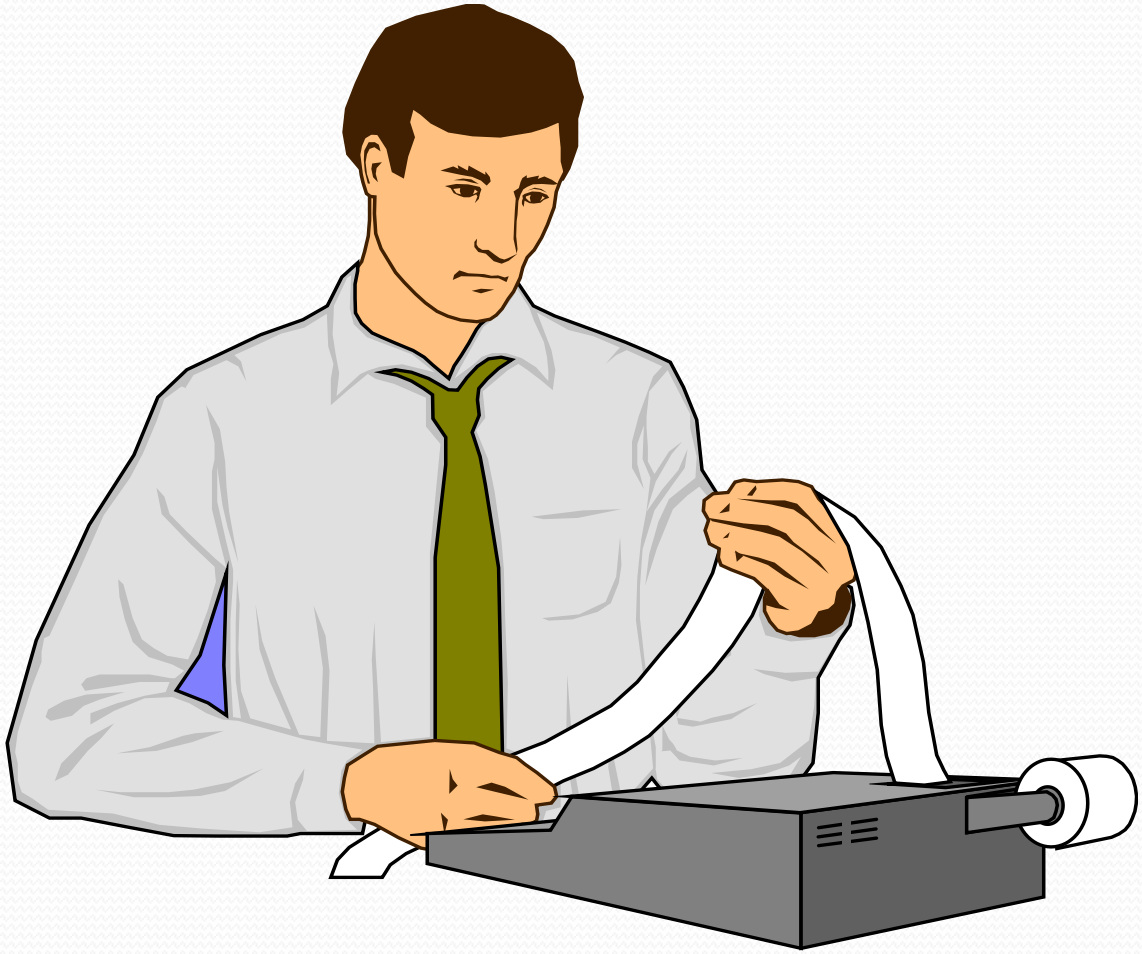
Designing A Cash Flow Worksheet

Your general format should allow a double width column along the left side of the page for the account headings, then two side by side vertical columns for each month of the year, beginning from the month you plan to open (e.g. the first dual column might be labelled April Planned and April Actual etc.).

Designing A Cash Flow Worksheet

From there, the cash flow worksheet breaks into three distinctive sections. The first section (at the top left portion of the worksheet, starting below and to the left of the month names) is headed CASH REVENUES (or Cash In). The second section, just below it, is headed CASH DISBURSEMENTS (or Cash Out). The final section, below that,is headed RECONCILIATION OF CASH FLOW.

Calculating Cashflows



Calculating Cashflows

Normally, the main sources of cash inflows to a business are receipts from sales, increases in bank loans, proceeds of share issues and

asset disposals, and other income such as interest earned. Cash outflows include payments to suppliers and staff, capital and interest repayments for loans, dividends, taxation and capital expenditure.

Calculating Cashflows

Net cashflow is the difference between the inflows and outflows within a given period. A projected cumulative positive net cashflow over several periods highlights the capacity of a business to generate surplus cash and, conversely, a cumulative negative cashflow indicates the amount of additional cash required to sustain the business.

Calculating Cashflows

Cashflow planning entails forecasting and tabulating all significant cash inflows relating to sales, new loans, interest received etc. and then analysing in detail the timing of expected payments relating to suppliers, wages, other expenses, capital expenditure, loan repayments, dividends, tax, interest payments etc. The difference between the cash in- and out-flows within a given period indicates the net cashflow.

When this net cashflow is added to or subtracted from opening bank balances, any likely short-term bank funding requirements can be ascertained.

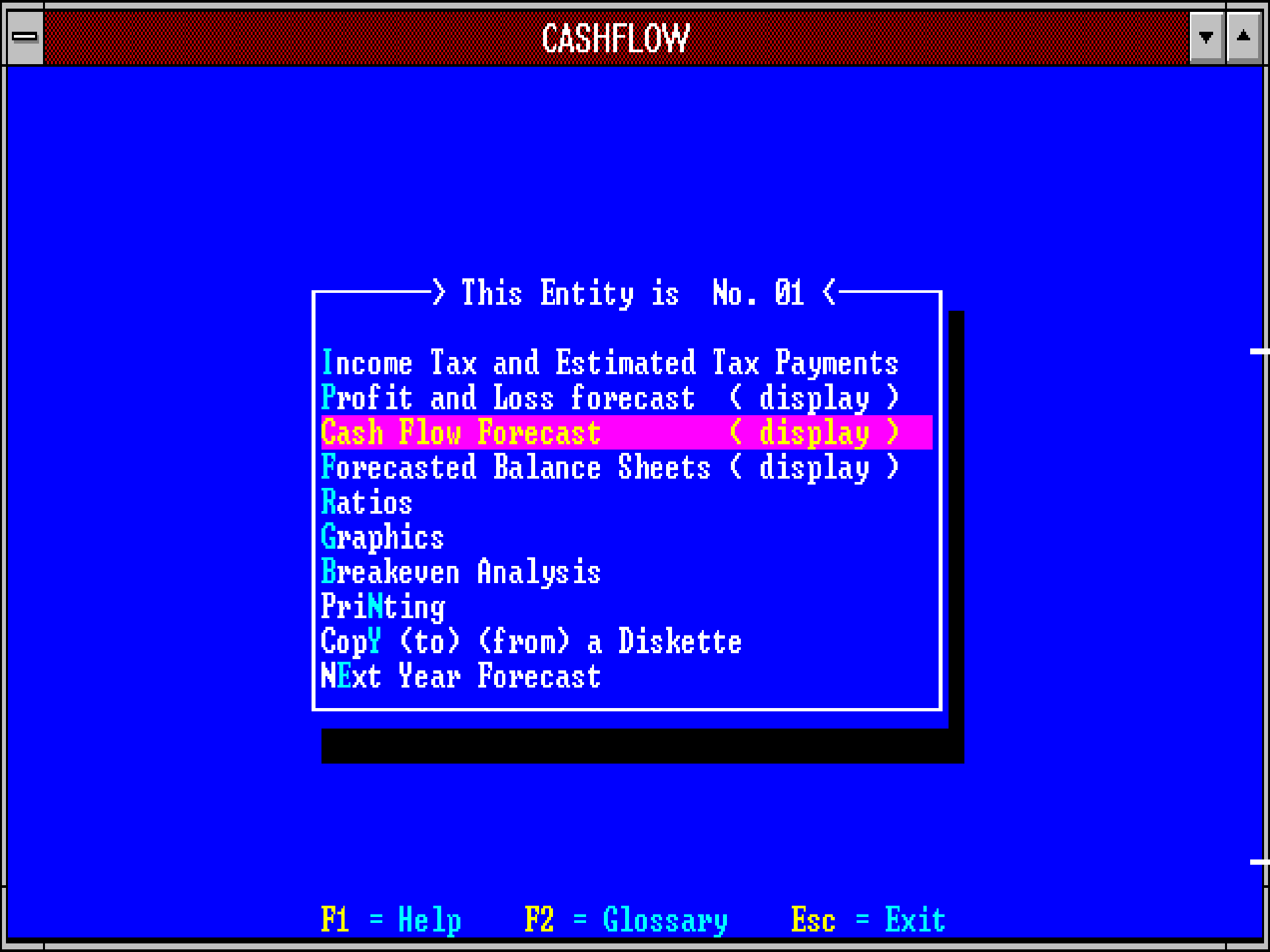
Using a Computer

With the aid of a computer and suitable software, a mathematical model can be used to prepare cashflow projections and project short-term banking requirements for a business. The use of a computer-based model reduces the tedium of carrying out numerous repetitive calculations and simplifies the alteration of assumptions and the presentation of results.

A computer-based model can be constructed using a spreadsheet or acquired as a stand-alone package. If constructing a spreadsheet model, be aware that it is not as easy as it might seem to build a friendly, robust and error-free planner.

UP YOUR CASH FLOW (Shareware Version) (c) 1993 by Granville Publications

A Comprehensive Cashflow forecasting and planning application.


CASHFLOW
This Entity is No. 01
Income Tax and Estimated Tax Payments
Profit and Loss forecast (display)
Cash Flow Forecast (display)
Forecasted Balance Sheets (display)
Ratios
Graphics
Breakeven Analysis
PriNting
CopY (to) (from) a Diskette
NExt Year Forecast
F1 = Help
F2 = Glossary
Esc = Exit

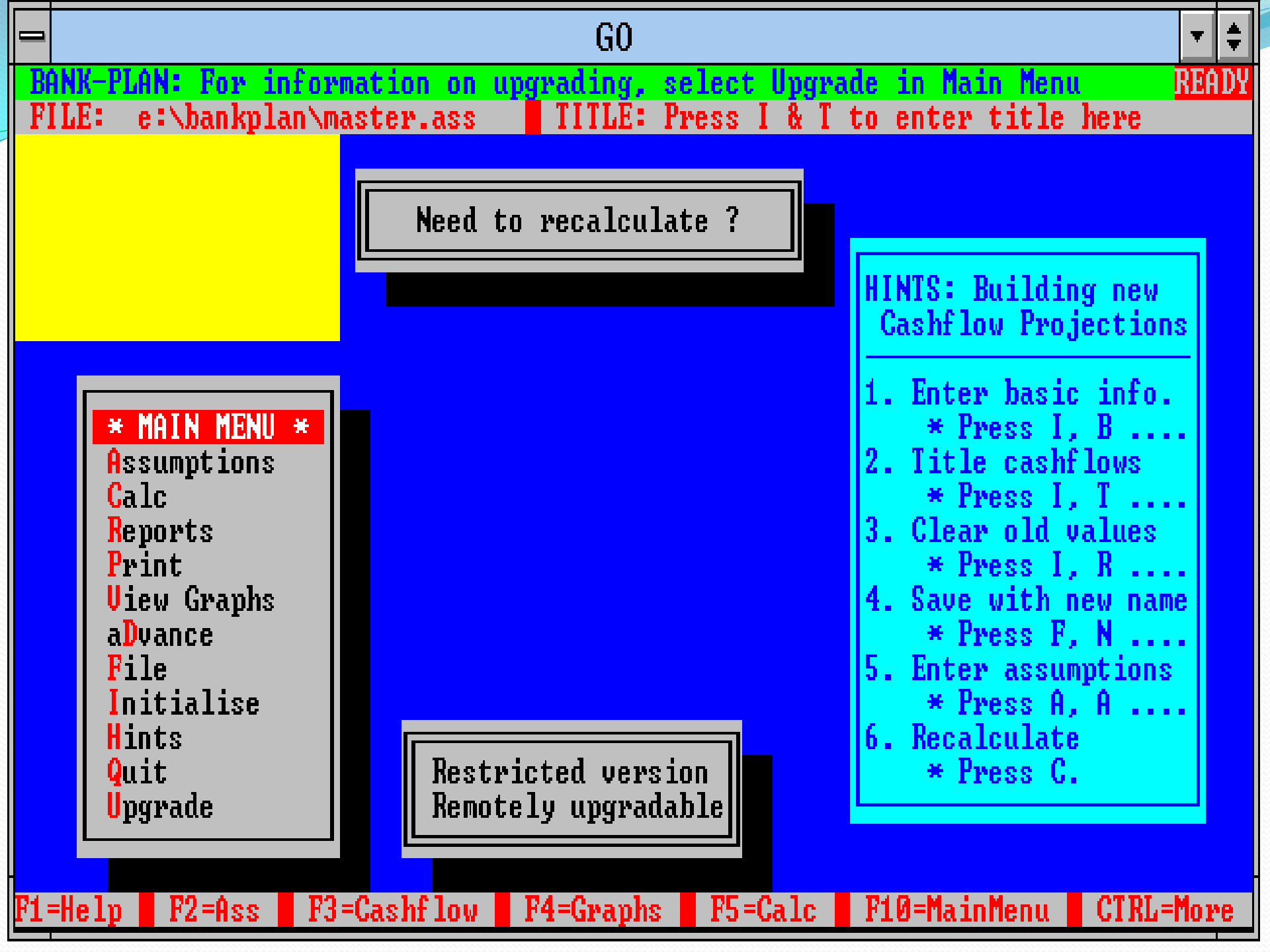
Bank-Plan

BANK-PLAN is a powerful and easy-to use software package specifically developed by Invest-Tech Limited to help small and medium-sized businesses to forecast their short-term funding requirements on the basis of cashflow projections, prepared on a monthly basis, for up to a year ahead.


GO
BANK-PLAN: For information on upgrading, select Upgrade in Main Menu
READY
FILE: e:\bankplan\master.ass
TITLE: Press I & T to enter title here
* MAIN MENU *
Assumptions
Calc
Reports
Print
View Graphs
aDvance
File
Initialise
Hints
Quit
Upgrade
Quit this Model
rsion
adable
HINTS: Building new Cashflow Projections
1. Enter basic info.
* Press I, B ....
2. Title cashflows
* Press I, T ....
3. Clear old values
* Press I, R ....
4. Save with new name
* Press F, N ....
5. Enter assumptions
* Press A, A ....
6. Recalculate
* Press C.
F1=Help
F2=Ass
F3=Cashflow
F4=Graphs
F5=Calc
F10=MainMenu
CTRL=More

Using a Computer

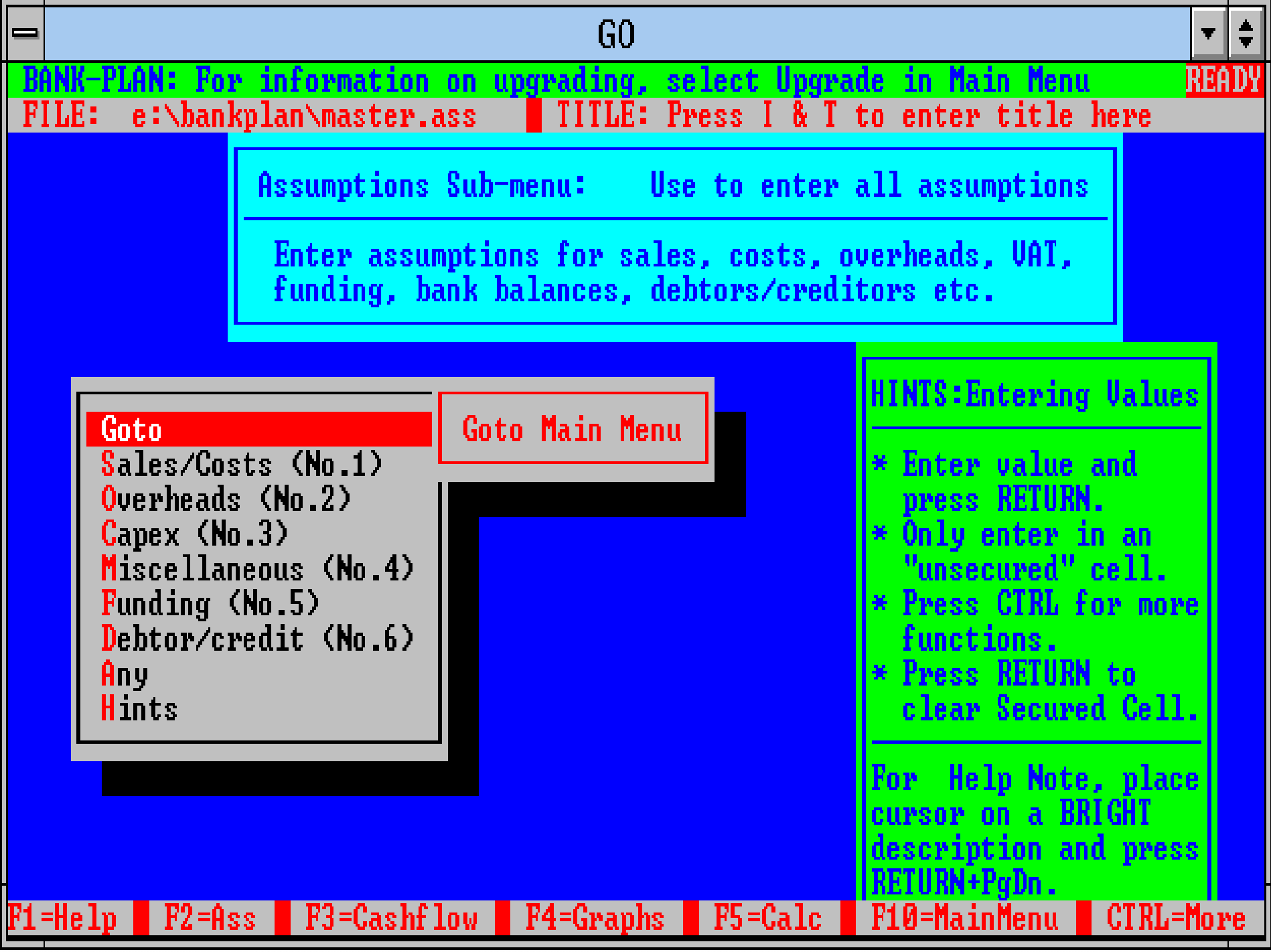
Typically, a computer model for short-term bank planning uses assumptions on sales, costs, credit, funding etc. to produce monthly cashflow projections for up to a year ahead. The initial assumptions can be readily altered to evaluate alternative scenarios. For example, a model could be used to explore the extent to which future sales could be increased whilst holding bank borrowings within predetermined limits; to assess the effects on cashflow of varying sales, costs or credit terms; or to determine the likely short-term funding requirements for a business.


GO
BANK-PLAN: For information on upgrading, select Upgrade in Main Menu
READY
FILE: e:\bankplan\master.ass
TITLE: Press I & T to enter title here
Need to recalculate ?
HINTS: Building new Cashflow Projections
1. Enter basic info.
* Press I, B ....
2. Title cashflows
* Press I, T ....
3. Clear old values
* Press I, R ....
4. Save with new name
* Press F, N ....
5. Enter assumptions
* Press A, A ....
6. Recalculate
* Press C.
* MAIN MENU *
Assumptions
Calc
Reports
Print
View Graphs
aDvance
File
Initialise
Hints
Quit
Upgrade
Restricted version
Remotely upgradable
F1=Help
F2=Ass
F3=Cashflow
F4=Graphs
F5=Calc
F10=MainMenu
CTRL=More

Using a Computer

Once assumptions on sales, expense payments etc. have been established, a model can be used to produce the cashflow projections which, in turn, indicate the likely future cash balances or banking requirements.

However, the quality of these projections will be completely determined by the standard and reliability of the underlying assumptions. For example, if forecasts for sales, working capital or costs are unrealistic or inadequately researched, then the value of the model's output is greatly diminished. An impressive set of projections is of little benefit if it is unsupported by experience or research or based on mere speculation. In fact, they could be very damaging, or even destroy the business.


GO
BANK-PLAN: For information on upgrading, select Upgrade in Main Menu
READY
FILE: e:\bankplan\master.ass
TITLE: Press I & T to enter title here
Assumptions Sub-menu: Use to enter all assumptions
Enter assumptions for sales, costs, overheads, VAT, funding, bank balances, debtors/creditors etc.
Goto
Sales/Costs (No.1)
Overheads (No.2)
Capex (No.3)
Miscellaneous (No.4)
Funding (No.5)
Debtor/credit (No.6)
Any
Hints
Goto Main Menu
HINTS:Entering Values
* Enter value and press RETURN.
* Only enter in an "unsecured" cell.
* Press CTRL for more functions.
* Press RETURN to clear Secured Cell.
For Help Note, place cursor on a BRIGHT description and press RETURN+PgDn.
F1=Help
F2=Ass
F3=Cashflow
F4=Graphs
F5=Calc
F10=MainMenu
CTRL=More

Using a Computer

Invest-Tech's Bank-Plan is purpose built for producing rolling 12-month cashflow projections for a small/mid-size business.

A cashflow model can be used to compile forecasts, assess possible funding requirements and explore the likely financial consequences of alternative strategies.

Used effectively, a model can help prevent major planning errors, anticipate problems, identify opportunities to improve cashflow or provide a basis for negotiating short-term funding from a bank.

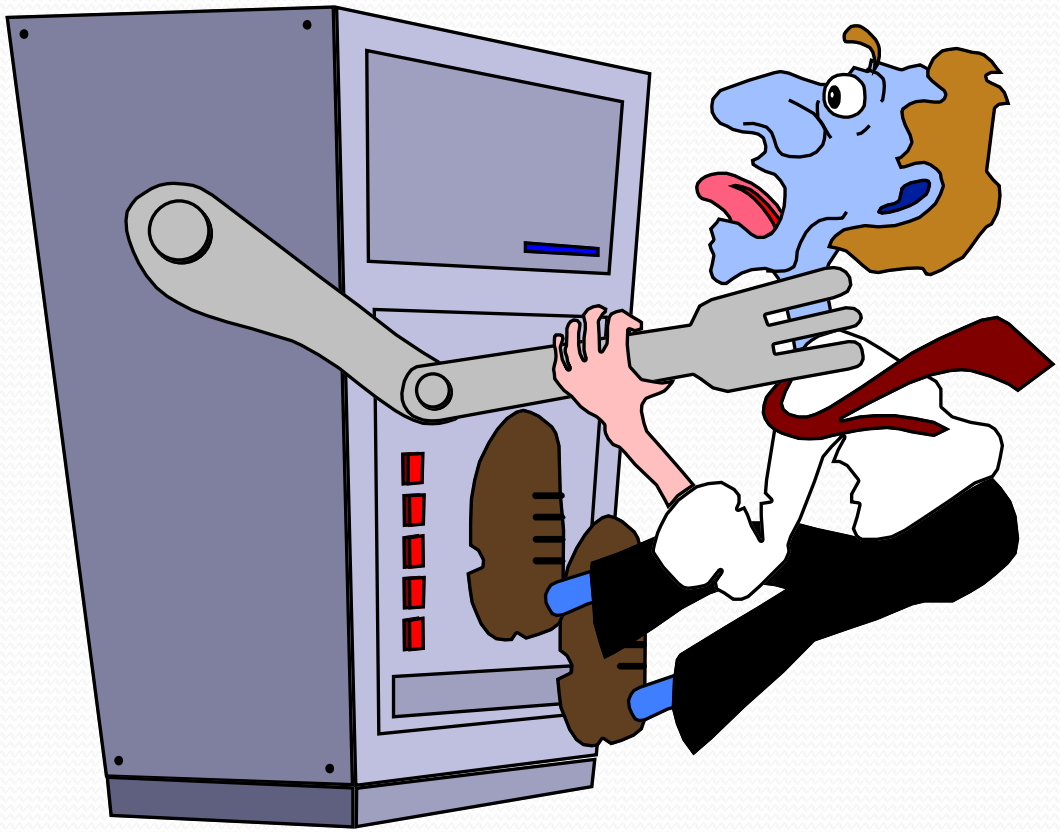
Using a Computer

Generally, when seeking external funding, the time horizon covered by a set of projections should be equal to or greater than the period for which the funding is needed. The greater the amount of funding required and the longer the period of exposure for the provider of these funds, the more comprehensive must be the supporting projections and plan.

Using a Computer

Whilst a package such as Bank-Plan can be used to support applications for bank facilities of up to a year's duration, it is unlikely to be suitable for raising longer term finance - multi-year loans or external equity - as most financiers would require projected profit & loss accounts and balance sheets in addition to cashflow forecasts. Invest-Tech's other planning packages are suitable for preparing comprehensive and fully integrated medium-term financial projections.

Planning Pitfalls



Planning Pitfalls

When preparing cashflow projections, be aware of the dangers of:

- Overstating sales forecasts
- Underestimating costs and delays likely to be encountered
- Ignoring historic trends or performances by debtors etc.
- Making unduly-optimistic assumptions about the availability of bank loans, credit, grants, equity etc.
- Seeking spurious accuracy whilst failing to recognise matters of strategic importance

Planning Pitfalls

These problems can arise as the result of a lack of foresight or knowledge, or because of excessive optimism. They can lead to underestimation of the cash and other resources required to sustain or develop a business with potentially disastrous consequences.

When forecasting bank requirements and preparing cashflow projections, realistic views should always be taken about future prospects. There

is often merit in compiling "worst" case projections to complement "most likely" or "best" forecasts and to accept that the "worst" case might occur and to plan accordingly.

Making the Best Use Of Your Cashflow



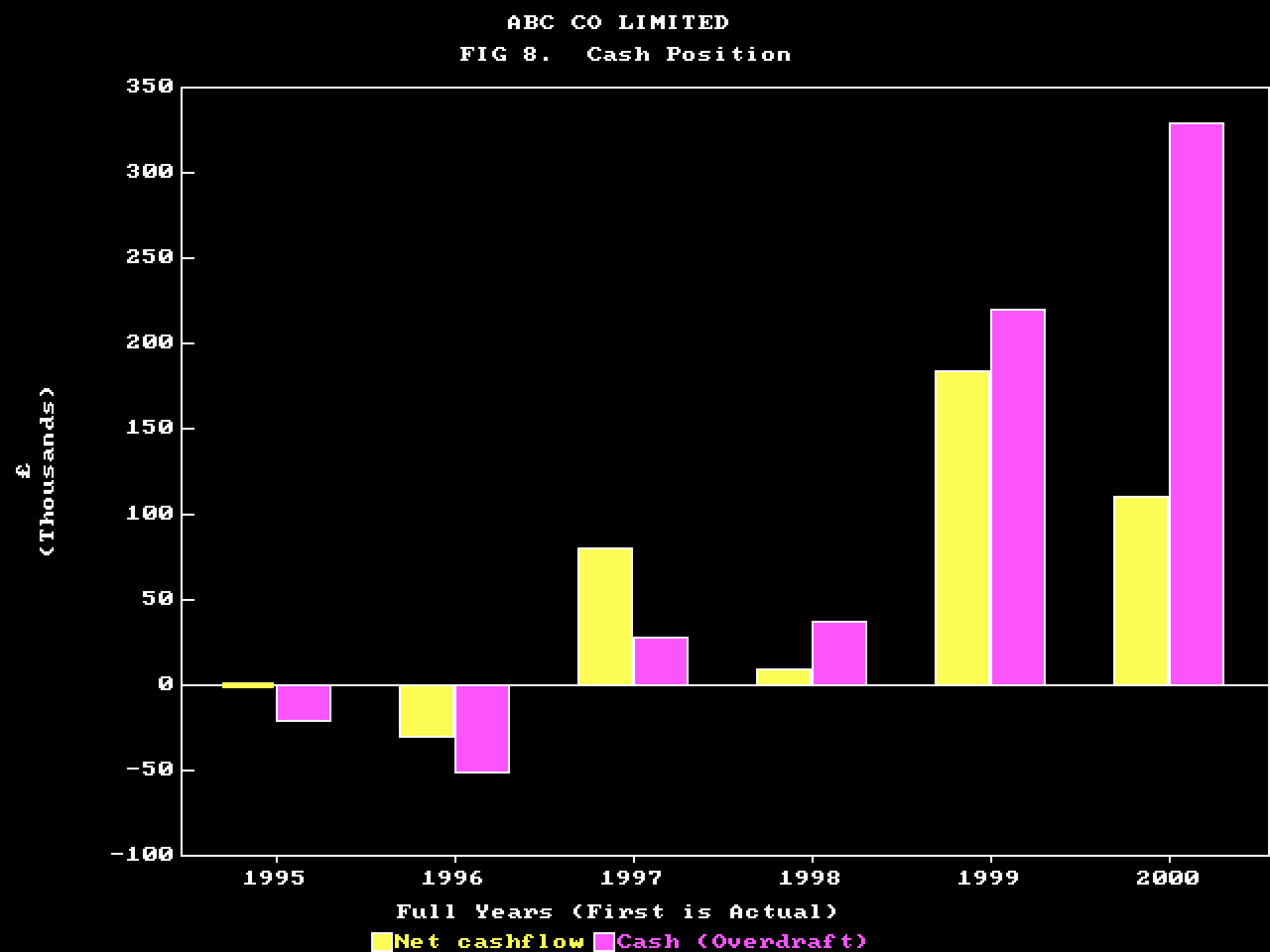
Making the Best Use Of Your Cash Flow

Cash flow plans are living entities and must constantly be modified as you learn new things about your business and your paying customers. Since you will use this cash flow forecast to regularly compare each month's projected figures with each month's actual performance figures, it will be useful to have a second column for the actual performance figures right alongside each of the planned columns in the cash flow worksheet. As the true strengths and weaknesses of your business unfold before your eyes, actual patterns of cash movement emerge. Look for significant discrepancies between the planned" and actual figures.

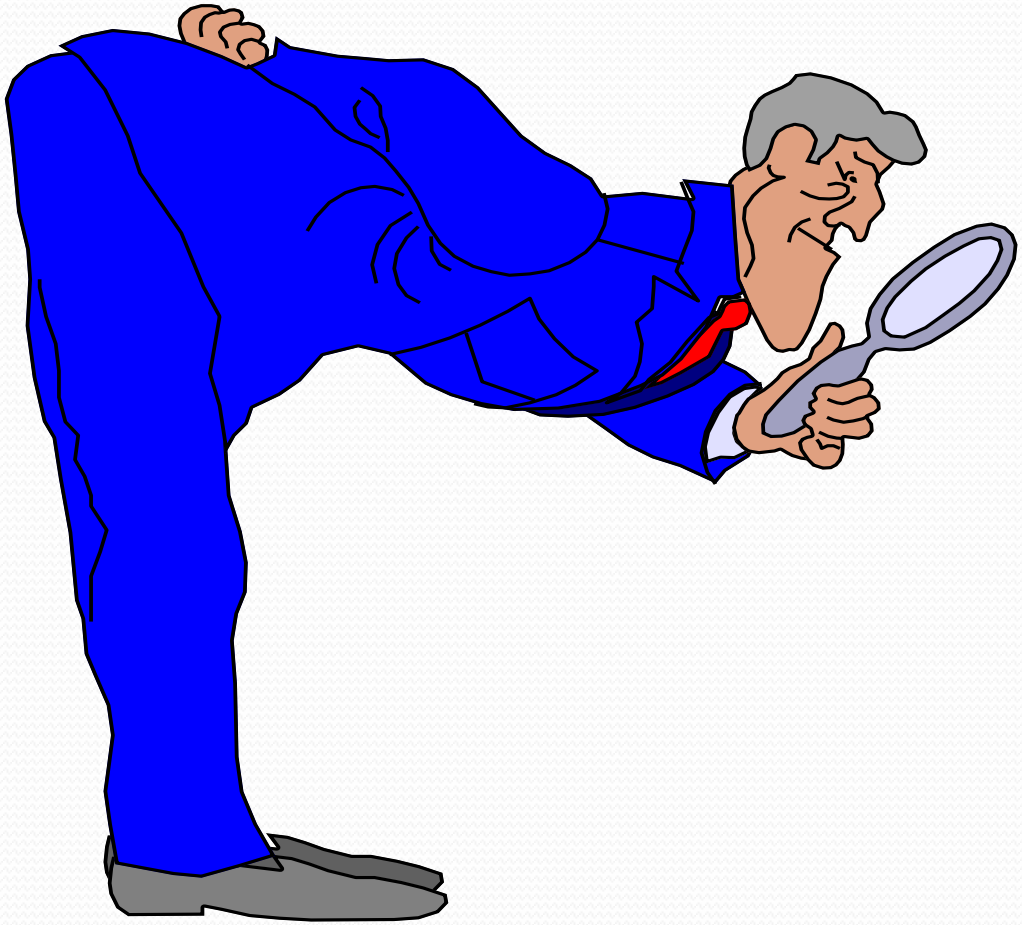
For example

If the business' actual figures are failing to meet your cash revenue projections for three months running, this is an unmistakable signal that it is time to revise the year's projections. It may be necessary to delay the stock replenishment plan, or apply to the bank to increase the upper limit of your revolving line of credit. Approaching the bank to increase an operating loan should be done well in advance of the date when the additional funds are required.

DO NOT LEAVE CASH INFLOW TO CHANCE.


ABC CO LIMITED
FIG 8. Cash Position
£ (Thousands)
350
300
250
200
150
100
50
0
-50
-100
1995
1996
1997
1998
1999
2000
Full Years (First is Actual)
Net cashflow
Cash (Overdraft)

Critically Examine Results



Critically Examine Results

Once the cashflow projections have been prepared, they should be critically examined and used as a management tool to control and improve the business's expected cash position.

Critically Examine Results

Issues which might be examined include the following:

- Increasing sales (particularly those involving cash payments) and/ or reducing direct and indirect costs;
- Reducing the amount of credit given to customers and/or increasing the credit taken from suppliers;
- Reducing stock levels and improving control over work-in-progress;
- Utilising factoring or discounting facilities to accelerate receipts from sales;
- Deferring major capital expenditure or using alternative financing methods, such as leasing, to gain access to the use, but not ownership, of the assets;
- Re-negotiating bank facilities to reduce charges and/or extend repayment periods;
- Selling off surplus assets or entering into sale and lease-back arrangements;
- Deferring dividends or raising additional equity.
- Once a set of cashflow projections have been prepared, a computer model, like Bank-Plan, can be used to explore the impact of alternative measures, such as those described above, on the net cashflow and on bank requirements.

Using Activity based Budgeting

- Developing the ABB application model
- Budgeting for Processes rather than Departments
- Defining Key Cost Drivers
- Defining Key Activities
- Development of ABB Cost Standards
- Developing the Activity-Based Budget

Developing the Activity-Based Budget

Using Activity based Budgeting

Activity-Based Costing and Management

Learning objectives

- Q1: What is activity-based costing (ABC)?
- Q2: What are activities and how are they identified?
- Q3: What process is used to assign costs in an ABC system?
- Q4: What is activity-based management?
- Q5: What are GPK and RCA?
- Q6: How does information from ABC, GPK, and RCA affect managers' incentives and decisions?

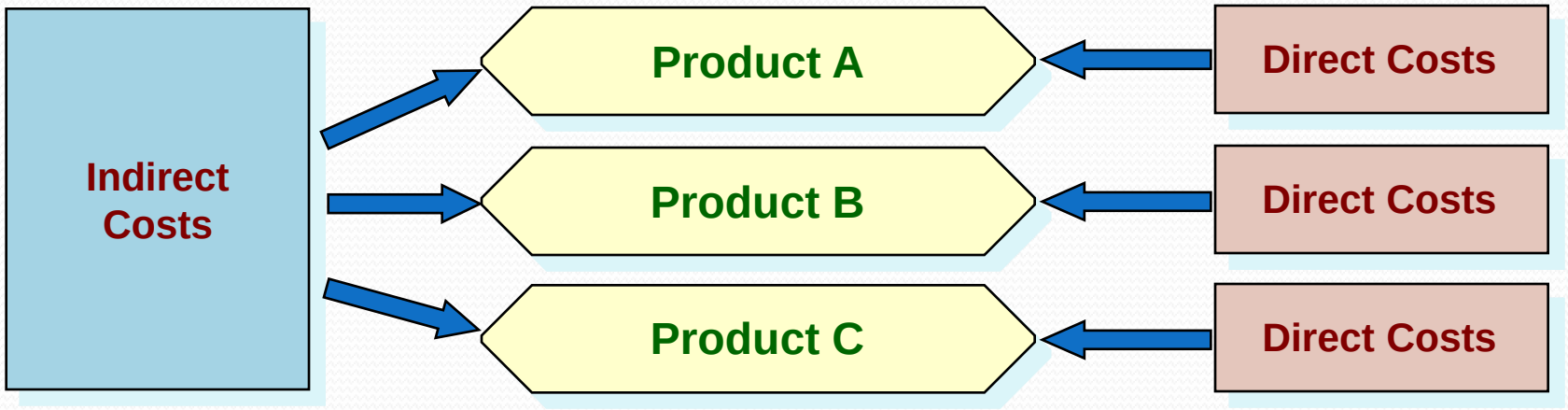
Q1: Activity-Based Costing (ABC)

- ABC is a method of cost system refinement.

- Indirect costs are divided into “sub-pools” of costs of activities.
- Activity costs are then allocated to the final cost objects using a cost allocation base (more commonly called cost drivers in ABC).
- Activities are measurable, making it more likely that cost drivers can be found so that a final cost object will absorb indirect costs in proportion to its use of the activity.

Q1: Traditional Costing vs. ABC

Traditional costing systems:

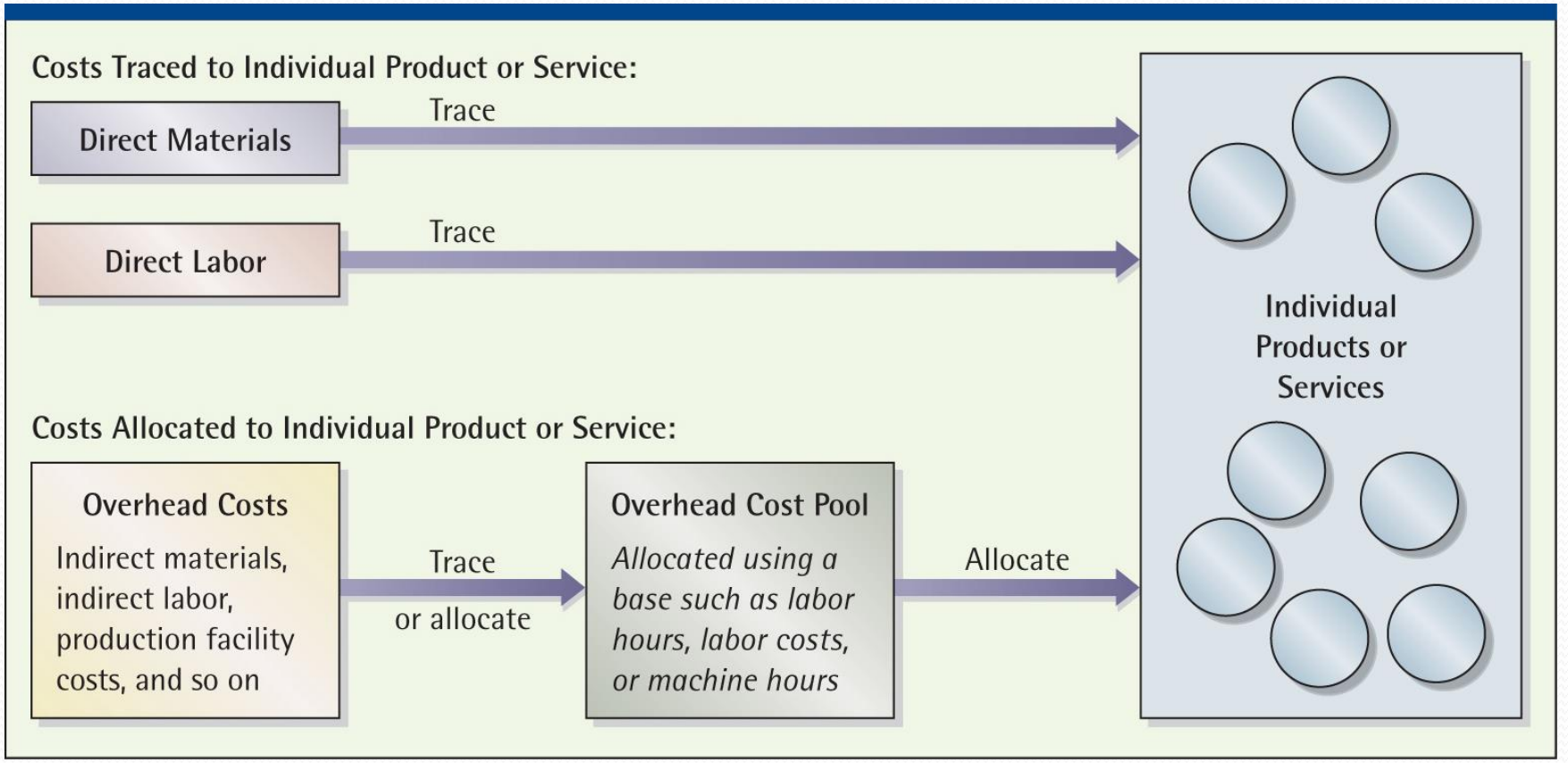


Indirect costs are grouped into one (or a small number) of cost pools; a cost allocation base assigns costs to the individual products

The individual products are the final cost objects.

Direct costs are traced to the individual products.

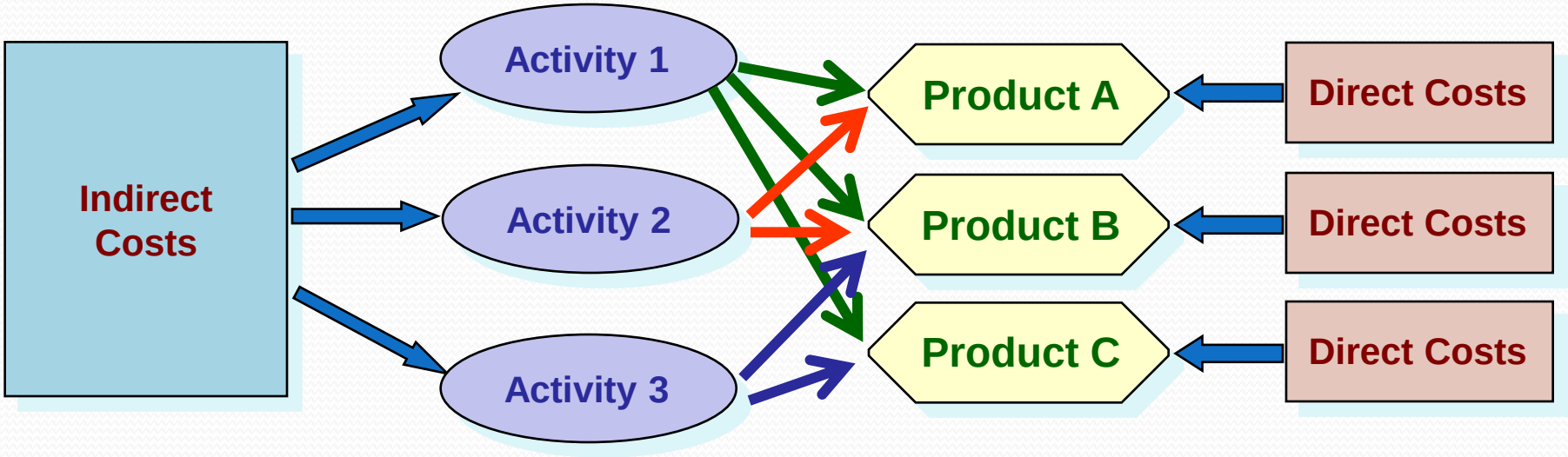
Q1: Traditional Costing Systems



Defining Key Cost Drivers

Q1: Traditional Costing vs. ABC

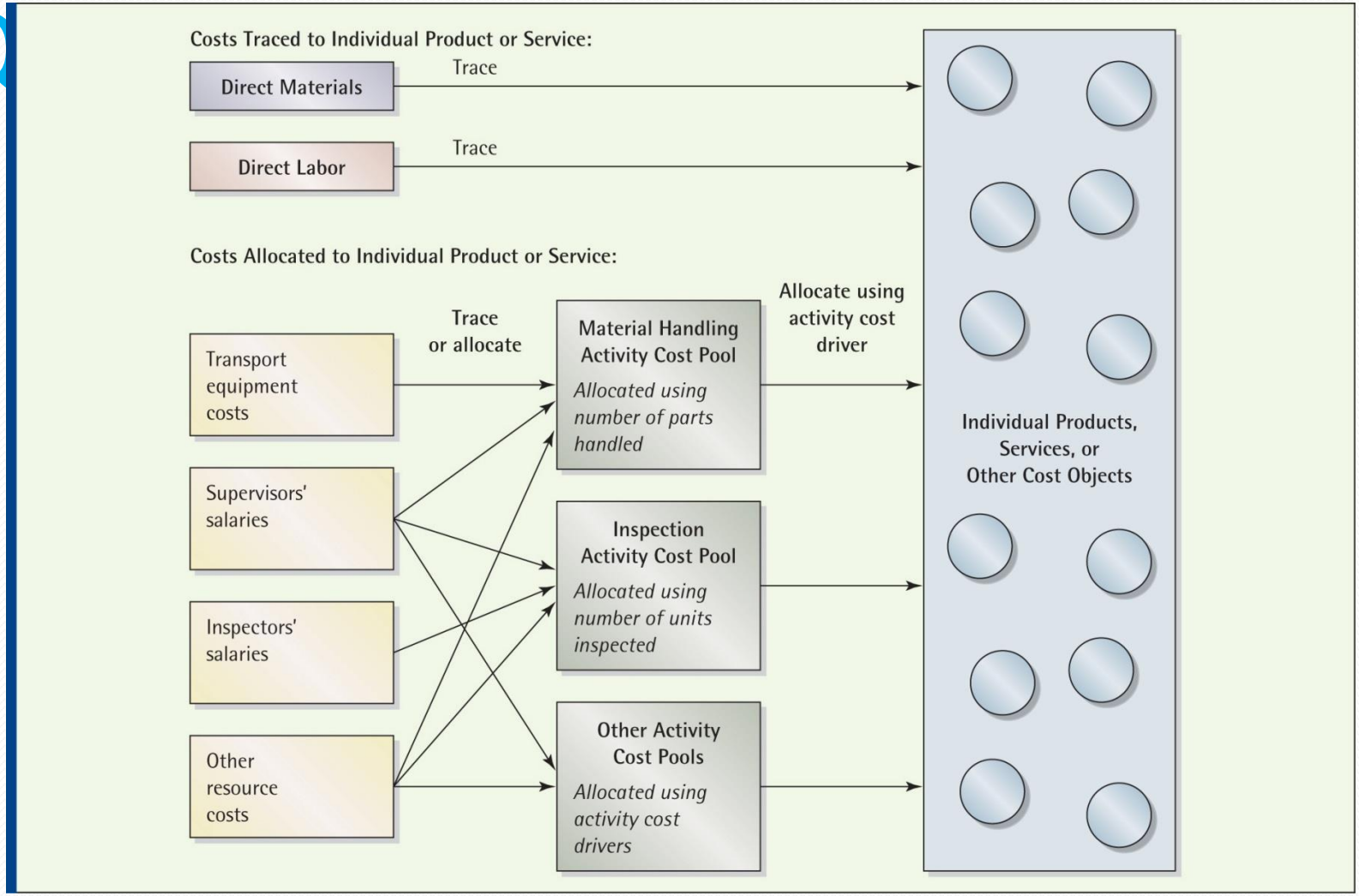
Activity-based costing systems:



Indirect costs are assigned (traced & allocated) to various pools of activity costs.

Activity costs are allocated to products

The individual products are the final cost objects & direct costs are traced to the individual products.


Costs Traced to Individual Product or Service:
Direct Materials
Trace
Direct Labor
Trace
Costs Allocated to Individual Product or Service:
Trace or allocate
Allocate using activity cost driver
Transport equipment costs
Supervisors' salaries
Inspectors' salaries
Other resource costs
Material Handling Activity Cost Pool
Allocated using number of parts handled
Inspection Activity Cost Pool
Allocated using number of units inspected
Other Activity Cost Pools
Allocated using activity cost drivers
Individual Products, Services, or Other Cost Objects

Q2: What are Activities and How are They Identified?

The ABC cost hierarchy includes the following activities:

- organization-sustaining – associated with overall organization
- facility-sustaining – associated with single manufacturing plant or service facility
- customer-sustaining – associated with a single customer
- product-sustaining – associated with product lien or single product
- batch-level – associated with each batch of product
- unit-level – associated with each unit produced

Q2: ABC Cost Hierarchy Example

Some of the costs incurred by the Dewey Chargem law firm are listed below. This firm specializes in immigration issues and family law. For each cost, identify whether the cost most likely relates to a(n) (1) organiz-ation-sustaining, (2) facility-sustaining, (3) customer-sustaining, (4) product-sustaining, (5) batch-level, or (6) unit-level activity and explain your choice.

Cost	Cost Hierarchy Level
Bookkeeping software	
Salary for partner in charge of family law	
Office supplies	
Subscription to family law update journal	
Telephone charges for local calls	
Long distance telephone charges	
Window washing service	
Salary of receptionist	

Budgeting for Processes rather than Departments

Q3: What Process is Used to Assign Costs in an ABC system?

1. Identify the relevant cost object.
2. Identify activities and group *homogeneous activities*.
3. Assign costs to the activity cost pools.
4. Choose a cost driver for each activity cost pool.
5. Calculate an allocation rate for each activity cost pool.
6. Allocate activity costs to the final cost object.

Q3: How Are Cost Drivers Selected for Activities?

- For each activity, determine its place in the ABC cost hierarchy.

- Look for drivers that have a good cause-and-effect relationship with the activities' costs.

- Use a reasonable driver when there is no cause-and-effect relationship.

Q3: ABC in Manufacturing Example

Alphabet Co. makes products A & B. Product A is a low-volume specialty item and B is a high-volume item. Estimated factory- wide overhead is $800,000, and the number of DL hours for the year is estimated to be 50,000 hours. DL costs are $10/hour. Each product uses 2 DL hours. Compute the traditional cost of each product if Products A & B use $25 and $10 in direct materials, respectively.

First, compute the estimated overhead rate:

Estimated overhead rate = $800,000/50,000 hours = $16/hour.

	Product A	Product B
Direct materials	$25	$10
Direct labor (2hrs @ $10)	20	20
Overhead (2 hrs @ $16)	32	32
	$77	$62

Q3: ABC in Manufacturing Example

Alphabet Co. is implementing an ABC system. It estimated the costs and activity levels for the upcoming year shown below.

	Estimated	Estimated Activity Levels			
	Costs	Prod. A	Prod. B	Total	Cost Driver
Machine set-ups	$200,000	3,000	2,000	5,000	# set-ups
Inspections	140,000	500	300	800	# inspections
Materials handling	80,000	400	400	800	# mat'l requistions
Machining dep't	320,000	12,000	28,000	40,000	# machine hours
Quality control dep't	60,000	600	150	750	# tests
	$800,000				

First, compute the estimated overhead rate for each activity:



Q3: ABC in Manufacturing Example

	Estimated Costs	Estimated Activity		Overhead Rate
Machine set-ups	$200,000	5,000	set-ups	$40 /setup
Inspections	140,000	800	inspections	$175 /inspection
Materials handling	80,000	800	mat'l requistions	$100 /requisition
Machining dep't	320,000	40,000	machine hours	$8 /mach hr
Quality control dep't	60,000	750	tests	$80 /test
	$800,000			

Q3: ABC in Manufacturing Example

Alphabet recently completed a batch of 100 As and a batch of 100 Bs. Direct material and labor costs were as budgeted. Information about each batch's use of the cost drivers is given below. Compute the overhead allocated to each unit of A and B.

	100 As	100 Bs
Machine set-ups	60	10
Inspections	10	2
Materials handling	4	2
Machining dep't	240	120
Quality control dep't	3	1

Overhead allocated:	100 As	100 Bs
Machine set-ups	$2,400	$400
Inspections	1,750	350
Materials handling	400	200
Machining dep't	1,920	960
Quality control dep't	240	80
Overhead for batch	$6,710	$1,990
Overhead per unit	$67.10	$19.90

Q3: ABC in Manufacturing Example

Compute the total cost of each product and compare it to the costs computed under traditional costing.

	Prod A	Prod B
Direct material	$25.00	$10.00
Direct labor	20.00	20.00
Overhead	67.10	19.90
Total	$112.10	$49.90

Traditional costing assigned $77 to a unit of Product A and $62 to a unit of Product B.

- The only difference between the two costing systems is that Product A is assigned more overhead costs under ABC.
- The additional overhead assigned to Product A reflects Product A's consumption of resources.

Q4: Activity-Based Management (ABM)

- ABM is the process of using ABC information to evaluate opportunities for improvements in an organization.

- Examples include managing & monitoring
  - customer profitability
  - product and process design
  - environmental costs
  - quality
  - constrained resources

Q4: ABM & Customer Profitability

- Activities can be defined so that different costs of servicing customers are accumulated.

- Examples include
  - analyzing the types of bank transactions used by various categories of customers
  - comparing the costs of servicing insurance contracts sold to married versus single individuals
  - comparing the costs of different distribution channels

Q4: ABM & Product/Process Improvements

- Activities can be defined so that the costs of stages of production or of a business process are accumulated.

- Examples include
  - determining the costs of non-value-added activities so the most costly can be reduced or eliminated
  - changing the steps in the accounts payable function to reduce the number of personnel
  - determining the most costly stages of product development so that the time to market is reduced

Q4: ABM & Environmental Costs

- Activities can be defined so that types of environmental costs are accumulated.

- Examples include
  - capturing the costs of contingent liabilities for waste disposal site remediation
  - comparing the cost of recycling packaging to the cost of disposal
  - computing the costs of treating different kinds of emissions

Q4: ABM & Quality Costs

- Activities can be defined so that categories of costs of managing quality are accumulated.

- Common categories of quality costs are
  - costs of prevention activities
  - costs of appraisal activities
  - costs of production activities
  - costs of postsales activities

Q5: What are GPK and RCA?

- Costing approaches similar to ABC because they involve multiple pools and multiple drivers
- GPK can be described as marginal planning and cost accounting
  - Each cost is traced to a cost center (smaller than a department) which performs a single repetitive activity, and is the responsibility of one manager)
  - Output measures tracks the volume of resource use
  - Costs are segregated into proportional (change with volume in resource use) and fixed
  - *Practical* capacity is used for estimated allocation rate volumes

Q5: Capacity Definitions

- Theoretical capacity – maximum assuming continuous, uninterrupted operations 365 days/year
- Practical capacity – typical operating conditions
- Budgeted capacity – expected volume for the upcoming time period
- Idle/excess capacity – difference between activity capacity used and one of the above measures of capacity

Q5: What are GPK and RCA?

- Resource Consumption Accounting (RCA)
- Builds on GPK and ABC principles
- Each cost is assigned to a resource cost pool
  - Labor and machinery are often placed in different cost pools since they are different types of resources
  - RCA involves a significantly larger number of cost pools than traditional accounting
  - Like GPK, segregates proportional and fixed costs
  - Utilizes *theoretical* rather than practical capacity for allocating fixed costs
    - More likely to focus manager attention on reducing idle and non-productive resource time

Q5: Benefits/Drawbacks to GPK/RCA

- Benefits
  - Generates multi-level internal income statements useful for short terms decisions because it focuses on marginal cost
  - Increases cause & effect awareness among managers
  - Categorizes costs (and generates profit margin) at the product, product group, division, and company level
  - Avoids arbitrary allocations of fixed costs
- Drawbacks
  - Can be costly to implement
  - Can result in a large number of variances to analyze

Q5: Comparison of ABC, GPK,

	ABC	GPK	RCA
Character of cost accounting system	Full costing	Marginal costing	Full and marginal costing
Location of data	Database separate from general ledger	Comprehensive accounting system	Comprehensive accounting system
Primary decision relevance	Mid- to long-term	Short-term	Short-, Mid-, and Long term
Allocation of overhead based on	Activities	Cost Centers	Resources and/or activities
Cost Drivers	Activity –Based	Resource Output related	Resource output or activity related
Fixed cost allocation rate denominator	Actual, budgeted, or practical capacity	Budgeted or practical capacity	Theoretical capacity

GPK, and RCA

- Benefits
  - more accurate and relevant product cost information
  - employees focus attention on activities
  - measurement of the costs of activities and business processes
  - identify non-value-added activities and reduce costs

- Costs
  - systems can be difficult to design and maintain
  - more information must be captured
  - decision makers may not use the information appropriately

Q6: Uncertainties in ABC and ABM Implementation

- Judgment is required when determining activities.
- Judgment is required when selecting cost drivers.
- Denominator levels for cost drivers are estimates.
- ABC information includes unitized fixed costs, so decision makers must use ABC information correctly.

Developing the ABB application model

Activity-Based Costing and Customer Profitability Analysis

Learning Objectives

- Explain the strategic role of activity-based costing (ABC)
- Describe ABC, the steps in developing an ABC system, and the benefits of an ABC system
- Determine product costs under both the volume-based method and the ABC method
- Explain activity-based management (ABM)

Learning Objectives (continued)

- Describe how ABC/M is used in manufacturing companies, service companies, and governmental organizations
- Use an activity-based approach to analyze customer profitability
- Identify key factors for successful ABC/M implementation

Strategic Role of ABC

Activity-based costing (ABC) vs. volume-based costing:

- Volume-based costing results may be distorted because indirect costs do not always occur in proportion to output volume
- Volume-based costing generally causes cross-subsidization of outputs (i.e., some products will be overcosted and others undercosted)
- Activity-based costing uses detailed information about the activities that make up indirect costs so that outputs are charged only for resources consumed by the activities needed to perform them

Volume-Based Costing

- **May be a good strategic choice for some firms**
  - When the costs to be allocated are relatively small versus the directly traceable costs
  - When the activities supporting production are relatively homogeneous across different product/service lines
- **Volume-based costing is often used by paper product manufacturers, producers of agricultural products, other commodity firms, and professional service firms**

ABC Terms

- ***Activity*** **- a specific task or action of work done, such as production set-up**
- ***Resource*** **- an economic element needed or consumed in performing activities, such as salaries and supplies**
- **Cost driver - either a *resource consumption cost driver* or an *activity consumption cost driver***

ABC Terms

- **Resource consumption cost drivers** measure the amount of resources consumed by an activity, such as the number of items in a purchase or sales order
- **Activity consumption cost drivers** measure the amount of activity performed for an object, such as the number of batches used to manufacture a product

Cost Assignment

- ***The two-stage cost assignment* approach for indirect (support) costs: resource costs such as factory overhead are assigned to activity cost pools and then to cost objects (jobs, clients, products, patients, etc.)**
  - Volume-based systems assign factory overhead to a single plant or departmental cost pool first and then to products or services using a volume-based rate
  - ABC systems assign factory overhead costs to activities or activity cost pools using resource consumption cost drivers and then assign these costs to cost objects using activity consumption cost drivers

Summary: ABC vs. volume-based costing

ABC systems differ from volume-based costing systems in two ways:

- ABC system defines cost pools as activities rather than production plant or department cost centers
- Cost drivers
  - ABC systems use drivers based on an activity or activities performed for the cost object
  - Volume-based approaches use a volume-based cost driver that often bears little or no relationship to the consumption of resources by the cost objects

Defining Key Activities

Activity Analysis

Through activity analysis, a firm identifies the work it performs to carry out its operations by

- Gathering data from existing documents and records
- Collecting additional data using questionnaires, observations, or interviews of key personnel
- Sample questions include:
  - What work or activities do you do?
  - How much time do you spend performing these activities?
  - What resources are required to perform these activities?
  - What value does the activity have for the product, service, customer, or organization?

Activity Analysis

To identify resource costs for various activities, a firm classifies all activities according to the way in which the activities consume resources

- A *unit-level* activity is performed on each individual unit of product or service of the firm (e.g., direct materials)
- A *batch-level* activity is performed for each batch or group of units of products or services (e.g., setting up machines or placing purchase orders)
- A *product-level* activity supports the production of a specific product or service (e.g., engineering changes to modify parts for a product)
- A f*acility-level* activity supports overall operations (e.g., property taxes and insurance)

Unit Level Costs

Performed for each unit of product or service

Examples include:

- Units of production related depreciation of factory machinery
- Energy costs for machinery used for individual units of production (e.g., A drill press that drills holes in pieces of metal)

Batch Level Costs

Performed for each batch of product or service produced

Examples include:

- Machine setup costs
- Quality control costs
- Wages for works that move products within the factory
- Energy costs for machinery that is used for multiple units of product at the same time (e.g., an oven that bakes a batch of cookies for a commercial baker)

Product Level Costs

Support production of a specific product or service line

Examples include:

- Salaries for product line purchasing managers
- Quality control costs
- Product development costs
- Depreciation and maintenance for specialized machinery dedicated to the production od a single product or service line

Facility Level Costs

Support overall operations

Examples include:

- Factory depreciation
- Security costs for the factory
- Insurance and property taxes for a factory
- Salary of a plant manager

Developing an ABC System

There are three steps in the development of an ABC system:

1. Identify resource costs and activities
   - An activity analysis is performed to identify key activities and the way in which the activities consume resources
2. Assign resource costs to activities
   - Use resource consumption cost drivers based on cause-and-effect relationships, such as the number of labor hours, setups, moves, machine-hours, employees, or square feet to assign resource costs
3. Assign activity costs to cost objects
   - Use activity consumption cost drivers, such as purchase orders, receiving reports, parts stored, direct labor-hours, or manufacturing cycle time to assign activity costs

Benefits of ABC Systems

1. Better profitability measures due to more accurate costs
2. Better decision making: identification of value-added vs. non-value-added activities and associated costs
3. Information for process improvement
4. Improved cost planning
5. Helps identify and control the cost of unused capacity

Volume-Based vs. ABC Example

Haymarket BioTech, Inc. (HBT) produces and sells two secure communication systems, AW (Anywhere) and SZ (SecureZone). HBT has the following operating data for the two products:

	AW	SZ
Production volume	5,000	20,000
Selling price	$400.00	$200.00
Unit direct materials and labor	$200.00	$80.00
Direct labor-hours	25,000	75,000
Direct labor-hours per unit	5	3.75

Volume-Based vs. ABC

The **traditional volume-based costing system** assigns factory overhead (OH) based on direct labor-hours (DLH). The firm has a total budgeted overhead of $2,000,000. Since the firm budgeted 100,000 DLHs for the year, the overhead rate per DLH is $20 ($2,000,000÷100,000 DLH).

Therefore……

Volume-Based vs. ABC

The factory overhead assigned to AW is $500,000 (25,000 DLH × $20) in total and $100 ($500,000÷5,000 units) per unit, since the firm used 25,000 direct labor hours to manufacture 5,000 units of AW

and

The factory overhead assigned to SZ is $1,500,000 (75,000 DLH × $20) in total and $75 ($1,500,000÷20,000 units) per unit, since the firm used 75,000 direct labor hours to manufacture 20,000 units of SZ

Volume-Based vs. ABC

Product profitability analysis per unit using volume-based costing:

	AW		SZ	
Unit selling price		$400.00		$200.00
Unit-level manufacturing costs				
Direct materials and labor	$200.00		$80.00	
Factory overhead	100.00		75.00	
Cost per unit		300.00		155.00
Profit margin		100.00		45.00

Volume-Based vs. ABC

In an attempt to use an ABC system, HBT has identified the following activities, budgeted costs, and activity consumption cost drivers:

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

Volume-Based vs. ABC

HBT also has gathered the following operating data pertaining to each of its products:

	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

Volume-Based vs. ABC

Using the operating data, the activity rate for each activity consumption cost driver is calculated as follows:

(1)	(2)	(3)	(4) = (2) ÷ (3)
Consumption Cost Driver	Budgeted Cost	Budgeted Activity Consumption	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

Volume-Based vs. ABC

Factory overhead costs for AW at 5,000 units of production:

(1)	(2)	(3)	(4) = (2) × (3)	(5)
Consumption Cost Driver	Activity Consumption Rate	Activity Consumption	Total Overhead	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
Total			$ 775,000	$ 155

Volume-Based vs. ABC

Factory overhead costs for SZ at 20,000 units of production:

(1)	(2)	(3)	(4)=(2)×(3)	(5)
Consumption Cost Driver	Activity Consumption Rate	Activity Consumption	Total Overhead	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
Total			$ 1,225,000	$ 61.25

Volume-Based vs. ABC Example

Product profitability analysis per unit using ABC:

	AW	SZ
Unit selling price	$ 400	$200.00
Unit-level manufacturing costs		
Direct materials and labor	$ 200	$ 80.00
Engineering	$ 10	3.75
Setups	40	5.00
Machine running	100	50.00
Packing	5	2.50
Factory overhead	155.00	61.25
Cost per unit	355.00	141.25
Profit margin	$ 45	$ 58.75

Volume-Based vs. ABC

The following chart compares the results of the two costing systems:

	AW	SZ
Unit overhead cost		
Volume-based	$ 100	$ 75.00
Ativity-based	155	61.25
Difference	$ 55	$ 13.75
Profit margin		
Volume-based	$ 100	$ 45.00
Ativity-based	45	58.75
Difference	$ 55	$ 13.75

Can you guess which is the high-volume and which is the low-volume product?

Keep in mind that volume-based costing tends to undercost low-volume products and overcost high-volume products, a situation often referred to as product cost cross-subsidization

Cost of Capacity for the HBT Example

- Suppose that instead of a budgeted activity consumption of 12,500 hours, HBT were to use the practical capacity of the engineering staff, which is 15,625 hours.
- Using practical capacity, the activity consumption rate would be $8 per engineering hour (=$125,000÷15,625). If only 12,500 hours were used, as shown in the HBT example, then the overhead cost charged to AW and SZ would be reduced because of the lower rate ($8 instead of the original rate of $10).
- AW overhead would be reduced by $10,000 (5,000 hours × $2) and SZ overhead would be reduced by $15,000 (7,500 hours × $2).
- The total reduction for the two products, $25,000 (=$10,000 + $15,000) is the **cost of unused capacity.**

Development of ABB Cost Standards

Five Steps of Strategic Decision Making in the HBT Example

1. **Determine the Strategic Issues Surrounding the Problem:** ***HBT competes on differentiation***
2. **Identify the Alternative Actions:** ***focus on AW or SZ?***
3. **Obtain Information and Conduct Analyses of the Alternatives:** ***cost analysis based on ABC costing***
4. **Based on Strategy and Analysis, Choose and Implement the Desired Alternative:** ***do not promote AW over SZ, but instead focus on SZ to improve overall profitability***
5. **Provide an On-going Evaluation of the Effectiveness of implementation in Step 4.**

Activity-Based Management (ABM)

ABM manages activities to improve the value of products or services to customers and increase the firm's competitiveness and profitability:

- Focuses on the efficiency and effectiveness of key business processes and activities
- Improves management's focus on the firm's critical success factors thereby enhancing the firm's competitive advantage
- ABC is its major source of information

Activity-Based Management (ABM)

ABM applications can be classified into two categories:

- ***Operational ABM*** enhances operational efficiency and asset utilization and lowers costs; it focuses on doing things right and performing activities more efficiently
- ***Strategic ABM*** attempts to alter the demand for activities and increases profitability through improved activity efficiency

ABC/M Tools

Some key ABC/M tools:

- In *activity analysis* an organization assesses each of its activities based on its need by the product or the customer, its efficiency, and its value content

- *Value-added analyses* are performed in an effort to eliminate activities that add little or no value to the customer; resource consumption can be reduced and the firm can focus on activities that increase customer satisfaction

ABC/M Tools

High-value-added activities:

- Increase significantly the value of the product or service
- Are necessary to meet customer requirements
- Enhance purchased materials or components
- Contribute to customer satisfaction
- Are critical steps in a business process

In short, removal would reduce the value of the product or service

ABC/M Tools

Low-value-added activities:

- Consume time, resources, or space but add little or nothing to satisfying customer needs
- Can be eliminated without affecting the form/fit/function of the product or service

Customer Profitability Analysis

ABC/M can be used to estimate customer-related costs and in therefore in assessing the profitability of a specific customer or group of customers

- *Customer profitability analysis* identifies customer service activities and cost drivers and determines profitability for each customer or group; this process allows the firm to chose its customer mix, determine an appropriate offering of after-sale services, decide what discounts to offer, etc.

- *Customer cost analysis* is the first step in a customer profitability analysis; it identifies activities and cost drivers to service customers before and after sales

Customer Profitability Analysis

Customer-related costs can be classified into the following categories:

- Customer unit-level costs - resources consumed for each unit sold to a customer, such as sales commissions and shipping costs based on units sold or shipped
- Customer batch-level costs - resources consumed for each sales transaction, such as order-processing costs or invoicing costs
- Customer-sustaining costs -resources consumed to service a customer regardless of the number of units or batches sold, such as monthly statement processing costs and collection costs for late payments

Customer Profitability Analysis (continued)

Customer costs can be classified into the following categories (continued):

- Distribution-channel costs are resources consumed in each distribution channel the firm uses to service customers, such as the cost of operating a regional warehouse or centralized distribution center

- Sales-sustaining costs are resources consumed to sustain sales and service activities that cannot be traced to an individual unit, batch, customer, or distribution channel, such as general corporate marketing expenditures

Customer Profitability Analysis (continued)

- **Customer Profitability Analysis** combines customer revenues and customer costs to assess customer profitability and helps identify actions to improve customer profitability
- Some companies quantify customer value in what is called **Customer Lifetime Value** (CLV), which is equal to the net present value (NPV) of all estimated future profits from the customer for a specified period of time

Customer Profitability Analysis (continued)

Customer profitability analysis helps to assess a customer's value to the company:

- What is the growth potential of the customer and the customer's industry?
- What is its "cross-selling" potential?
- What are the possible reactions of the customer to changes in sales terms or services?
- How important is this customer as a future sales reference?

ABC/M Implementation Issues

- A successful ABC/M implementation requires close cooperation among management accountants, engineers, and manufacturing and operating managers

- There are three important issues to consider in ABC/M implementation:
  - Multiple-Stage ABC
  - Time-Driven ABC (TDABC)
  - Resource Consumption Accounting

ABC/M Implementation Issues (continued)

- **Multiple-stage ABC** takes into account that some activities are cost objects for other activities

- **Time-driven ABC (TDABC)** simplifies some of the complexity involved in large ABC systems

ABC/M Implementation Issues

- Time-driven ABC (TDABC)
- Is based on the idea that the common element in the utilization of many activities is the unit of time
- Assigns resource costs directly to cost objects using the cost per time unit of supplying the resource
- Requires the total activity cost be divided by the number of minutes available to that activity to provide a cost per unit of time

Resource Consumption Accounting

- Emphasis is on being able to attribute costs, both fixed and proportional, to cost objects for decision support
- Three foundational concepts for RCA:
  - The view of resources – resources are the suppliers of capacity, meaning that capacity is a function of the resources available.
  - The quantity-based model – an operational view of the organization based on the concept that there is a causal relationship that can be expressed in terms of input and output units.
  - Cost behavior – the characteristics of the cost are inherent to the underlying resource and the consumption of those resources by value creating operations.

TDABC Example

- Assume 2 clerical workers paid $45,000 annually perform a certain activity that is expected to require 17 minutes. TDABC calculates the total cost as $45,000 × 2 = $90,000; TDABC then calculates the total time available for the activity as 180,000 minutes (assuming 30 hours per week with two weeks vacation: 2 workers × 50 weeks × 30 hours × 60 minutes per hour = 180,000 minutes per year).

- The TDAC rate for the activity is $0.50 per minute ($90,000 ÷ 180,000). The cost of a unit of activity is $0.50 × 17 min = $8.50.

DAY 4

Strategic and Operational Cost Analysis Techniques

- Identifying fixed, variable and semi-variable costs
- Application of Regression in the development of budgets
- Building the financial simulation model using articulated financial statements
- Building the financial simulation model using deterministic simulation
- Building the financial simulation model using probabilistic (Monte Carlo) simulation

Identifying fixed, variable and semi-variable costs

Basic Definitions

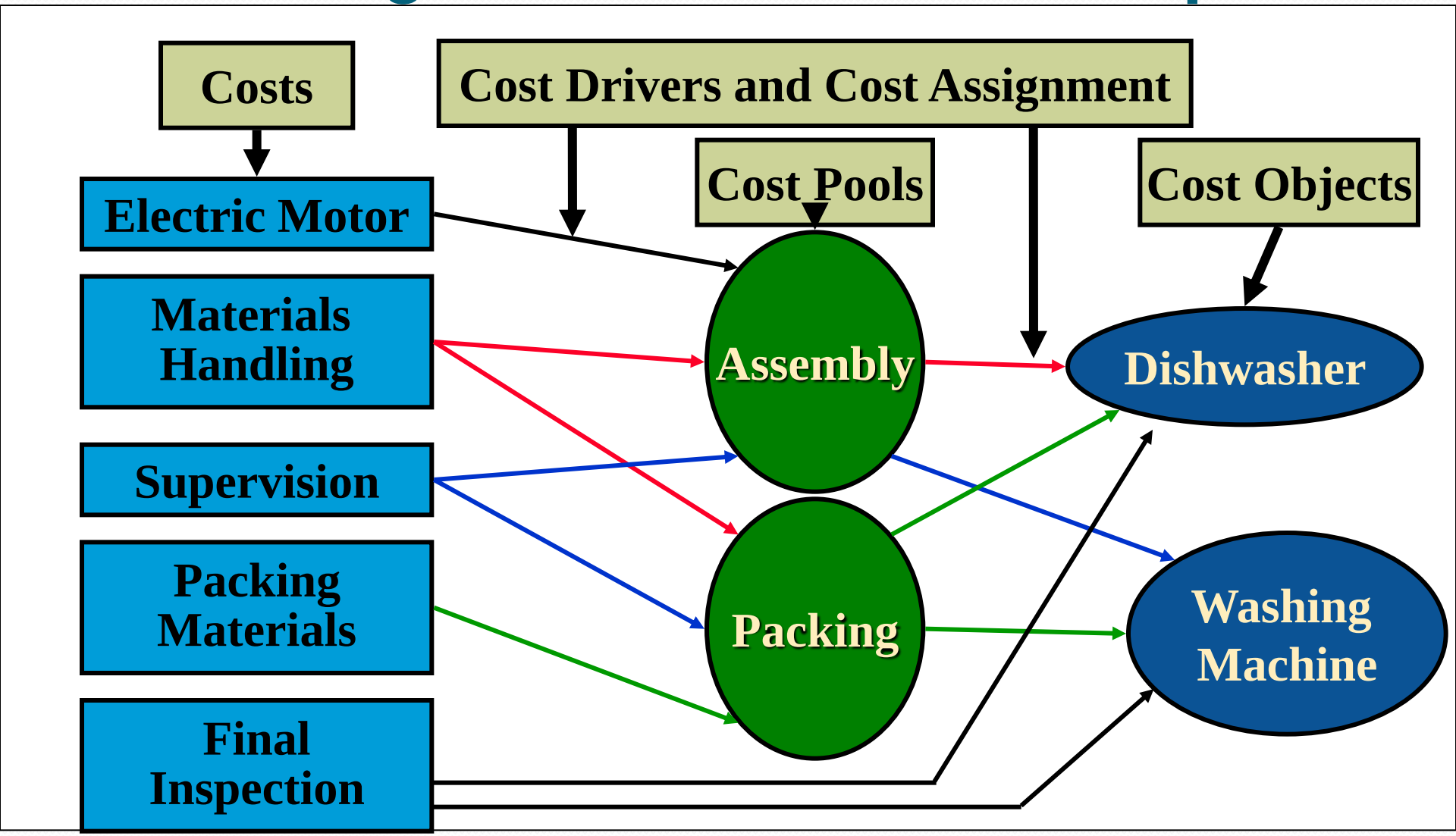
- A *cost* is incurred when a firm uses a resource for some purpose
- Costs are assembled into meaningful groups called *cost pools* (e.g., by type of cost or source)
- Any factor that has the effect of changing the level of total cost is called a *cost driver*
- A *cost object* is any product, service, customer, activity, or organizational unit to which costs are assigned for some management purpose

Product/Service Costing: Cost Assignment

The process of assigning costs to cost pools or from cost pools to cost objects

- *Direct costs* can be conveniently and economically traced to a cost pool or a cost object
- *Indirect costs* cannot be traced conveniently or economically to a cost pool or a cost object
- Because indirect costs cannot be traced, assignment is made through the use of cost drivers (*cost allocation*)
- These cost drivers are often called *allocation bases*

Cost Assignment: General Principles



Direct and Indirect Product Costs for a Manufacturer

- **Direct material costs** = cost of materials that can be readily traced to outputs = purchase price of materials + freight – purchase discounts + reasonable allowance for scrap and defective units
- **Indirect material costs** = cost of materials that cannot readily be traced to outputs (e.g., rags, lubricants, and small tools)
- **Direct labor costs** = labor that can be readily traced to outputs = wages paid plus a reasonable allowance for nonproductive time
- **Indirect labor costs** = labor costs that cannot be readily traced to outputs (i.e., they are manufacturing support costs)

Product Costs: (continued)

- **All indirect costs** for the manufacturer, including indirect materials, indirect labor, and other indirect items are often combined in a cost pool referred to as *overhead* (or, *factory overhead*, or *indirect manufacturing costs*)

- **The three main types of costs,** direct materials, direct labor, and overhead, are often condensed even further:
  - Direct materials + Direct labor = Prime costs
  - Direct labor + Overhead = Conversion costs

Cost Behavior: Cost Drivers

- ***Cost drivers* provide two roles for the management accountant**
  - Assigning costs to cost objects
  - Explaining cost behavior, i.e., how total cost changes as the cost driver changes
- **There are four types of *cost drivers*:**
  - Activity-based
  - Volume-based
  - Structural
  - Executional

Cost Drivers

- ***Activity-based* cost (ABC) drivers** are developed at a detailed level of operations using activity analysis–a cost driver is determined for each activity
- ***Volume-based* cost drivers** relate to the amount produced or quantity of service provided:
  - The relationship between the cost driver and total cost is approximately linear within the relevant range

Volume Based Cost Drivers: Classification by Behavior

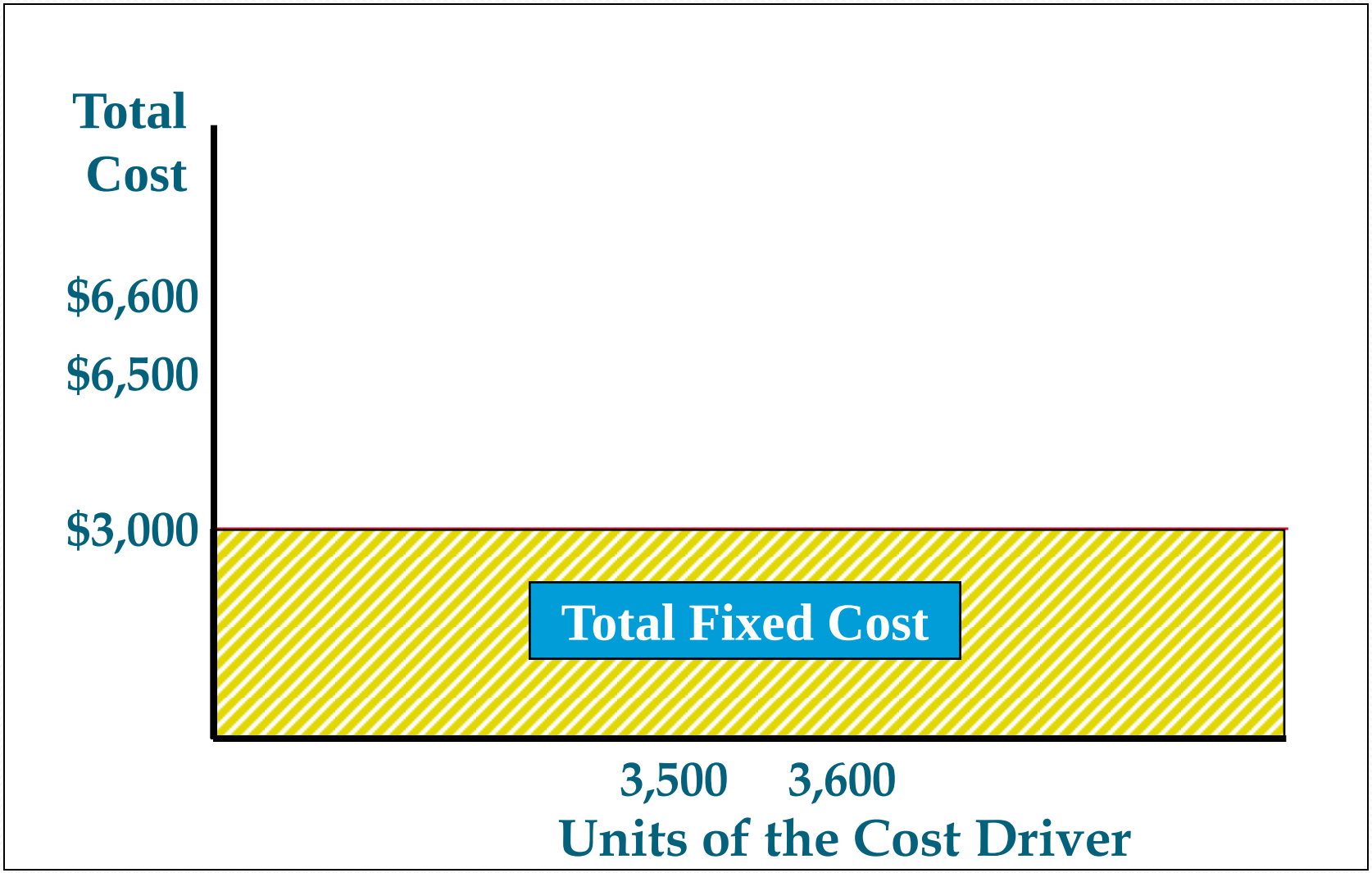
- *Fixed cost* is the portion of total cost that does not change with changes in output
- *Variable cost* is the change in total cost associated with each change in quantity of the cost driver
- *Mixed cost* is used to refer to a total cost figure that includes both a fixed and variable component
- *Step costs* vary with the cost driver but do so in steps

Cost Drivers

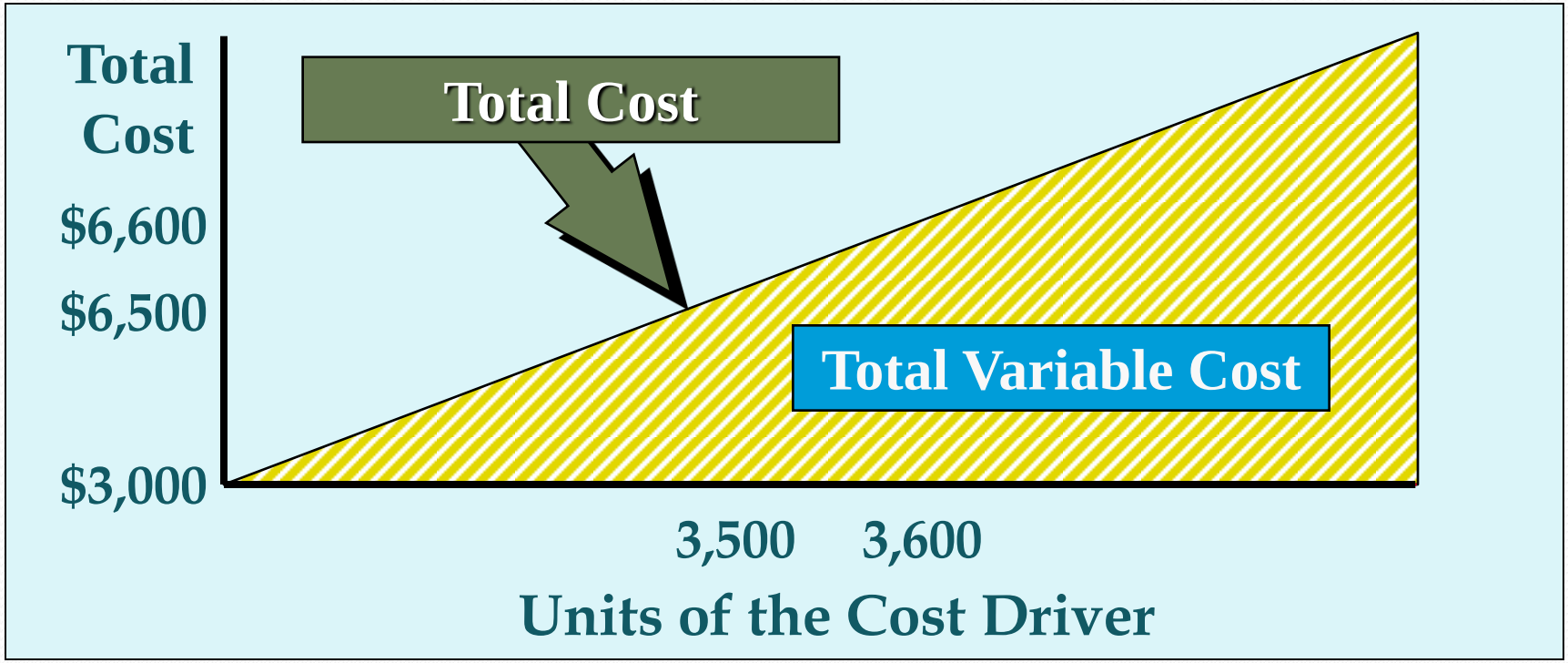
- ***Structural cost* drivers** facilitate strategic decision making because they involve plans and decisions that have long-term effects
  - Scale, experience, technology, and complexity are considered in hopes of improving competitive position

- ***Executional cost* drivers** facilitate operational decision making by focusing on short-term effects
  - Workforce involvement, design of the production process, and supplier relationships are considered in an attempt to reduce costs

Fixed Costs


Total Cost
$6,600
$6,500
$3,000
Total Fixed Cost
3,500
3,600
Units of the Cost Driver

Variable Costs



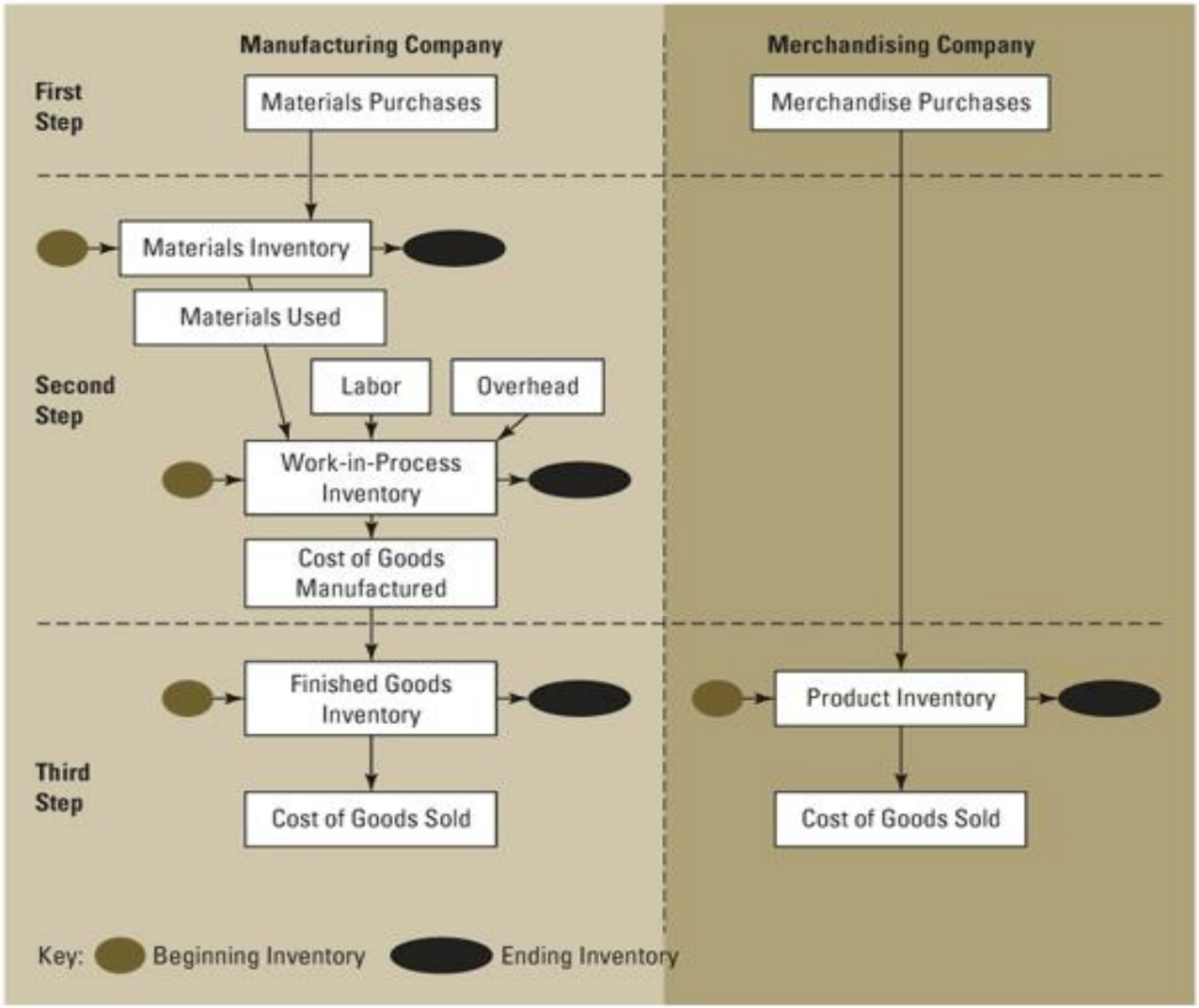
Product and Service Costing Concepts

- **Product costs** include only the costs necessary to complete the product at the manufacturing step in the value chain (manufacturing) or to purchase and transport the product to the location of sale (merchandising)

- **Period costs (also called non-product costs)** include all other costs incurred by the firm in managing or selling the product (indirect costs outside the manufacturing step of the value chain)

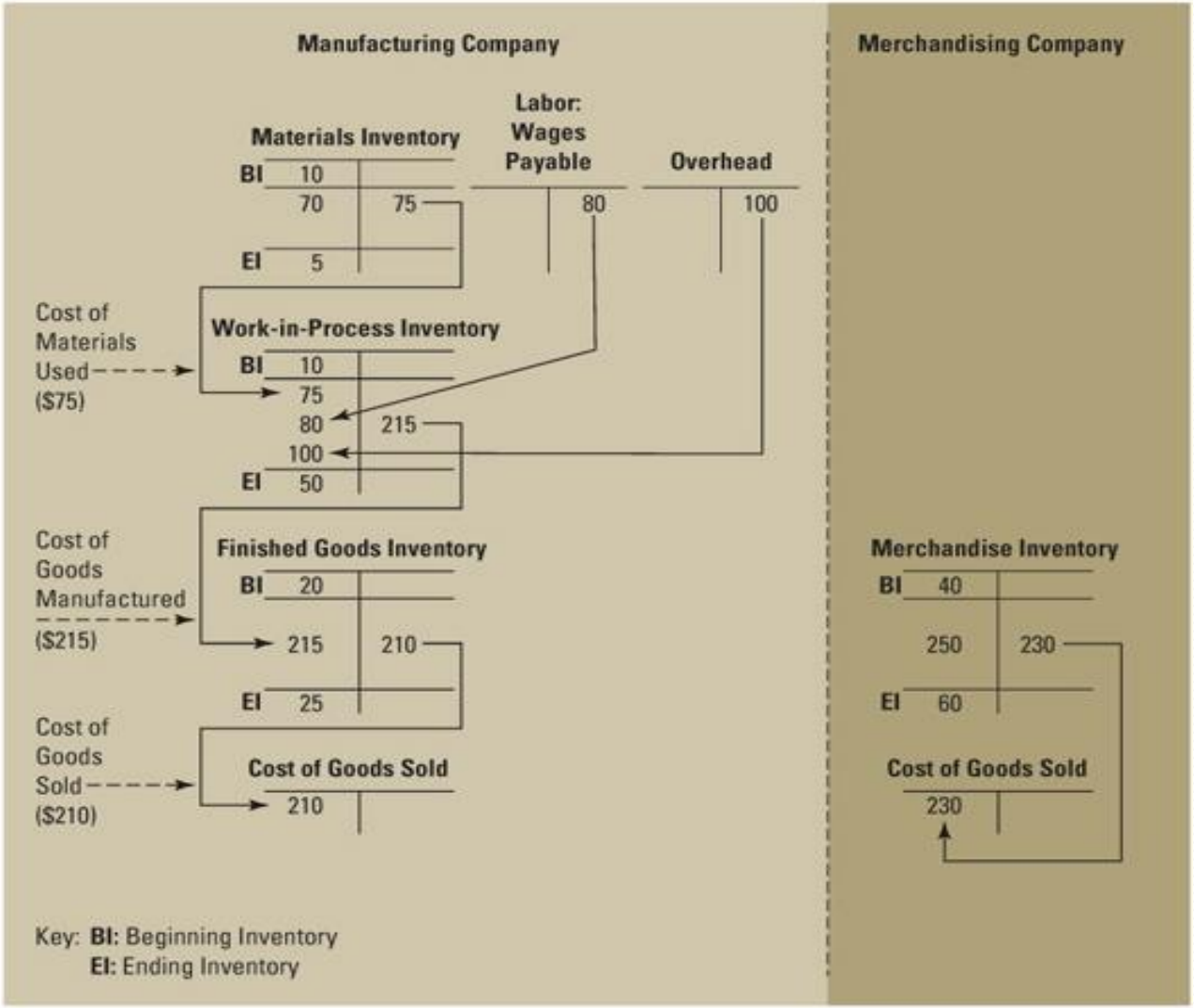
Manufacturing vs. Merchandising

EXHIBIT 3.13
Cost Flows in Manufacturing and Merchandising Firms



Inventory and Related Expense Accounts

EXHIBIT 3.14
Account Relationships for Manufacturing and Merchandising Companies



Qualitative Characteristics of Cost Information

- *Accuracy* (and the need to monitor internal accounting controls)
- *Cost and value of cost information* (the cost of information should be monitored by the management accountant to ensure that costs do not outweigh the associated benefits)
- *Timeliness* (often involves sacrificing in the other two areas)

Application of Regression in the development of budgets

Business Forecasting

7

Forecasting with Simple Regression

Topics

- Types of Regression Models
- Determining the Simple Linear Regression Equation
- Measures of Variation
- Assumptions of Regression and Correlation
- Residual Analysis
- Measuring Autocorrelation
- Inferences about the Slope

Topics

(continued)

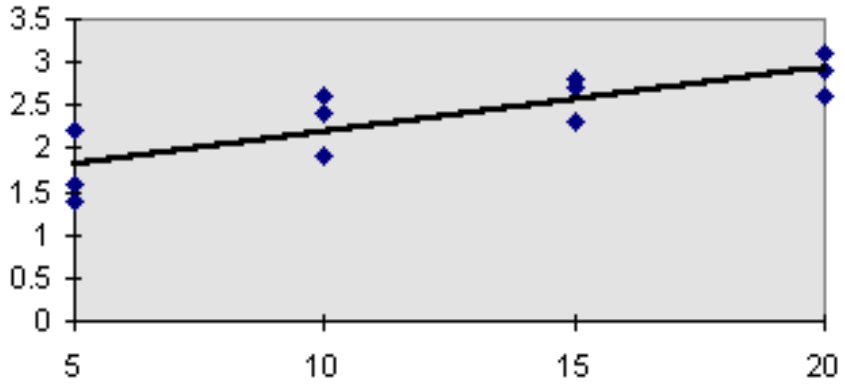
- Correlation—Measuring the Strength of the Association
- Estimation of Mean Values and Prediction of Individual Values
- Pitfalls in Regression and Ethical Issues

Purpose of Regression Analysis

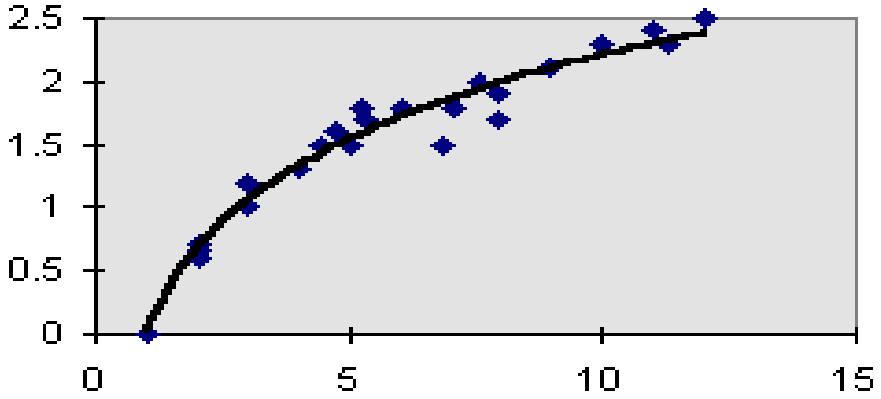
- Regression Analysis is Used Primarily to Model Causality and Provide Prediction
  - Predict the values of a dependent (response) variable based on values of at least one independent (explanatory) variable.
  - Explain the effect of the independent variables on the dependent variable.

Types of Regression Models

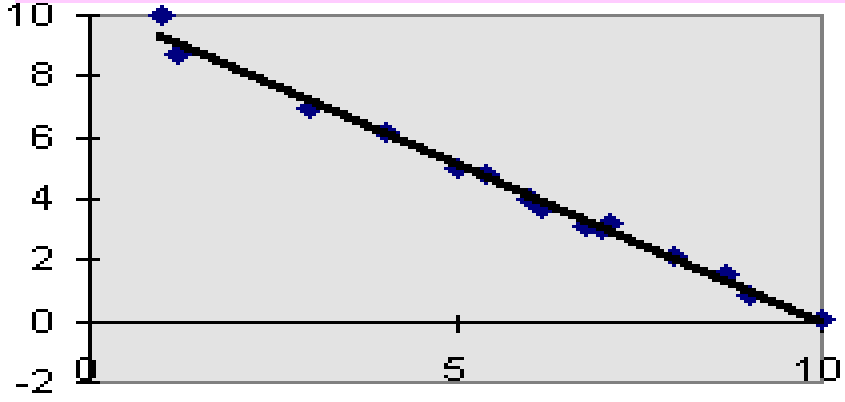
Positive Linear Relationship



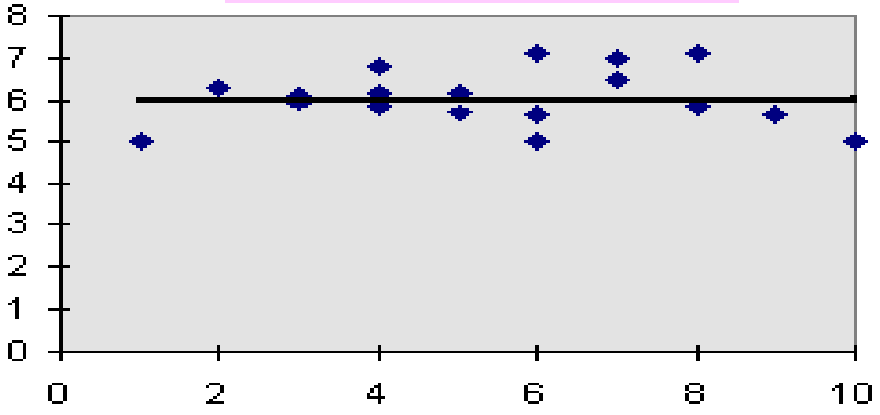
Relationship NOT Linear



Negative Linear Relationship

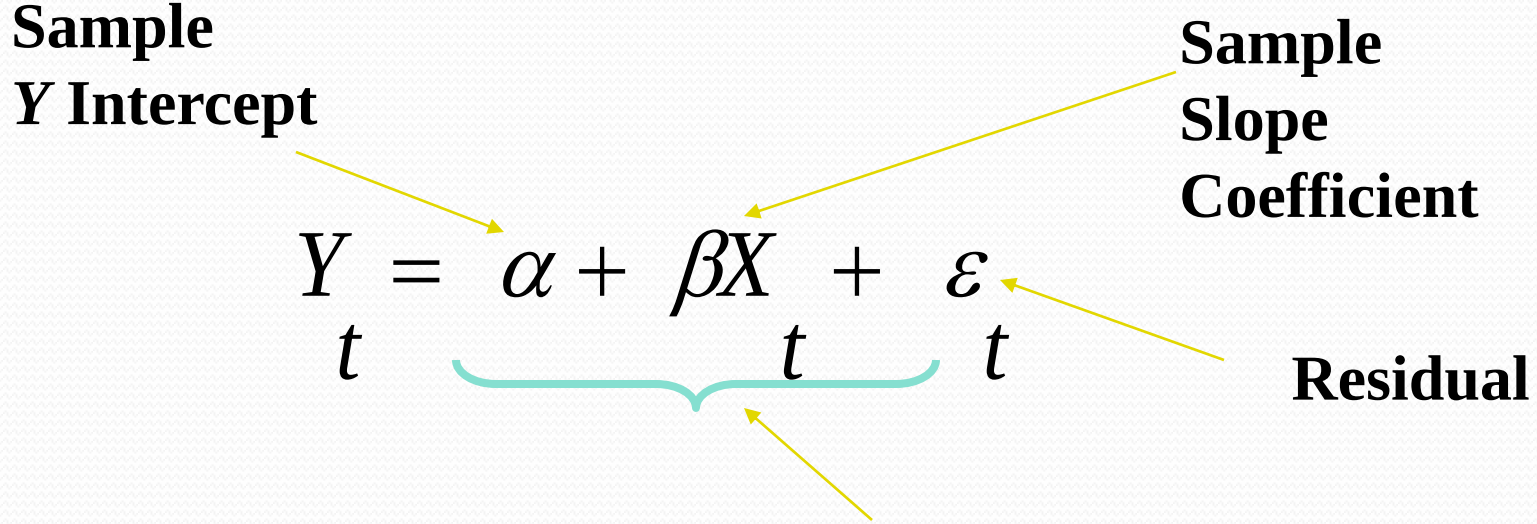


No Relationship



Linear Regression Equation

Sample regression line provides an *estimate* of the population regression line as well as a predicted value of Y.



$$\hat{Y} = a + bX$$

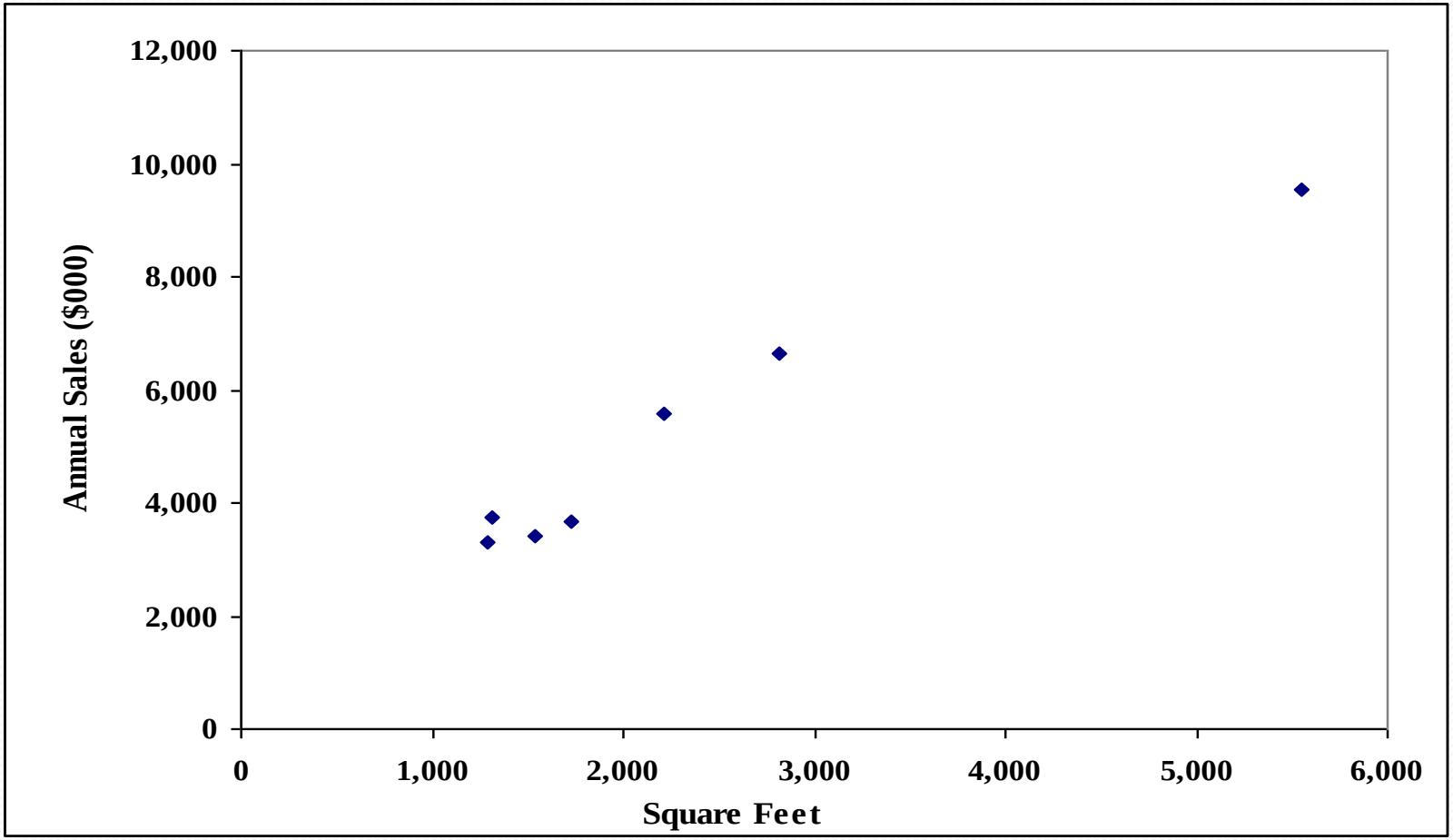
Simple Regression Equation (Fitted Regression Line, Predicted Value)

Simple Linear Regression: Example

You wish to examine the linear dependency of the annual sales of produce stores on their sizes in square footage. Sample data for seven stores were obtained. Find the equation of the straight line that best fits the data.

Store	Square Feet	Annual Sales ($1000)
1	1,726	3,681
2	1,542	3,395
3	2,816	6,653
4	5,555	9,543
5	1,292	3,318
6	2,208	5,563
7	1,313	3,760

Scatter Diagram: Example



Excel Output

Simple Linear Regression Equation: Example

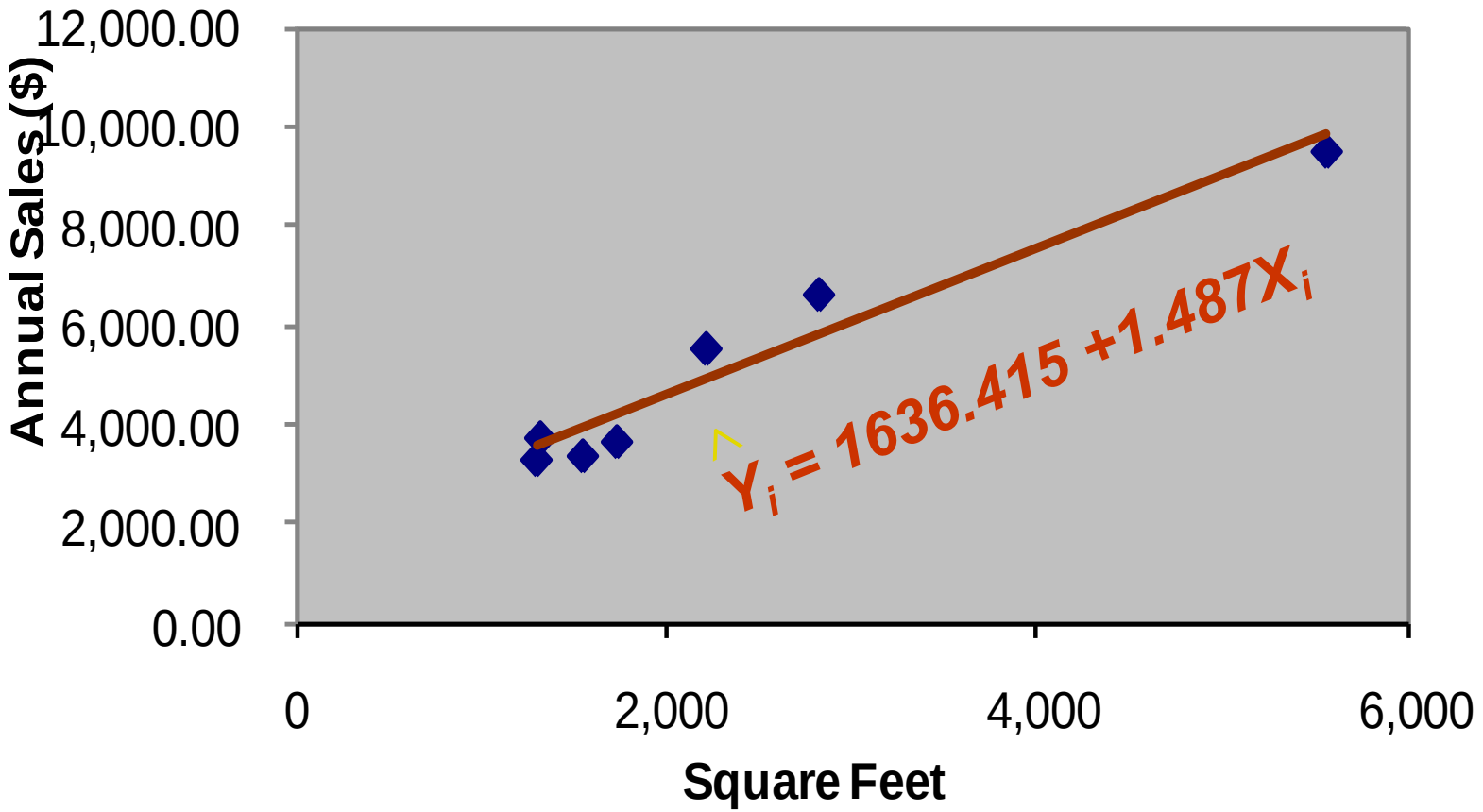
$$\hat{Y}_i = a + bX_i$$

$$= 1636.415 + 1.487 X_i$$

From Excel Printout:

Intercept	1636.415
Square Footage	1.486634

Graph of the Simple Linear Regression Equation: Example



Interpretation of Results: Example

$$\hat{Y}_i = 1636.415 + 1.487 X_i$$

The slope of 1.487 means that, for each increase of one unit in X, we predict the average of Y to increase by an estimated 1.487 units.

The equation estimates that, for each increase of 1 square foot in the size of the store, the expected annual sales are predicted to increase by $1,487.

Simple Linear Regression in Excel

- In Excel, use | Regression …
- EXCEL Spreadsheet of Regression Sales on Square Footage



Microsoft Excel Worksheet

Measures of Variation: The Sum of Squares

SST = **SSR** + **SSE**

Total Sample Variability = **Explained Variability** + **Unexplained Variability**

The ANOVA Table in Excel

ANOVA					
	df	**SS**	**MS**	***F***	***Significance F***
Regression	*k*	SSR	MSR=SSR/*k*	MSR/MSE	*P*-value of the *F* Test
Residuals	*n–k–1*	SSE	MSE= SSE/(n–k–1)		
Total	*n–1*	SST			

Measures of Variation
The Sum of Squares: Example

Excel Output for Produce Stores

Degrees of freedom

Regression (explained) df

ANOVA

	df	SS	MS	F	Significance F
Regression	1	30,380,456.12	30,380,456.12	81.17909	0.000281201
Residual	5	1,871,199.59	374,239.92		
Total	6	32,251,655.71			

Error (residual) df

Total df

SST

SSE

SSR

The Coefficient of Determination

- $$r^2 = \frac{\text{SSR}}{\text{SST}} = \frac{\text{Regression Sum of Squares}}{\text{Total Sum of Squares}}$$

- Measures the proportion of variation in Y that is explained by the independent variable X in the regression model.

Measures of Variation: Produce Store Example

Excel Output for Produce Stores

Regression Statistics	
Multiple *R*	0.9705572
R Square	0.94198129
Adjusted *R* Square	0.93037754
Standard Error	611.751517
Observations	7

$r^2 = 0.94$

S_{yx}

94% of the variation in annual sales can be explained by the variability in the size of the store as measured by square footage.

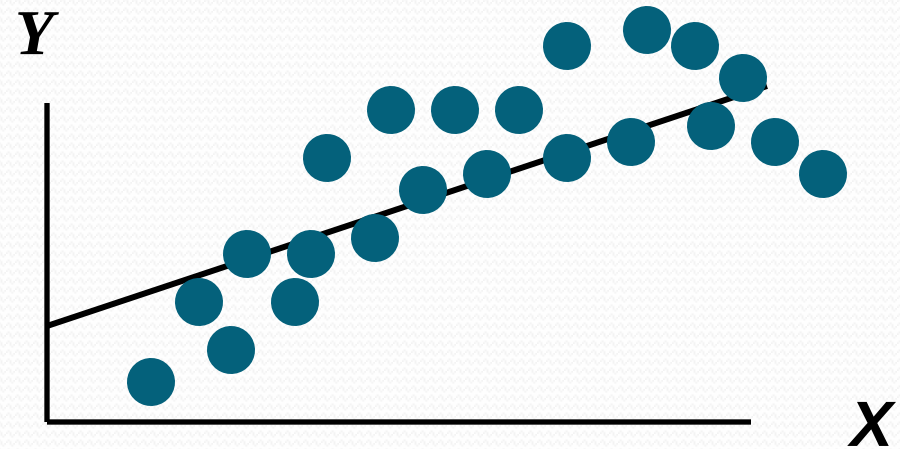
Linear Regression Assumptions

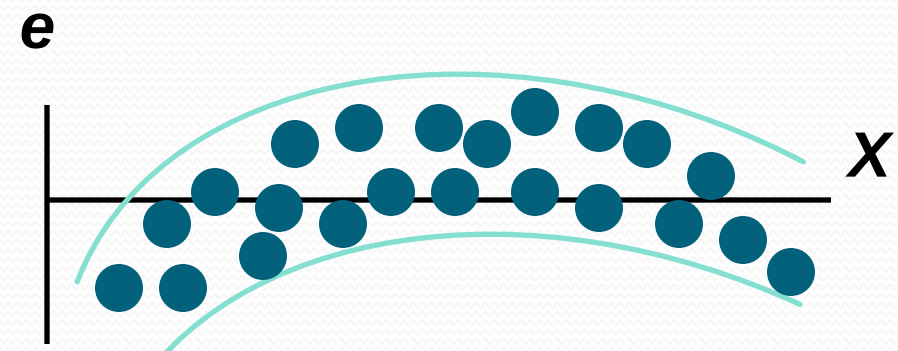
- Normality
  - *Y* values are normally distributed for each *X*.
  - Probability distribution of error is normal.
- 2. Homoscedasticity (Constant Variance)
- 3. Independence of Errors

Residual Analysis

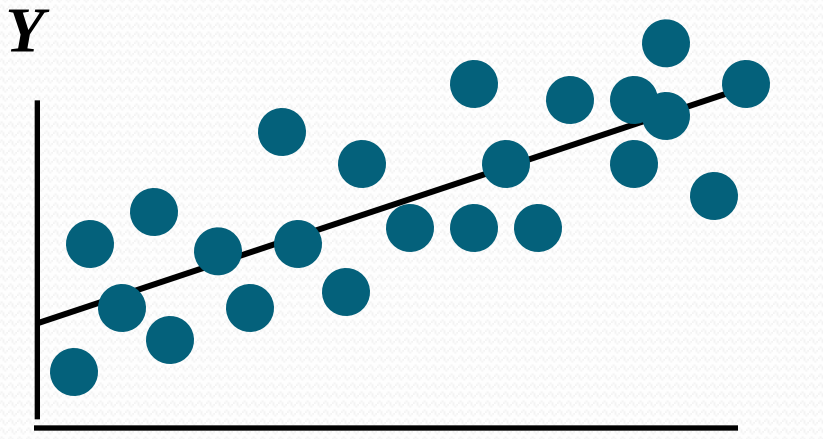
- Purposes
  - Examine linearity
  - Evaluate violations of assumptions
- Graphical Analysis of Residuals
  - Plot residuals vs. X and time

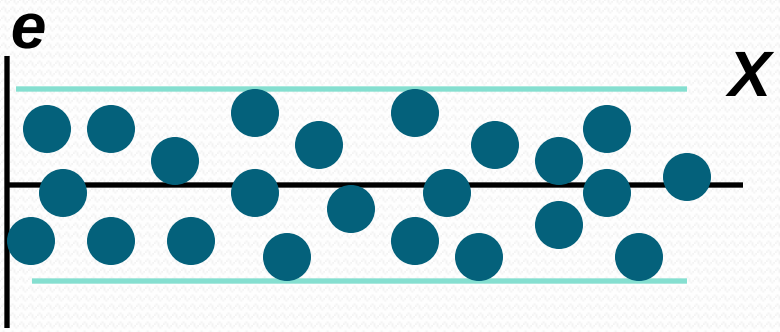
Residual Analysis for Linearity





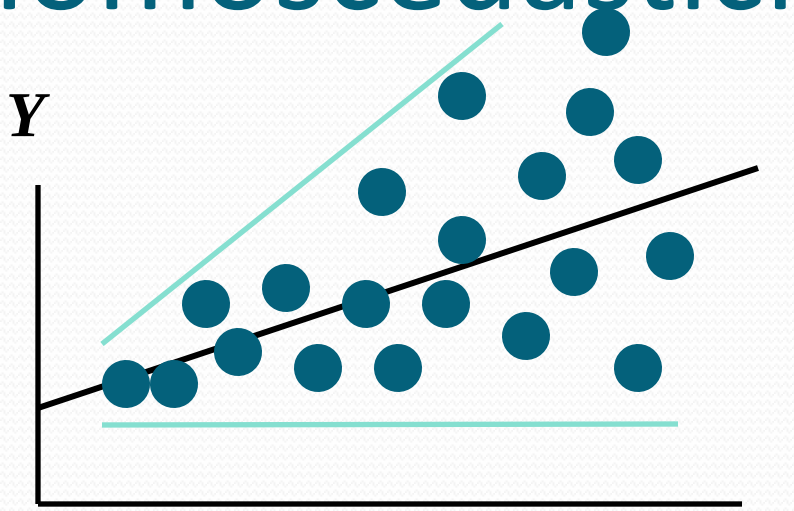
Not Linear

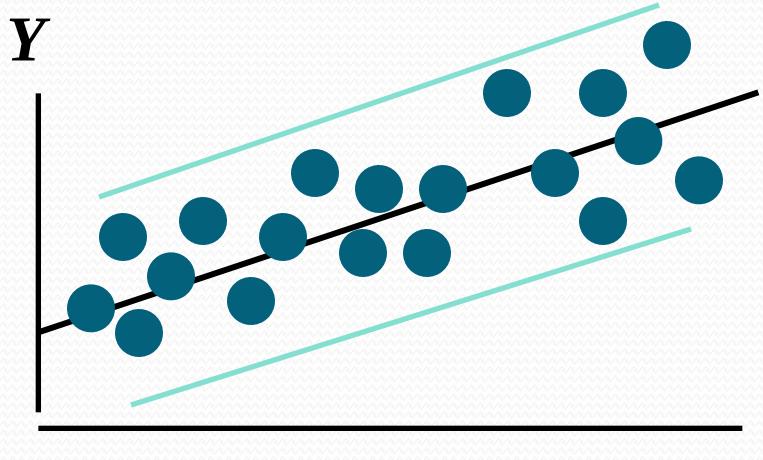


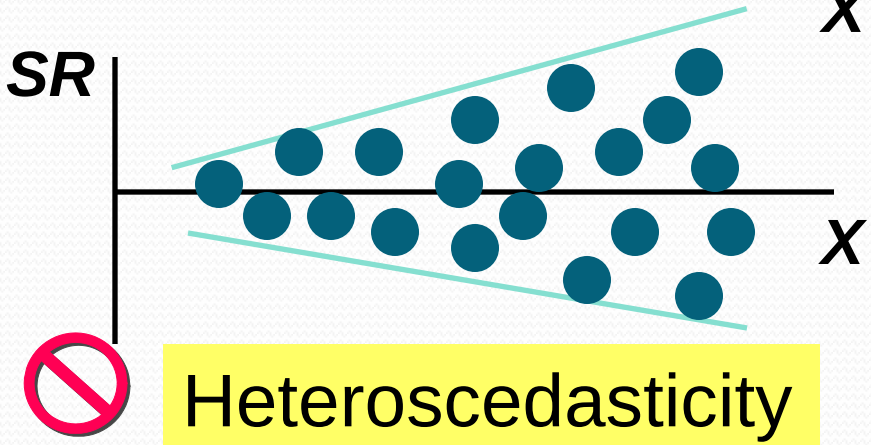


Linear

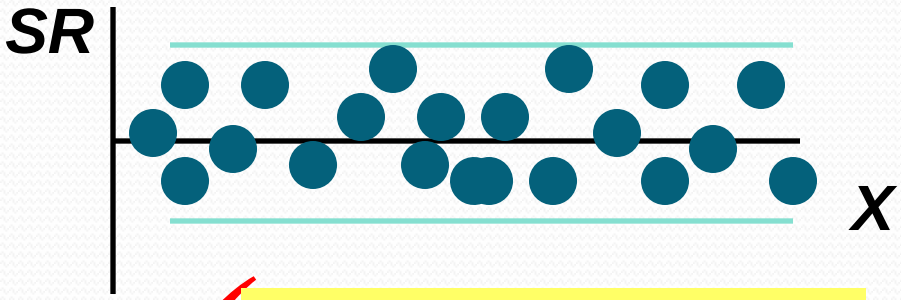
Residual Analysis for Homoscedasticity







Heteroscedasticity

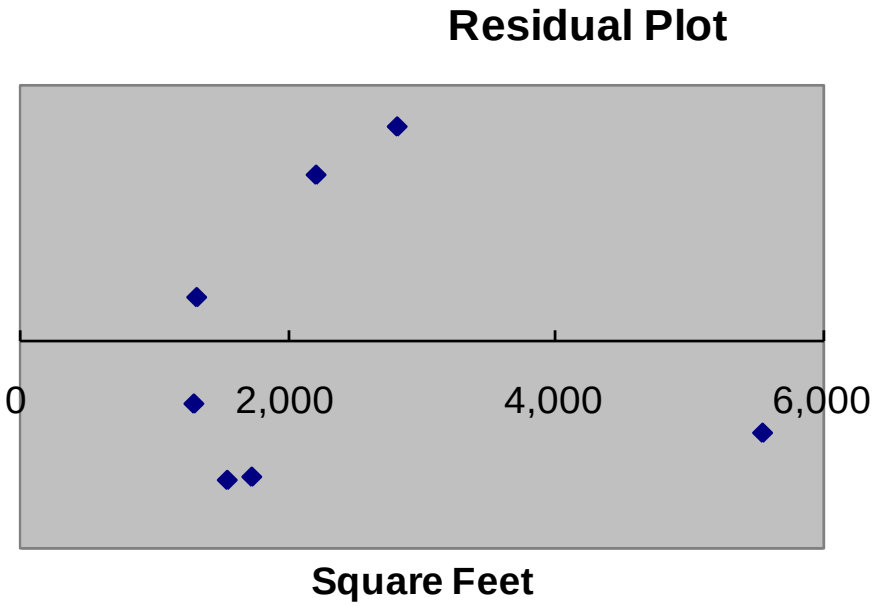


Homoscedasticity

Output for Produce Stores Example

Excel Output

Observation	Predicted Y	Residuals
1	4,202.34442	-$521.34442
2	3,928.80382	-$533.80382
3	5,822.77510	$830.22490
4	9,894.66469	-$351.66469
5	3,557.14541	-$239.14541
6	4,918.90184	$644.09816
7	3,588.36472	$171.63528



Residual Analysis for Independence

- The Durbin–Watson Statistic
  - Used when data are collected over time to detect autocorrelation (residuals in one time period are related to residuals in another period).
  - Measures the violation of the independence assumption

$$D = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

Should be close to 2.

If not, examine the model for autocorrelation.

Durbin–Watson Statistic in Minitab

- Minitab | Regression | Simple Linear Regression …
  - Check the box for Durbin–Watson Statistic

Obtaining the Critical Values of Durbin–Watson Statistic

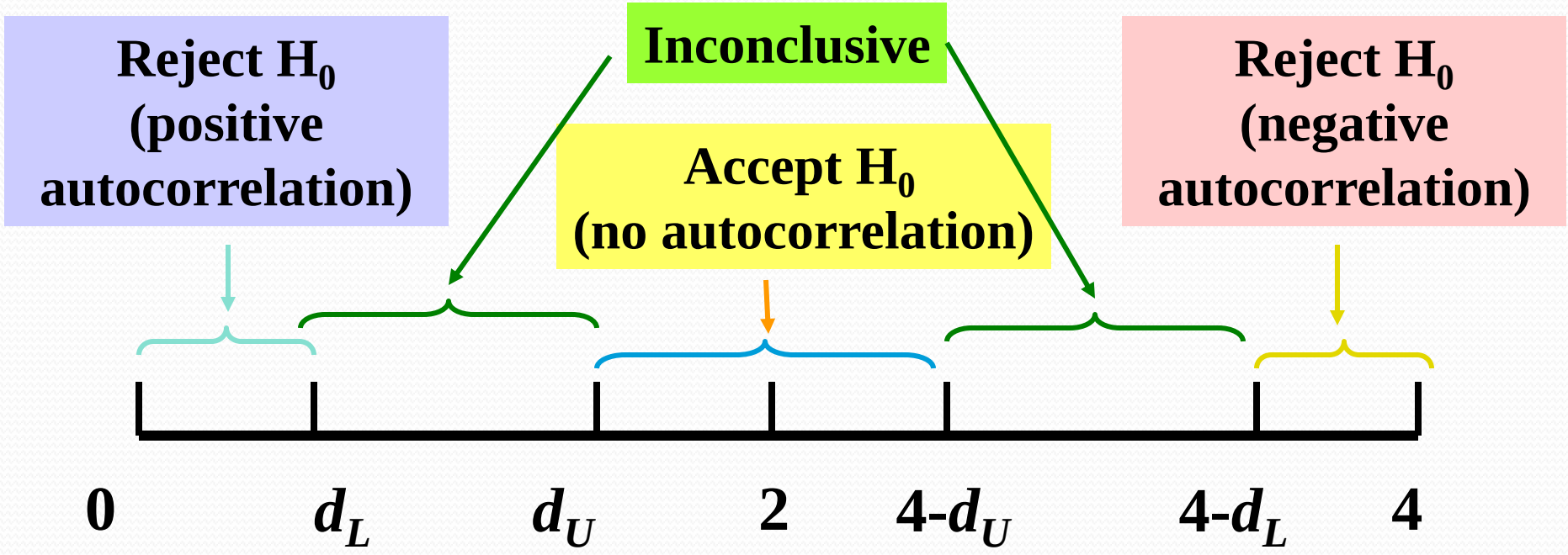
Finding the Critical Values of Durbin–Watson Statistic

$\alpha = .05$				
	$k=1$		$k=2$	
n	d_L	d_U	d_L	d_U
15	1.08	1.36	0.95	1.54
16	1.10	1.37	0.98	1.54

Using the Durbin–Watson Statistic

H_0 : No autocorrelation (error terms are independent).

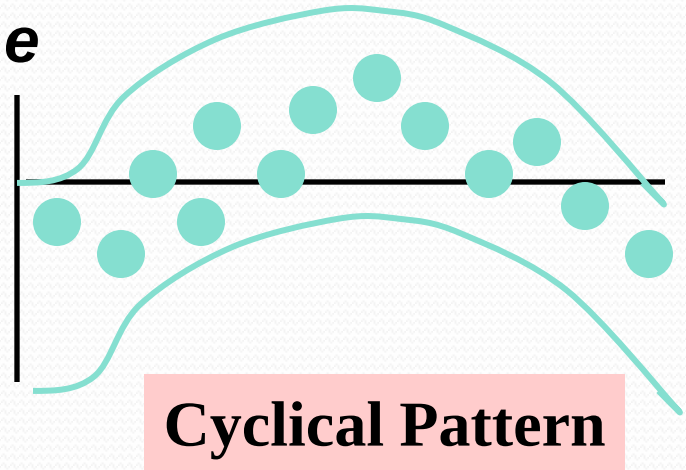
H_1 : There is autocorrelation (error terms are not independent).



Residual Analysis for Independence

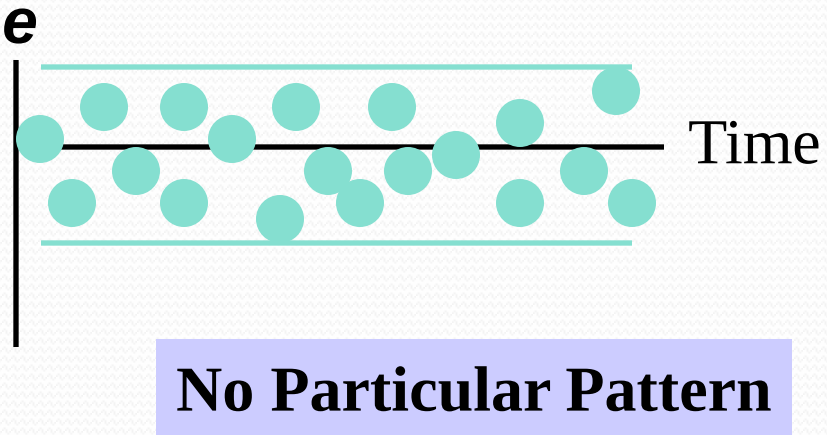
Graphical Approach

Not Independent



Cyclical Pattern

Independent



No Particular Pattern

Residual is plotted against time to detect any autocorrelation

Inference about the Slope: *t* Test

- *t* Test for a Population Slope
  - Is there a linear dependency of *Y* on *X* ?
- Null and Alternative Hypotheses
  - H_0: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)
- Test Statistic

$$t = \frac{b - \beta}{S_b} \quad \text{where} \quad S_b = \frac{S_{YX}}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}}$$

df = n - 2

Example: Produce Store

Data for Seven Stores:

Store	Square Feet	Annual Sales ($000)
1	1,726	3,681
2	1,542	3,395
3	2,816	6,653
4	5,555	9,543
5	1,292	3,318
6	2,208	5,563
7	1,313	3,760

Estimated Regression Equation:

$$\hat{Y} = 1636.415 + 1.487 X_i$$

The slope of this model is 1.487.

Does Square Footage Affect Annual Sales?

Inferences about the Slope: *t* Test Example

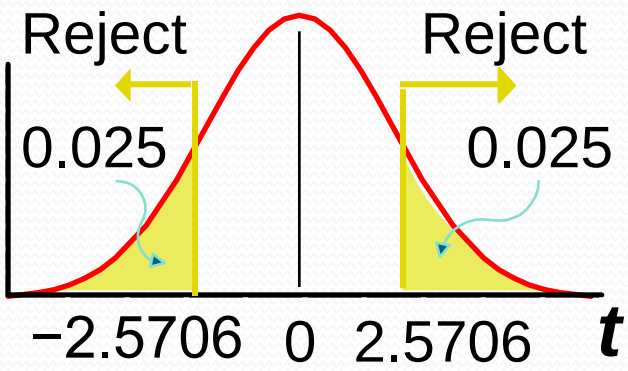
$H_0: \beta = 0$

$H_1: \beta \neq 0$

$\alpha = 0.05$

$df = 7 - 2 = 5$

Critical Value(s):



Test Statistic:

From Excel Printout

b S_b t

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	1636.4147	451.4953	3.6244	0.01515
Footage	1.4866	0.1650	9.0099	0.00028

Decision:

Reject H_0

Conclusion:

There is evidence that square footage affects annual sales.

Inferences about the Slope: *F* Test

- F Test for a Population Slope
  - Is there a linear dependency of Y on X ?
- Null and Alternative Hypotheses
  - H_0: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)
- Test Statistic

$$F = \frac{\frac{SSR}{1}}{\frac{SSE}{(n-2)}}$$

  - Numerator df=1, denominator df=n-2

Relationship between a *t* Test and an *F* Test

- Null and Alternative Hypotheses
  - H_o: $\beta = 0$ (No Linear Dependency)
  - H_1: $\beta \neq 0$ (Linear Dependency)

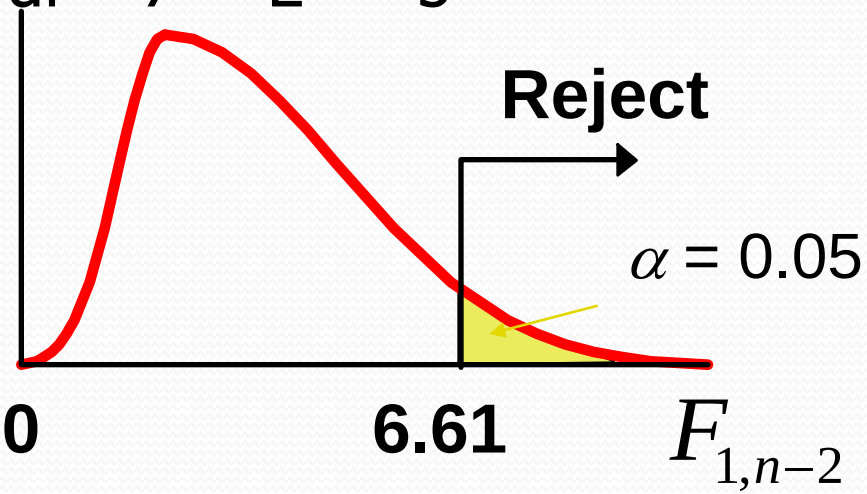
$$\left(t_{n-2}\right)^2 = F_{1,n-2}$$

Inferences about the Slope: *F* Test Example

H_0: $\beta = 0$
H_1: $\beta \neq 0$
$\alpha = 0.05$
numerator
df = 1
denominator
df = 7 − 2 = 5

Test Statistic:
From Excel Printout

ANOVA	df	SS	MS	F	Significance F
Regression	1	30,380,456.12	30,380,456.12	81.179	0.000281
Residual	5	1,871,199.59	374,239.92		
Total	6	32,251,655.71			



Decision: Reject H_0

Conclusion:

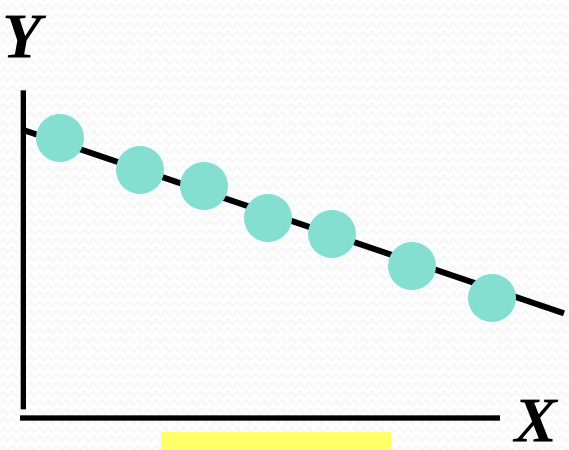
There is evidence that square footage affects annual sales.

Purpose of Correlation Analysis

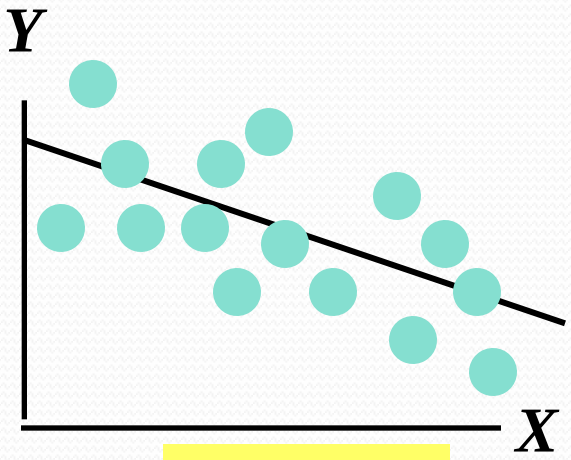
(continued)

- Population Correlation Coefficient ρ (rho) is used to measure the strength between the variables.
- Sample Correlation Coefficient r is an estimate of ρ and is used to measure the strength of the linear relationship in the sample observations.

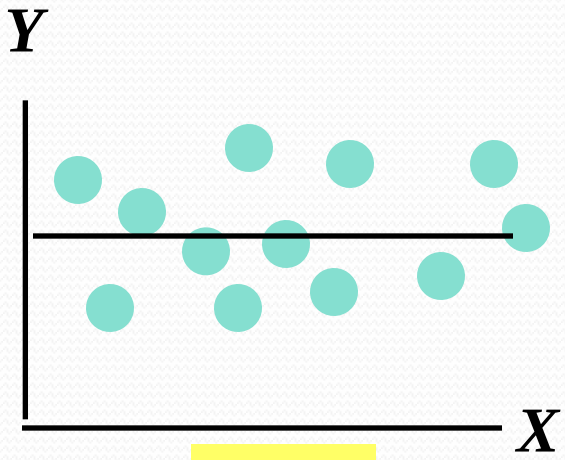
Sample of Observations from Various *r* Values



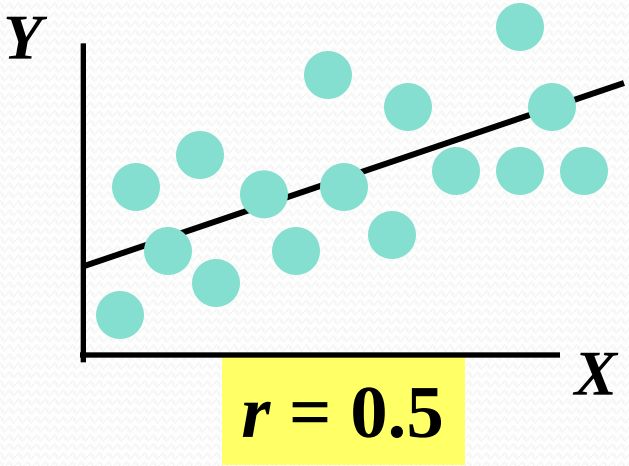
$r = -1$



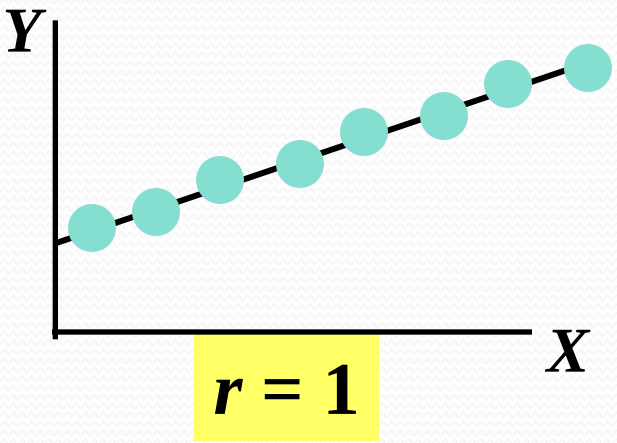
$r = -0.5$



$r = 0$



$r = 0.5$



$r = 1$

Features of ρ and r

- Unit Free
- Range between –1 and 1
- The Closer to –1, the Stronger the Negative Linear Relationship.
- The Closer to 1, the Stronger the Positive Linear Relationship.
- The Closer to 0, the Weaker the Linear Relationship.

Pitfalls of Regression Analysis

- Lacking an Awareness of the Assumptions Underlining Least-squares Regression.
- Not Knowing How to Evaluate the Assumptions.
- Not Knowing What the Alternatives to Least-squares Regression are if a Particular Assumption is Violated.
- Using a Regression Model Without Knowledge of the Subject Matter.

Strategy for Avoiding the Pitfalls of Regression

- Start with a scatter plot of *X* on *Y* to observe possible relationship.
- Perform residual analysis to check the assumptions.
- Use a normal probability plot of the residuals to uncover possible non-normality.

Strategy for Avoiding the Pitfalls of Regression *(continued)*

- If there is violation of any assumption, use alternative methods (e.g., least absolute deviation regression or least median of squares regression) to least-squares regression or alternative least-squares models (e.g., curvilinear or multiple regression).
- If there is no evidence of assumption violation, then test for the significance of the regression coefficients and construct confidence intervals and prediction intervals.

Summary

- Introduced Types of Regression Models.
- Discussed Determining the Simple Linear Regression Equation.
- Described Measures of Variation.
- Addressed Assumptions of Regression and Correlation.
- Discussed Residual Analysis.
- Addressed Measuring Autocorrelation.

Summary *(continued)*

- Described Inference about the Slope.
- Discussed Correlation—Measuring the Strength of the Association.
- Discussed Pitfalls in Regression and Ethical Issues.

Building the financial simulation model using articulated financial statements

Building the financial simulation model using articulated financial statements

- Once the accounts have been set, simulations then can be carried out.

Business Forecasting

8

Forecasting with Multiple Regression

Topics

- The Multiple Regression Model
- Estimating the Multiple Regression Model—The Least Squares Method
- The Standard Error of Estimate
- Multiple Correlation Analysis
  - Partial Correlation
  - Partial Coefficient of Determination

Topics

(continued)

- Inferences Regarding Regression and Correlation Coefficients
- The *F*-Test
- The t-test
- Confidence Interval
- Validation of the Regression Model for Forecasting
- Serial or Autocorrelation

Topics

(continued)

- Equal Variances or Homoscedasticity
- Multicollinearity
- Curvilinear Regression Analysis
  - The Polynomial Curve
- Application to Management
- Summary

The Multiple Regression Model

Relationship between one dependent and two or more independent variables is a linear function.

Population *Y*-intercept

Population slopes

Random Error

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \varepsilon_i$$

Dependent (Response) Variable

Independent (Explanatory) Variables

Interpretation of Estimated Coefficients

- Slope (b_i)
  - Estimated that the average value of Y changes by b_i for each 1 unit increase in Xi, holding all other variables constant (ceterus paribus).
  - Example: If $b_1 = -2$, then fuel oil usage (Y) is expected to decrease by an estimated 2 gallons for each 1 degree increase in temperature (X_1), given the inches of insulation (X_2).
- Y-Intercept (b_0)
  - The estimated average value of Y when all $X_i = 0$.

Multiple Regression Model: Example

Develop a model for estimating heating oil used for a single family home in the month of January, based on average temperature and amount of insulation in inches.



Oil (Gal)	Temp (°F)	Insulation
267.00	38	4
350.00	25	3
158.30	39	11
45.30	76	8
88.00	66	9
210.80	32	8
350.50	11	7
310.60	6	11
232.80	25	12
130.90	59	4
34.70	63	11
216.70	40	5
398.50	20	4
302.80	37	4
65.40	54	12

Multiple Regression Equation: Example

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + \cdots + b_k X_{ki}$$

Excel Output

	Coefficients
Intercept	515.8174635
Temperature	-4.860259128
Insulation	-15.0668036

$$\hat{Y}_i = 515.82 - 4.86 X_{1i} - 15.07 X_{2i}$$

For each degree increase in temperature, the estimated average amount of heating oil used is decreased by 4.86 gallons, holding insulation constant.

For each increase in one inch of insulation, the estimated average use of heating oil is decreased by 15.07 gallons, holding temperature constant.

Multiple Regression Using Excel

- Stat | Regression …

- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Simple and Multiple Regression Compared

- Coefficients in a *simple* regression pick up the impact of that variable (plus the impacts of other variables that are correlated with it) and the dependent variable.
- Coefficients in a *multiple* regression account for the impacts of the other variables in the equation.

Simple and Multiple Regression Compared: Example

- Two simple regressions:

$$\text{Oil} = \beta_0 + \beta_1 \text{ Temp} + \varepsilon_i$$

$$\text{Oil} = \beta_0 + \beta_1 \text{ Insulation} + \varepsilon_i$$

- Multiple Regression:

$$\text{Oil} = \beta_0 + \beta_1 \text{ Temp} + \beta_2 \text{ Insulation} + \varepsilon_i$$

Standard Error of Estimate

- Measures the standard deviation of the residuals about the regression plane, and thus specifies the amount of error incurred when the least squares regression equation is used to predict values of the dependent variable.
- The standard error of estimate is computed by using the following equation:

$$s_e = \sqrt{\frac{\text{SSE}}{n-k-1}}$$

Coefficient of *Multiple* Determination

- Proportion of total variation in Y explained by all X Variables taken together.
  - $$r^2_{Y.12\ldots k} = \frac{\text{SSR}}{\text{SST}} = \frac{\text{Explained Variation}}{\text{Total Variation}}$$
- Never decreases when a new X variable is added to model.
  - Disadvantage when comparing models.

Adjusted Coefficient of Multiple Determination

- Proportion of variation in Y explained by all X variables adjusted for the number of X variables used and sample size:
  - $$r^2_{adj} = 1 - \left[\left(1 - r^2_{Y \bullet 12 \cdots k}\right) \frac{n-1}{n-k-1} \right]$$
  - Penalizes excessive use of independent variables.
  - Smaller than $r^2_{Y \bullet 12 \cdots k}$.
  - Useful in comparing among models.

Coefficient of Multiple Determination

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.98145
R Square	0.963245
Adjusted R Square	0.957119
Standard Error	24.74983
Observations	15

$$r^2_{Y.12..k} = \frac{SSR}{SST}$$

Adjusted R^2

- **Reflects the number of explanatory variables and sample size**
- **Is smaller than R^2**

Interpretation of Coefficient of Multiple Determination

$$r^2_{Y.12} = \frac{\text{SSR}}{\text{SST}} = 0.9632$$

- 96.32% of the total variation in heating oil can be explained by temperature and amount of insulation.

$$r^2_{adj} = 0.9571$$

- 95.71% of the total fluctuation in heating oil can be explained by temperature and amount of insulation after adjusting for the number of explanatory variables and sample size.

Using The Regression Equation to Make Predictions

Predict the amount of heating oil used for a home if the average temperature is 30° and the insulation is 6 inches.

$$\hat{Y}_i = 515.82 - 4.86X_{1i} - 15.07X_{2i}$$

$$= 515.82 - 4.86(28) - 15.07(5)$$

$$= 304.39$$

The predicted heating oil used is 304.39 gallons.

Predictions Using Excel

- Stat | Regression …
  - Check the "Confidence and Prediction Interval Estimate" box
- EXCEL spreadsheet for the heating oil example.

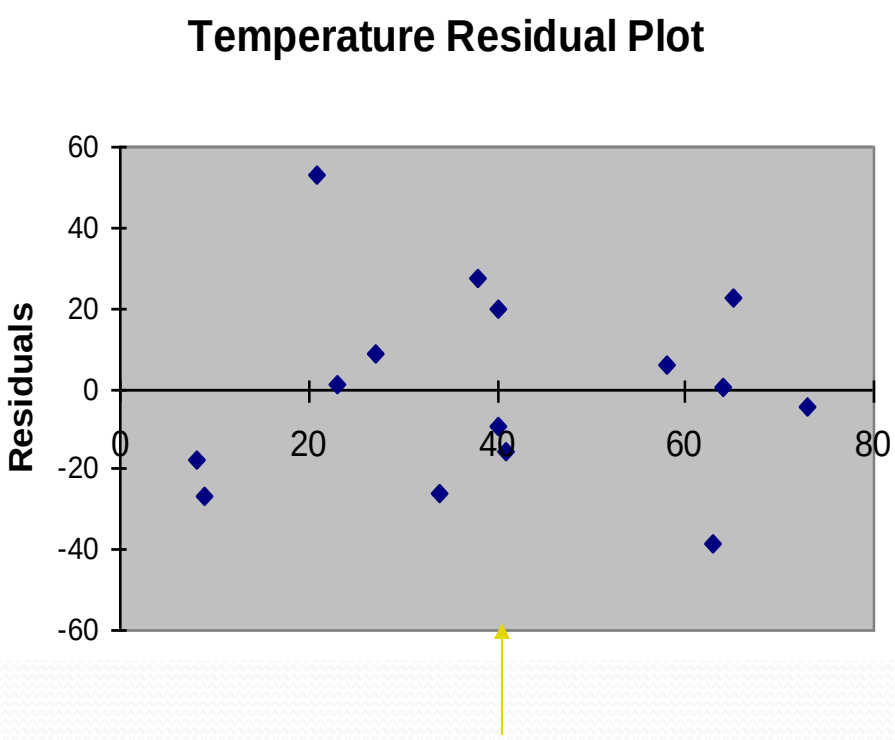


Microsoft Excel Worksheet

Residual Plots

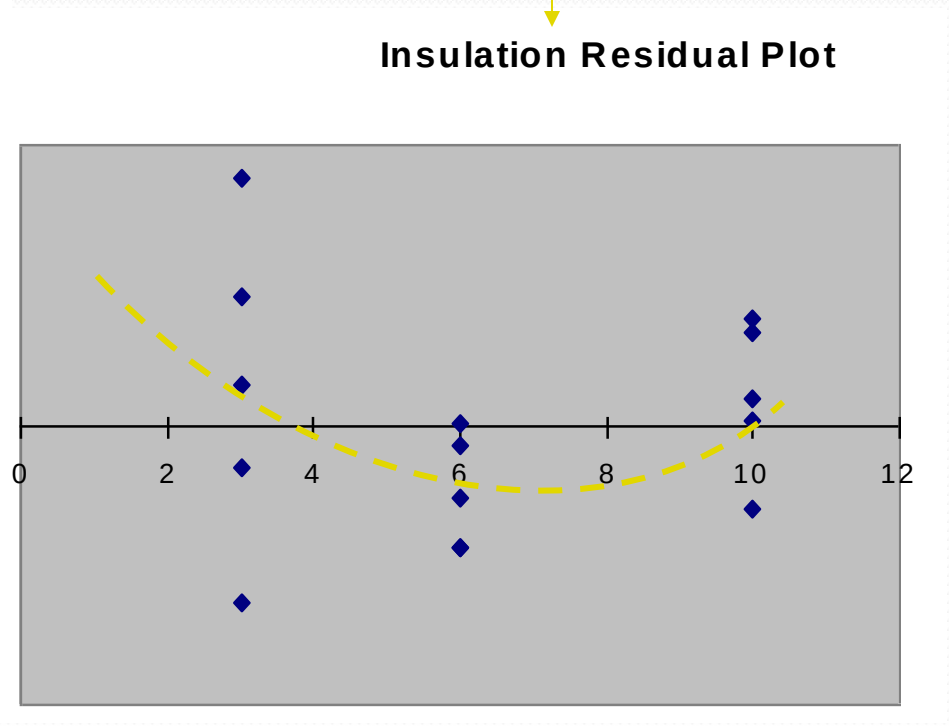
- Residuals vs. $\hat{Y}$
  - May need to transform *Y* variable.
- Residuals vs. X_1
  - May need to transform variable.
- Residuals vs. X_2
  - May need to transform variable.
- Residuals vs. Time
  - May have autocorrelation.

Residual Plots: Example



No Discernible Pattern

May be some non-linear relationship.



Testing for Overall Significance

- Shows if there is a linear relationship between all of the X variables together and Y.
- Use F test statistic.
- Hypotheses:
  - H_o: $\beta_1 = \beta_2 = \ldots = \beta_k = 0$ (No linear relationship)
  - H_1: At least one $\beta_i \neq 0$ (At least one independent variable affects Y.)
- The Null Hypothesis is a very strong statement.
- The Null Hypothesis is almost always rejected.

Testing for Overall Significance

(continued)

- Test Statistic:

$$F = \frac{\mathrm{MSR}}{\mathrm{MSE}} = \frac{\mathrm{SSR(all)}/k}{\mathrm{MSE(all)}}$$

  - where F has k numerator and $(n\text{-}k\text{-}1)$ denominator degrees of freedom.

Test for Overall Significance

Excel Output: Example

ANOVA					
	df	SS	MS	*F*	*Significance F*
Regression	2	192637.4	96318.69	157.241063	2.4656E-09
Residual	12	7350.651	612.5543		
Total	14	199988			

k = 2, the number of explanatory variables.

n - 1

p value

$$\frac{\mathrm{MSR}}{\mathrm{MSE}} = F \text{ Test Statistic}$$

Test for Overall Significance Example Solution

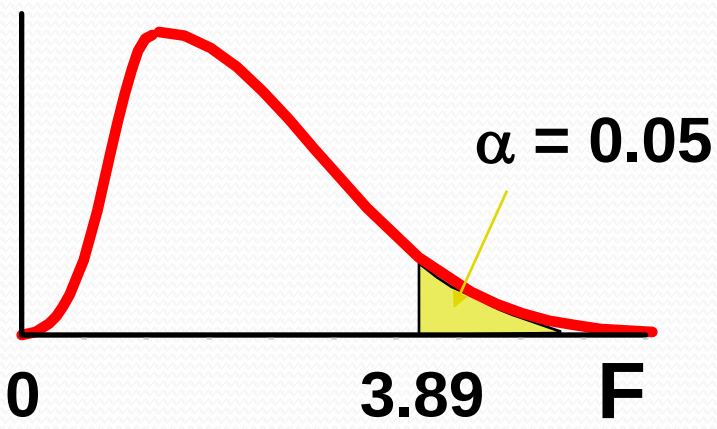
$H_0: \beta_1 = \beta_2 = \ldots = \beta_k = 0$

$H_1:$ At least one $\beta_i \neq 0$

$\alpha = 0.05$

df = 2 and 12

Critical Value:



Test Statistic:

$F = 157.24$

(Excel Output)

Decision:

Reject at $\alpha = 0.05$

Conclusion:

There is evidence that at least one independent variable affects Y.

Test for Significance: Individual Variables

- Shows if there is a linear relationship between the variable X_i and Y.
- Use t Test Statistic.
- Hypotheses:
  - H_0: $\beta_i = 0$ (No linear relationship.)
  - H_1: $\beta_i \neq 0$ (Linear relationship between X_i and Y.)

t Test Statistic
Excel Output: Example

t Test Statistic for X_1 (Temperature)

	Coefficients	*Standard Error*	t *Stat*
Intercept	515.8174635	19.61379316	26.29871
Temperature	-4.860259128	0.322210331	-15.0841
Insulation	-15.0668036	1.996236982	-7.5476

$$t = \frac{b_i}{S_{b_i}}$$

t Test Statistic for X_2 (Insulation)

t Test : Example Solution

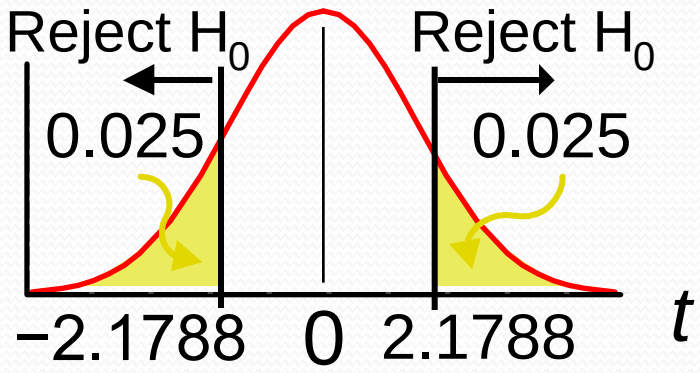
Does temperature have a significant effect on monthly consumption of heating oil? Test at $\alpha = 0.05$.

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

df = 12

Critical Values:



Test Statistic:

t Test Statistic = –15.084

Decision:

Reject H_0 at $\alpha = 0.05$

Conclusion:

There is evidence of a significant effect of temperature on oil consumption.

Confidence Interval Estimate for the Slope

Provide the 95% confidence interval for the population slope β_1 (the effect of temperature on oil consumption).

$$b_1 \pm t_{n-p-1} S_{b_1}$$

	Lower 95%	*Upper 95%*
Intercept	473.0827	558.5522
Temp	-5.562295	-4.158223
Insulation	-19.41623	-10.71738

$$-5.56 \leq \beta_1 \leq -4.15$$

The estimated average consumption of oil is reduced by between 4.15 gallons and 5.56 gallons for each increase of 1° F.

Contribution of a Single Independent Variable X_k

- Let X_k be the independent variable of interest
- $$\text{SSR}\left\langle X_k \,\middle|\, \text{all others except } X_k \right\rangle$$
  $$= \text{SSR(all)} - \text{SSR(all others except } X_k)$$
  - Measures the contribution of X_k in explaining the total variation in Y.

Contribution of a Single Independent Variable X_k

$$\mathrm{SSR}\left\langle X_1 \middle| X_2 \text{ and } X_3 \right\rangle$$

$$= \mathrm{SSR}(X_1, X_2, \text{and } X_3) - \mathrm{SSR}(X_2, \text{and } X_3)$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i}$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_2 X_{2i} + b_3 X_{3i}$$

Measures the contribution of X_1 in explaining Y.

Coefficient of Partial Determination of X_k

- $$r_{Yk.\text{all others}} = \frac{\text{SSR}\left\langle \text{X}_k \,\middle|\, \text{all others} \right\rangle}{\text{SST} - \text{SSR(all)} + \text{SSR}\left\langle \text{X}_\text{k} \,\middle|\, \text{all others} \right\rangle}$$

- Measures the proportion of variation in the dependent variable that is explained by X_k , while controlling for (Holding Constant) the other independent variables.

Coefficient of Partial Determination for X_k *(continued)*

Example: Model with two independent variables

$$r^2_{Y1.2} = \frac{\text{SSR}\left(X_1 \mid X_2\right)}{\text{SST} - \text{SSR}(X_1, X_2) + \text{SSR}\left(X_1 \mid X_2\right)}$$

Coefficient of Partial Determination in Excel

- Stat | Regression…
  - Check the "Coefficient of partial determination" box.
- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Contribution of a Subset of Independent Variables

- Let X_s be the subset of independent variables of interest
  - $$SSR\left(X_s \mid \text{all others except } X_s\right)$$
    $$= SSR(\text{all}) - SSR(\text{all others except } X_s)$$
  - Measures the contribution of the subset X_s in explaining SST.

Contribution of a Subset of Independent Variables: Example

Let X_s be X_1 and X_3

$$\text{SSR}\left(X_1 \text{ and } X_3 \mid X_2\right)$$

$$= \text{SSR}(X_1, X_2, \text{and } X_3) - \text{SSR}(X_2)$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + b_3 X_{3i}$$

From ANOVA section of regression for:

$$\hat{Y}_i = b_0 + b_2 X_{2i}$$

Testing Portions of Model

- Examines the contribution of a subset X_s of explanatory variables to the relationship with Y.
- Null Hypothesis:
  - Variables in the subset do not improve significantly the model when all other variables are included.
- Alternative Hypothesis:
  - At least one variable is significant.

Testing Portions of Model *(continued)*

- One-tailed Rejection Region
- Requires comparison of two regressions:
  - One regression includes everything.
  - Another regression includes everything except the portion to be tested.

Contribution of a Subset of *X* variables

- Hypotheses:
  - H_0 : Variables X_s do not significantly improve the model, given all other variables included.
  - H_1 : Variables X_s significantly improve the model, given all others included.
- Test Statistic:

$$F = \frac{\mathrm{SSR}\left(\mathrm{X_s} \,\middle|\, \text{all others}\right) / m}{\mathrm{MSE\,(all)}}$$

  - with df = m and $(n\text{-}k\text{-}1)$
  - m = # of variables in the subset X_s .

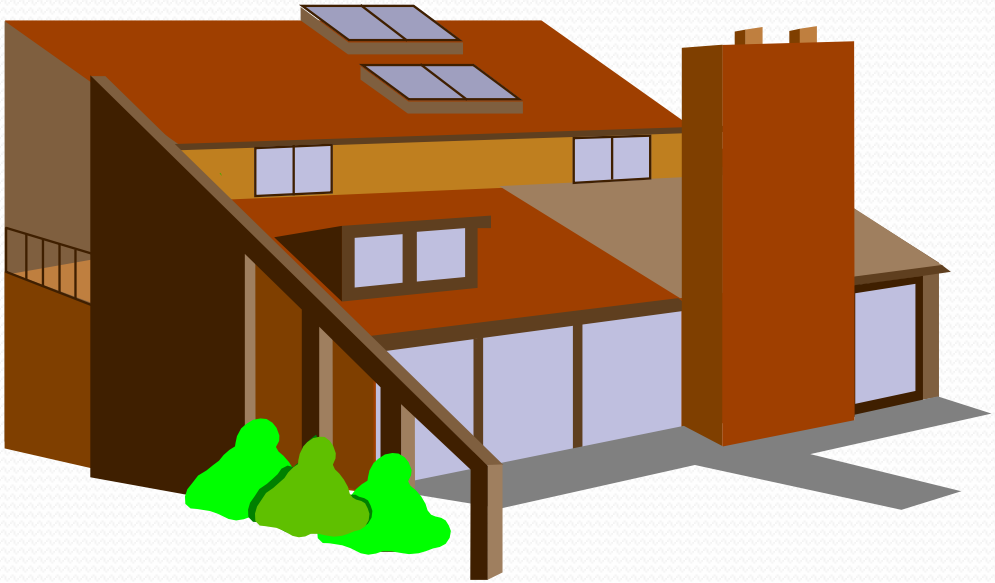
Partial *F* Test for the Contribution of a Single X_j

- Hypotheses:
  - H_0 : Variable X_j does not significantly improve the model, given all others included.
  - H_1 : Variable X_j significantly improves the model, given all others included.
- Test Statistic:

$$F = \frac{\text{SSR}\left(X_j \,\middle|\, \text{all others}\right)/m}{\text{MSE(all)}}$$

  - With df = 1 and $(n-k-1)$
  - $m = 1$ here

Testing Portions of Model: Example



Test at the $\alpha = 0.05$ level to determine if the variable of average temperature significantly improves the model, given that insulation is included.

Testing Portions of Model: Example

H_0: X_1 (temperature) does not improve model with X_2 (insulation) included.

H_1: X_1 does improve model

α = 0.05, df = 1 and 12

Critical Value = 4.75

(For X_1 and X_2)

	df	SS	MS
Regression	2	192,637.37	96,318.69
Residual	12	7,350.65	612.5543
Total	14	199,988.02	

(For X_2)

	df	SS
Regression	1	53,262.49
Residual	13	146,725.53
Total	14	199,988.02

$$F = \frac{SSR\langle X_1 | X_2 \rangle}{MSE(X_1, X_2)} = \frac{(192{,}637 - 53{,}262)}{612.55} = 227.53$$

Conclusion: Reject H_0; X_1 does improve model.

Testing Portions of Model in Excel

- Stat | Regression…
  - Calculations for this example are given in the spreadsheet. When using Minitab, simply check the box for "partial coefficient of determination.
- EXCEL spreadsheet for the heating oil example.



Microsoft Excel Worksheet

Do We Need to Do This for One Variable?

- The *F* Test for the inclusion of a single variable after all other variables are included in the model is IDENTICAL to the *t* Test of the slope for that variable.
- The only reason to do an *F* Test is to test several variables together.

The Quadratic Regression Model

- Relationship between the response variable and the explanatory variable is a quadratic polynomial function.
- Useful when scatter diagram indicates non-linear relationship.
- Quadratic Model:

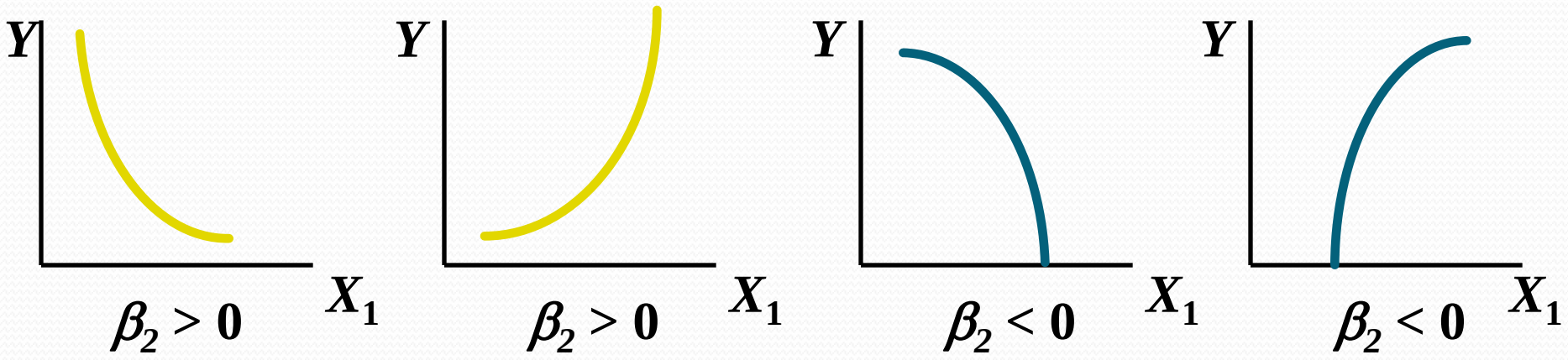
$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{1i}^2 + \varepsilon_i$$

- The second explanatory variable is the square of the first variable.

Quadratic Regression Model

(continued)

Quadratic model may be considered when a scatter diagram takes on the following shapes:



β_2 = the coefficient of the quadratic term.

Testing for Significance: Quadratic Model

- Testing for Overall Relationship
  - Similar to test for linear model
  - F test statistic = $\frac{MSR}{MSE}$
- Testing the Quadratic Effect
  - Compare quadratic model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{1i}^2 + \varepsilon_i$$

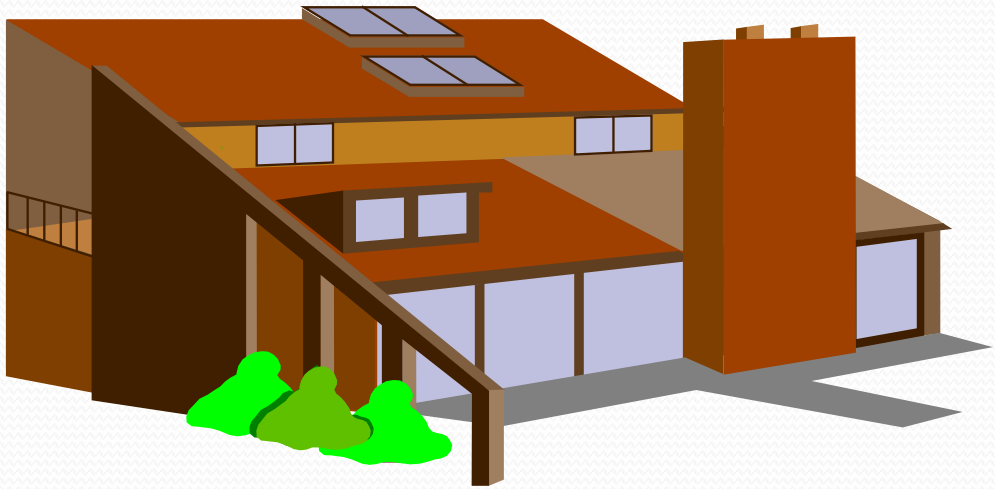
with the linear model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_i$$

  - Hypotheses:
    - $H_0 : \beta_2 = 0$ (No quadratic term.)
    - $H_1 : \beta_2 \neq 0$ (Quadratic term is needed.)

Heating Oil Example

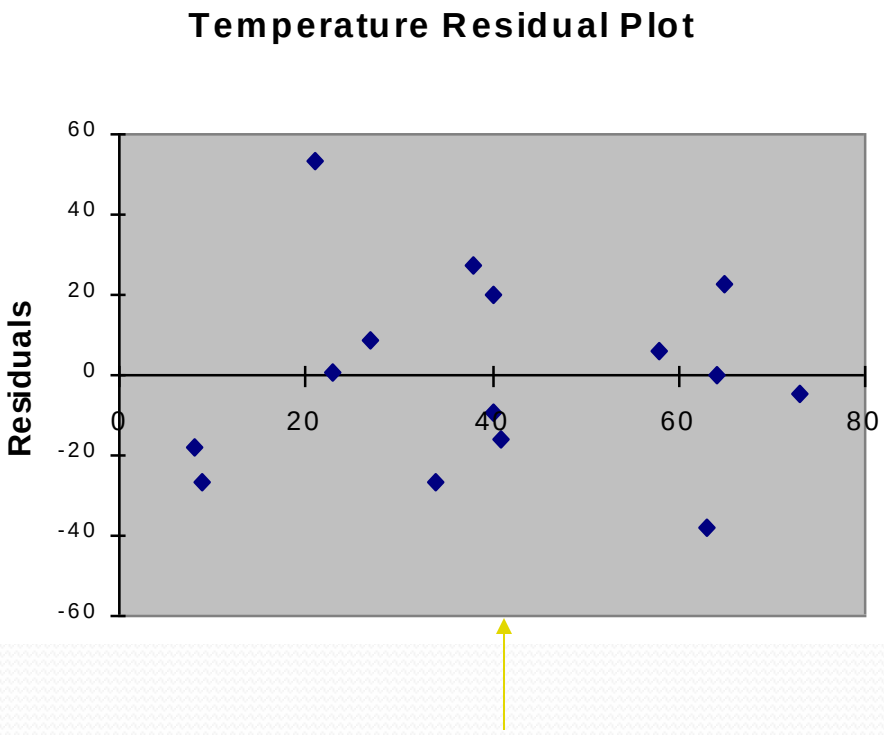
Determine if a quadratic model is needed for estimating heating oil used for a single family home in the month of January based on average temperature and amount of insulation in inches.



Oil (Gal)	Temp (°F)	Insulation
267.00	38	4
350.00	25	3
158.30	39	11
45.30	76	8
88.00	66	9
210.80	32	8
350.50	11	7
310.60	6	11
232.80	25	12
130.90	59	4
34.70	63	11
216.70	40	5
398.50	20	4
302.80	37	4
65.40	54	12

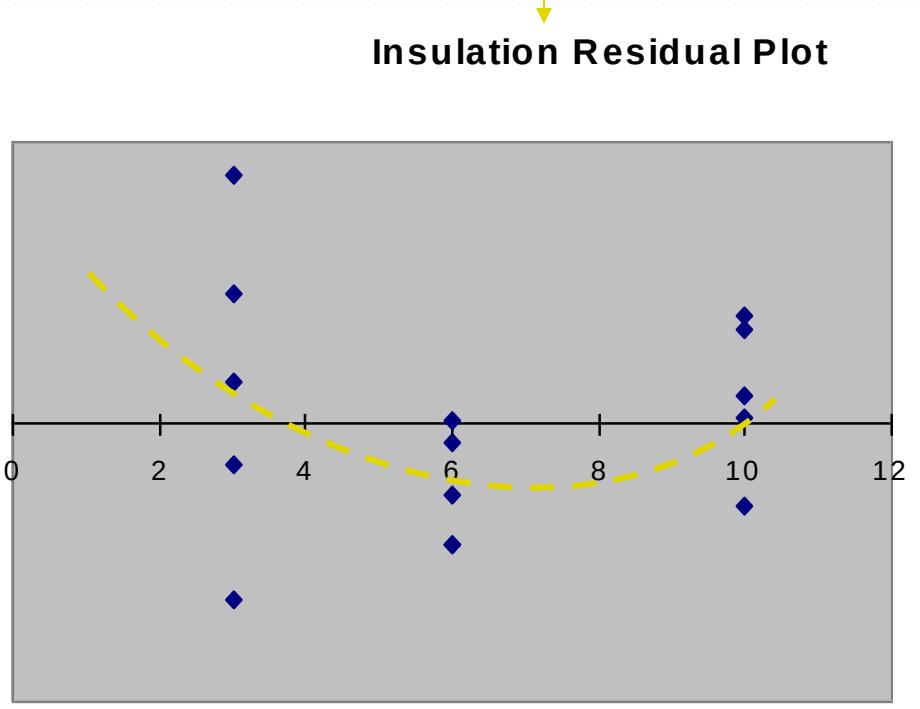
Heating Oil Example: Residual Analysis

(continued)



No Discernible Pattern

Possible non-linear relationship



Heating Oil Example: *t* Test for Quadratic Model *(continued)*

- Testing the Quadratic Effect
  - Model with quadratic insulation term:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{2i}^2 + \varepsilon_i$$

  - Model without quadratic insulation term:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i$$

  - Hypotheses
    - $H_0 : \beta_3 = 0$ (No quadratic term in insulation.)
    - $H_1 : \beta_3 \neq 0$ (Quadratic term is needed in insulation.)

Example Solution

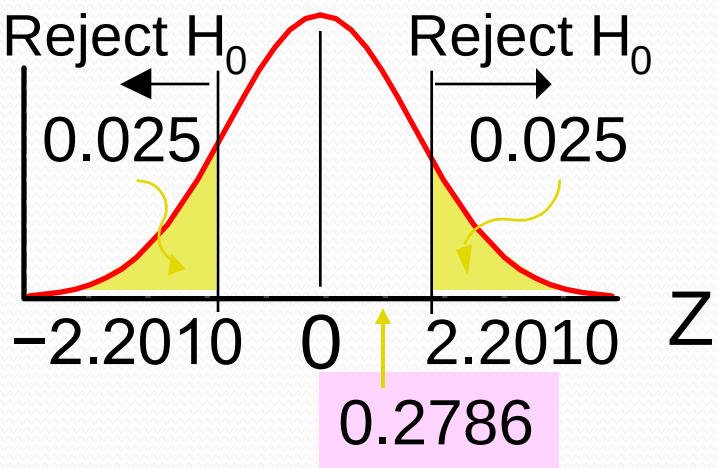
Is quadratic term in insulation needed on monthly consumption of heating oil? Test at $\alpha = 0.05$.

H_0: $\beta_3 = 0$

H_1: $\beta_3 \neq 0$

df = 11

Critical Values:



$$t = \frac{b_3 - \beta_3}{S_{b_3}} = \frac{0.2768}{0.9934} = 0.2786$$

Do not reject H_0 at $\alpha = 0.05$.

There is not sufficient evidence for the need to include quadratic effect of insulation on oil consumption.

Validation of the Regression Model

- Are there violations of the multiple regression assumption?
  - Linearity
  - Autocorrelation
  - Normality
  - Homoscedasticity

Validation of the Regression Model *(Continued…)*

- The independent variables are nonrandom variables whose values are fixed.
- The error term has an expected value of zero.
- The independent variables are independent of each other.

Linearity

- How do we know if the assumption is violated?
  - Perform regression analysis on the various forms of the model and observe which model fits best.
  - Examine the residuals when plotted against the fitted values.
  - Use the Lagrange Multiplier Test.

Linearity (*continued*)

- Linearity assumption is met by transforming the data using any one of several transformation techniques.
  - Logarithmic Transformation
  - Square-root Transformation
  - Arc-Sine Transformation

Serial or Autocorrelation

- Assumption of the independence of *Y* values is not met.
- A major cause of autocorrelated error terms is the misspecification of the model.
- Two approaches to determine if autocorrelation exists:
  - Examine the plot of the error terms as well as the signs of the error term over time.

Serial or Autocorrelation

(*continued*)

- Durbin–Watson statistic could be used as a measure of autocorrelation:

$$\mathrm{DW} = d = \frac{\sum_{t=2}^{n} (e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2}$$

Serial or Autocorrelation

(*continued*)

- Serial correlation may be caused by misspecification error such as an omitted variable, or it can be caused by correlated error terms.
- Serial correlation problems can be remedied by a variety of techniques:
  - Cochrane–Orcutt and Hildreth–Lu iterative procedures

Serial or Autocorrelation

(*continued*)

- Generalized least square
- Improved specification
- Various autoregressive methodologies
- First-order differences

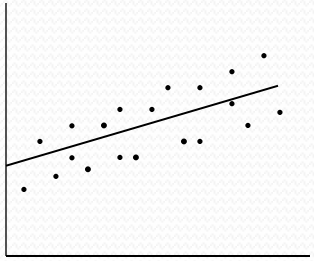
Homoscedasticity

- One of the assumptions of the regression model is that the error terms all have equal variances.
- This condition of equal variance is known as homoscedasticity.
- Violation of the assumption of equal variances gives rise to the problem of heteroscedasticity.
- How do we know if we have heteroscedastic condition?

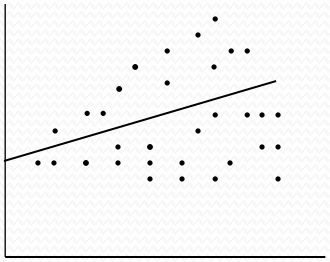
Homoscedasticity

- Plot the residuals against the values of *X*.
- When there is a constant variance appearing as a band around the predicted values, then we do not have to be concerned about heteroscedasticity.

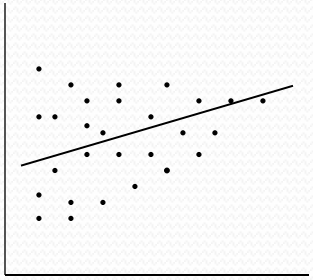
Homoscedasticity



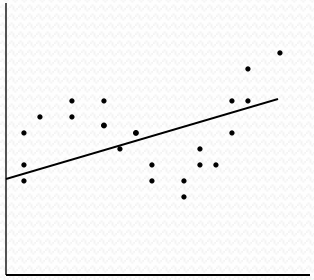
Constant Variance



Fluctuating Variance



Fluctuating Variance



Fluctuating Variance

Homoscedasticity

- Several approaches have been developed to test for the presence of heteroscedasticity.
  - Goldfeld–Quandt test
  - Breusch–Pagan test
  - White's test
  - Engle's ARCH test

Homoscedasticity Goldfeld–Quandt Test

- This test compares the variance of one part of the sample with another using the *F*-test.
- To perform the test, we follow these steps:
  - Sort the data from low to high of the independent variable that is suspect for heteroscedasticity.
  - Omit the observations in the middle fifth or one-sixth. This results in two groups with $\frac{(n-d)}{2}$.
  - Run two separate regression one for the low values and the other with high values.
  - Observe the error sum of squares for each group and label them as SSE_L and SSE_H.

Homoscedasticity
Goldfeld-Quandt Test (*Continued…*)

- Compute the ratio of SSE_H / SSE_L
- If there is no heteroscedasticity, this ratio will be distributed as an F-Statistic with $\frac{(n-d)}{2}$ degrees of freedom in the numerator and denominator, where k is the number of coefficients.
- Reject the null hypothesis of homoscedasticity if the ratio exceeds the F table value.

Multicollinearity

- High correlation between explanatory variables.
- Coefficient of multiple determination measures combined effect of the correlated explanatory variables.
- Leads to unstable coefficients (large standard error).

Multicollinearity

- How do we know whether we have a problem of multicollinearity?
  - When a researcher observes a large coefficient of determination (R^2) accompanied by statistically insignificant estimates of the regression coefficients.
  - When one (or more) independent variable(s) is an exact linear combination of the others, we have perfect multicollinearity.

Detect Collinearity (Variance Inflationary Factor)

- VIF_j Used to Measure Collinearity

$$\mathrm{VIF}_j = \frac{1}{(1 - R_j^2)}$$

R_j^2 = The coefficient of multiple determination from the regression of X_j on all the other explanatory variables.

- If $\mathrm{VIF}_j > 5, X_j$ is Highly Correlated with the Other Explanatory Variables.

Detect Collinearity in Excel

- Stat | Regression…
  - Check the "Variance Inflationary Factor (VIF)" box.
- EXCEL spreadsheet for the heating oil example
  - Since there are only two explanatory variables, only one *VIF* is reported in the Excel spreadsheet.
    - No *VIF* is >5
    - There is no evidence of collinearity.



Microsoft Excel Worksheet

Summary

- Developed the Multiple Regression Model.
- Discussed Residual Plots.
- Addressed Testing the Significance of the Multiple Regression Model.
- Discussed Inferences on Population Regression Coefficients.
- Addressed Testing Portions of the Multiple Regression Model.

Summary

(continued)

- Described the Quadratic Regression Model.
- Addressed the violations of the regression assumptions.

Business Forecasting

9

Advanced Regression Methodologies in Forecasting

Topics

- Proxy and dummy variables
- Selection of Independent variables
  - All possible regression
  - Stepwise regression
- Lagged variables
  - Distributed lag models
  - Adaptive expectation models
  - Partial adjustment model
- Summary

Dummy Variable Models (with two Levels)

Given: $\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i}$

Y = Assessed Value of House

X_1 = Square footage of House

X_2 = Desirability of Neighborhood = $\begin{cases} 0 & \text{if undesirable} \\ 1 & \text{if desirable} \end{cases}$

Desirable ($X_2 = 1$)

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2(1) = (b_0 + b_2) + b_1 X_{1i}$$

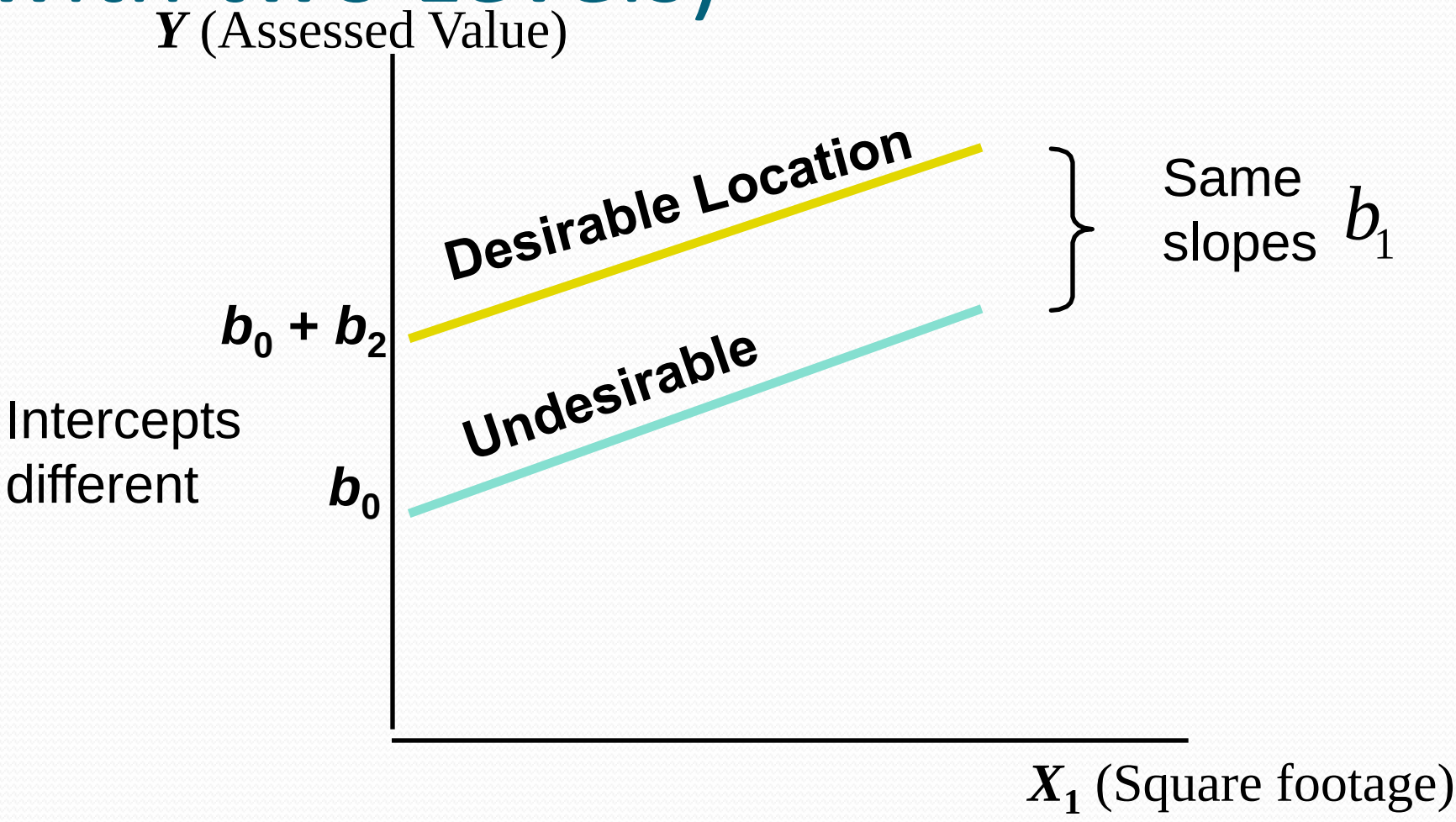
Undesirable ($X_2 = 0$)

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2(0) = b_0 + b_1 X_{1i}$$

Same slopes

Dummy Variable Models (with two Levels)

(continued)



Interpretation of the Dummy Variable Coefficient (with two Levels)

Example:

$$\hat{Y}_i = b_0 + b_1 X_{1i} + b_2 X_{2i} = 20 + 5X_{1i} + 6X_{2i}$$

Y: **Annual salary of college graduate in thousand $**

X_1: **GPA**

X_2: **0 nonbusiness degree**

1 business degree

With the same GPA, college graduates with a business degree are making an estimated 6 thousand dollars more than graduates with a nonbusiness degree on average.

Selection of Independent Variables

- Theory should be the guiding principle.
- Follow the principle of "Parsimony."
  - Less is better than more.
- A number of approaches can be adopted:
  - All possible Regression
  - Stepwise Regression
    - Forward stepwise selection
    - Backward stepwise elimination

Stepwise Regression

- Forward Stepwise Selection
  - A simple regression model is developed with one independent variable, and other variables are added to the equation without deleting any variable as the process continues.
  - May lead to a model that includes too many variables without satisfying the theoretical framework or the statistical criterion for selection.

Stepwise Regression

- Backward stepwise elimination
  - Begins with a model that considers all variables of interest and subsequently reduces the number until the "best" model that satisfies theory and is statistically significant is found.
  - The steps in using this model are:
    - Choose a value of α_{stay} and α_{entry}.

Stepwise Regression

- The stepwise approach considers the *k* possible one-independent variable regression model of the form:

$$Y = \beta_o + \beta_1 X_j + \varepsilon$$

- where X_j is a different potential independent variable in a different model.
- If the *t* Statistic shows that values for X_j are not significant, the stepwise procedure terminates otherwise the variable included.

Stepwise Regression

- The stepwise approach considers the *k* possible one-independent variable regression model of the form:

$$Y = \beta_o + \beta_1 X_j + \varepsilon$$

- where X_j is a different potential independent variable in a different model.
- If the *t* Statistic shows that values for all X_j are not significant, the stepwise procedure terminates otherwise the variable is included.

Stepwise Regression

- After each addition or deletion of an independent variable to the model, the stepwise procedure checks all the independent variables included and removes those independent variables that have the smallest (in absolute value) *t* Statistic from the model and that are considered not significant at the level.

Lagged Variables

- In a dynamic model the variable of interest may be influenced by the value of the same variable in the previous time period.
- In these cases the explanatory variable determines the dependent variable with a lag.

Lagged Variables *(continued)*

- A regression model where the dependent variable depends not only on the current value, but also on a one-period lag, may be written as:

$$Y_i = \beta_o + \beta_1 X_1 + \beta_2 X_{i-1} + e_i$$

where X_{i-1} is the value of X one period before i, and e_i is the error term.

Distributed Lagged Models

- In this model we will consider the fact that the recent past may have more impact on the variable of interest than a more distant time period.
- Hence in specifying a distributed lag model we assign weights (ω) to each variable that is lagged.

$$Y_t = \beta_0 + \beta_1(\omega_0 X_t + \omega_1 X_{t-1} + \omega_2 X_{t-2} + \ldots) + \varepsilon_t$$

Adaptive Expectation Models

- In this model, the dependent variable is Y_t impacted by the "expectation" of the causal variable X_t
- Suppose capital investment is the dependent variable and is influenced by corporate earnings.
- Since decisions to invest might be tied to the expected future earnings, the independent variable is unobservable.

Adaptive Expectation Models

- How then do we capture the notion of Y_t "expectation" in a model?

$$Y_t = \beta_0 + \beta_1 X_t^* + \varepsilon_t$$

where X_t^* is the independent variable representing the expectation.

Adaptive Expectation Models

- Since X_t^* is unobservable, we must make some assumptions about the way in which expectations are formed:

$$X_t^* = (1-\omega)X_t + \omega X_{t-1}^*$$

$$0 < \omega < 1$$

Adaptive Expectation Models

where X_t is the actual earnings at time t, and the expectation at time t and the expectations are adjusted proportionally by the factor ω to the difference between expected values in period t –1 and the actual value of X in t.

Adaptive Expectation Models

- To link the observable process of Y_t and X_t we put the two equations together. With simple manipulations of the equations, we are able to create a model for prediction.
- Note that we substituted $t-1$ for t. The result is:

$$Y_{t-1} = \beta_0 + \beta_1 X^*_{t-1} + \varepsilon_{t-1}$$

Adaptive Expectation Models

- We multiply both sides of the previous two equations by ω, and subtract it from the first equation to get:

$$Y_t - \omega Y_{t-1} = \beta_0(1-\omega) + \beta_1(X_t^* - \omega X_{t-1}^*) + \varepsilon_t + \omega\varepsilon_{t-1}$$

$$= \beta_0(1-\omega) + \beta_1(1-\omega)X_t + \varepsilon_t - \omega\varepsilon_{t-1}$$

Adaptive Expectation Models

- This last equation can be rewritten as:

$$Y_t = \alpha + \beta X_t + \omega Y_{t-1} + u_t$$

Where:

$$\alpha = \beta_0(1-\omega)$$

$$\beta = \beta_1(1-\omega)$$

$$u_t = \varepsilon_t - \omega\varepsilon_{t-1}$$

- We now have a multiple regression equation that can be used for prediction.

Partial Adjustment Model

- The partial adjustment model presumes that habit plays a critical role in how consumers and producers do not move completely from one equilibrium point to another.
- The theory behind the partial adjustment model is that the behaviorally desired level of Y in period t is an unobservable variable Y^* that can be written as:

Partial Adjustment Model

$$Y_t^* = \alpha + \beta_0 X_t + \varepsilon_t$$

- For reasons such as inertia, habit, cost, or other constraints, actual behavior in each period closes only part of the gap between last period's actual and this period's desired Y^*. This can be stated as:

$$Y_t - Y_{t-1} = \omega(Y_t^* - Y_{t-1}), \qquad 0 < \omega < 1$$

Partial Adjustment Model

- Similarly to the adaptive expectation model, we combine equations and rearrange the terms to arrive at:

$$Y_t = \omega\alpha + \omega\beta_0 X_t + (1-\omega)Y_{t-1} + u_t$$

where:

$$u_t = \omega\varepsilon_t$$

- The coefficient on Y_{t-1} identifies the adjustment factor ω

Summary

- Proxy and dummy variables
- Selection of independent variables
  - All possible regression
  - Stepwise regression
- Lagged variables
  - Distributed lag models
  - Adaptive expectation models
  - Partial adjustment model

Business Forecasting

10

The Box–Jenkins Method of Forecasting

Topics

- The Box–Jenkins Models
- Forecasting with Autoregressive Models (AR)
- Forecasting with Moving Average Models (MA)
- Autoregressive Integrated Moving Average (ARIMA) models
- Trends and Seasonality in Time Series
  - Trends
  - Seasonal Data
- Summary

Univariate Data

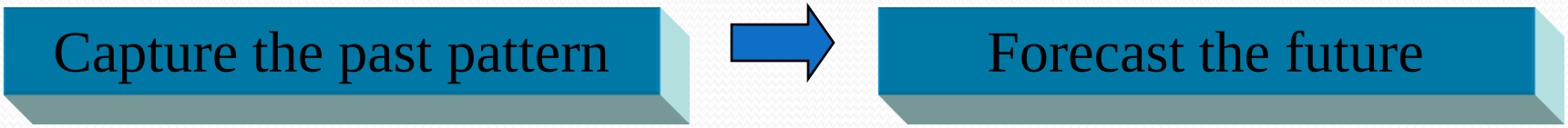
- Stationary
- Trend
- Seasonality
- Cyclical

- A majority of the real-world data show certain combinations of the above patterns.

Box–Jenkins Method

Besides the smoothing techniques, what other methods can we use to forecast univariate data?

Using Box–Jenkins Methods



Why Use The Box–Jenkins Method?

- When facing very complicated data patterns such as a combination of a trend, seasonal, cyclical, and random fluctuations:

  e.g. Earning data of a corporation

  e.g. Forecasting stock price

  e.g. Sales forecasting

  e.g. Energy forecasting (electricity, gas)

  e.g. Traffic flow of a city

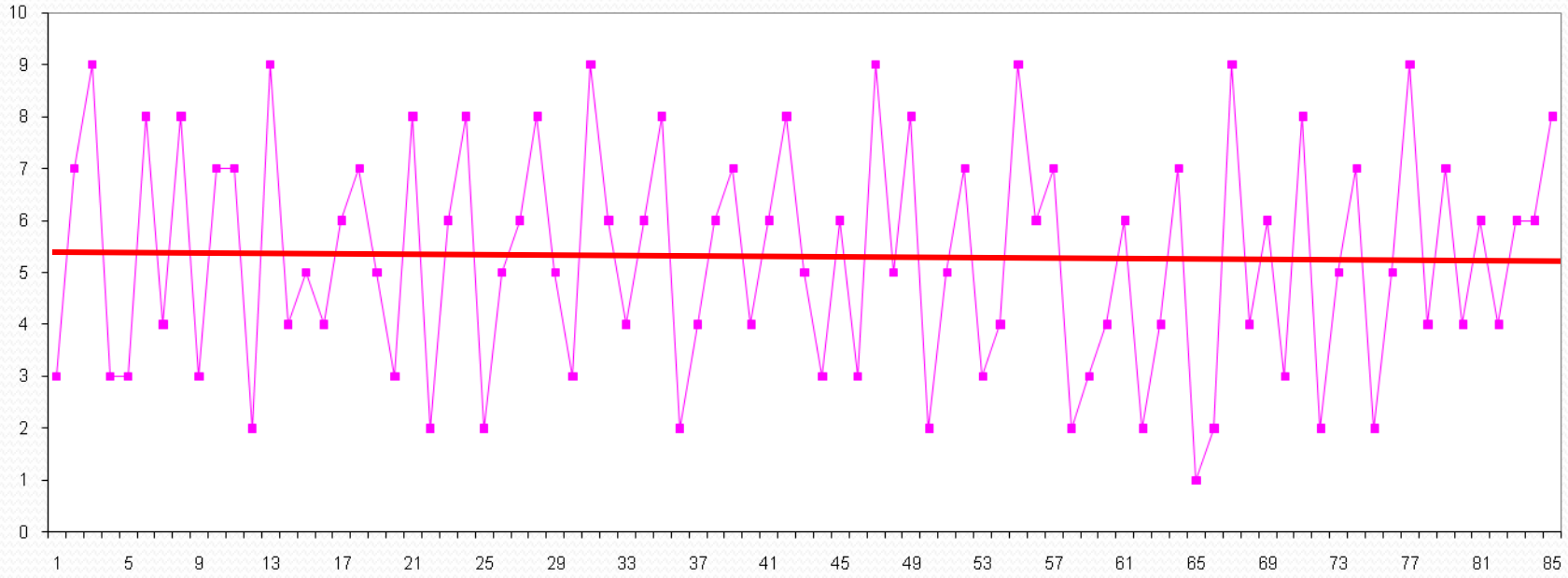
Why Use the Box–Jenkins Method?

- When forecasting is the sole purpose of the model.
- Very reliable especially in short term (0–6 months) prediction; reliable in short-to-mid (6 months–1.5years) -term prediction.
- Confidence intervals for the estimates are easily constructed.

Pattern I: Stationary

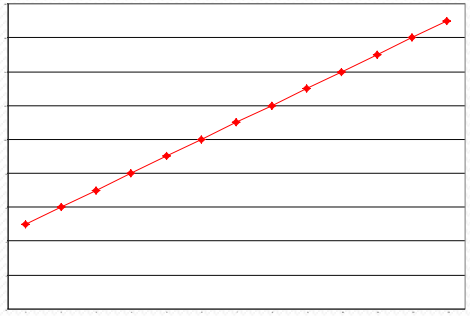
Pattern 1: No Trend—Stationary

demand seems to cluster around a specific level.

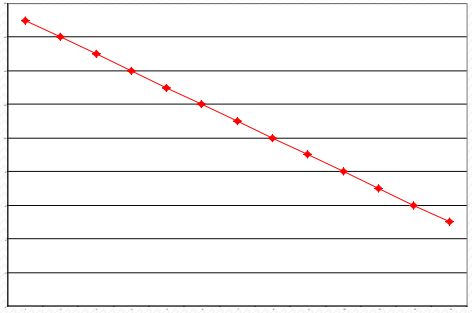


Pattern II: Trend

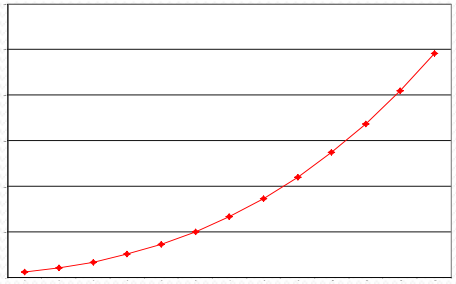
Demand consistently increases or decreases over time.



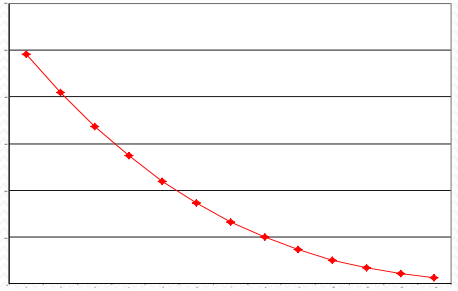
Time



Time

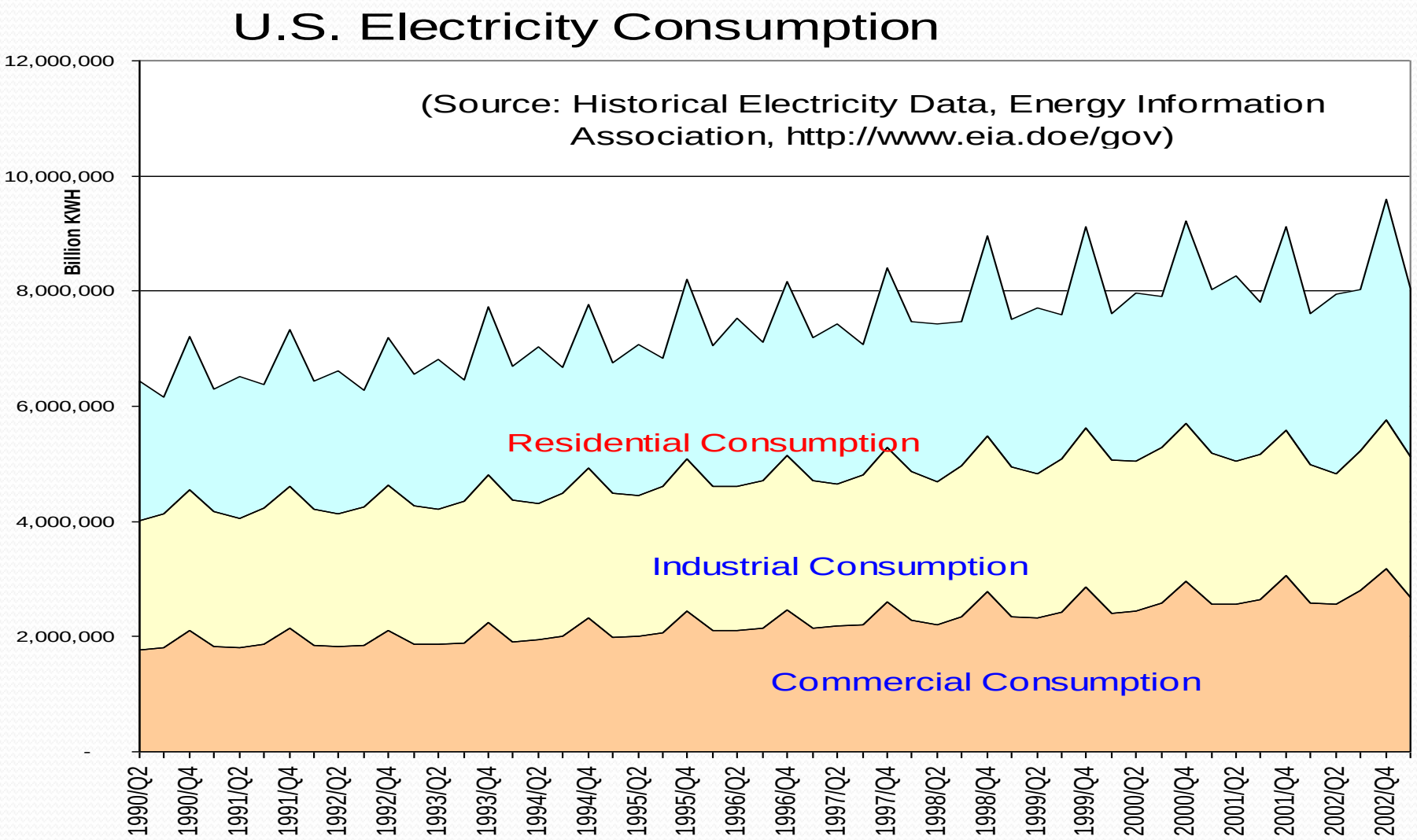


Time

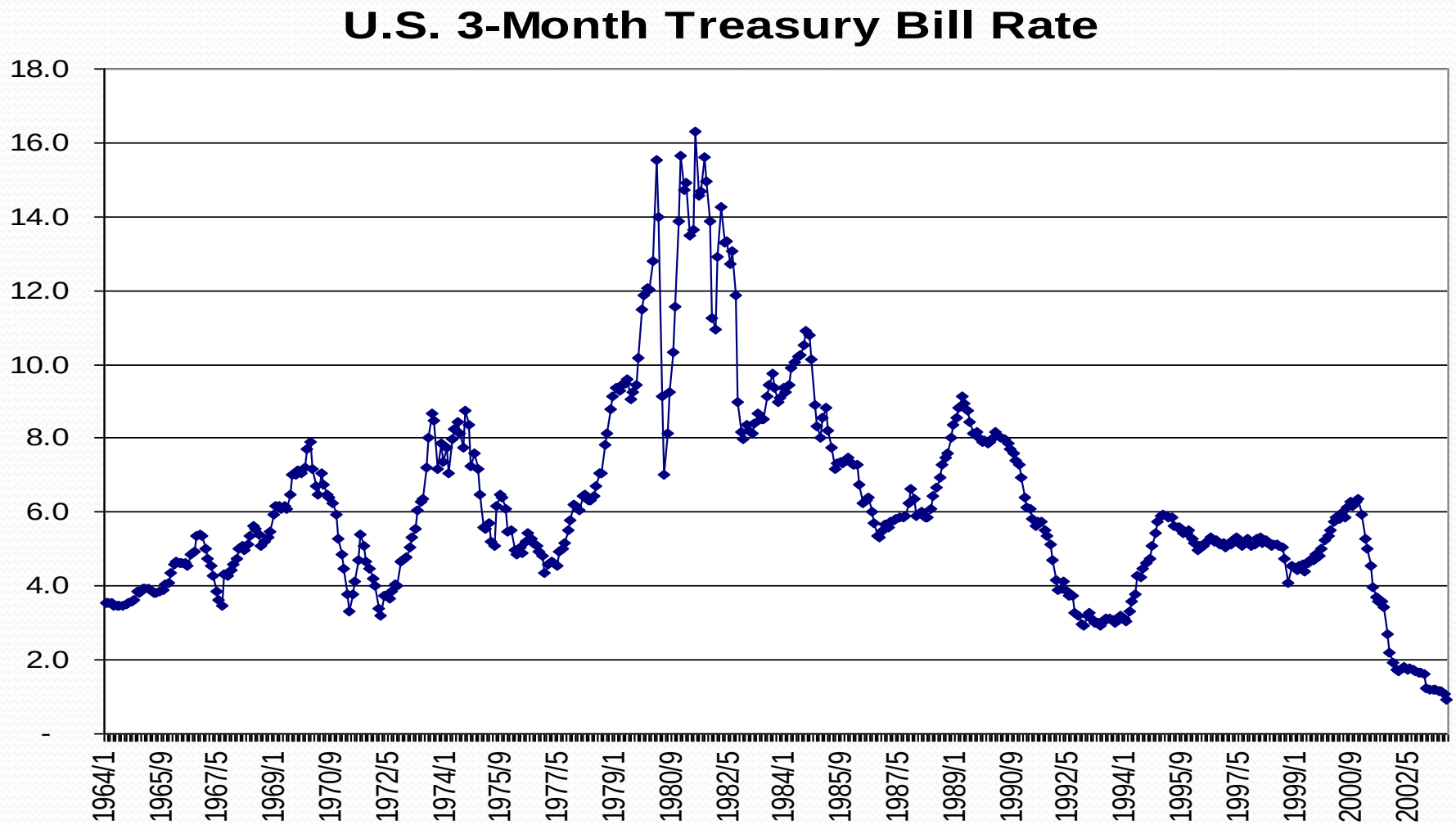


Time

Pattern III: Seasonality

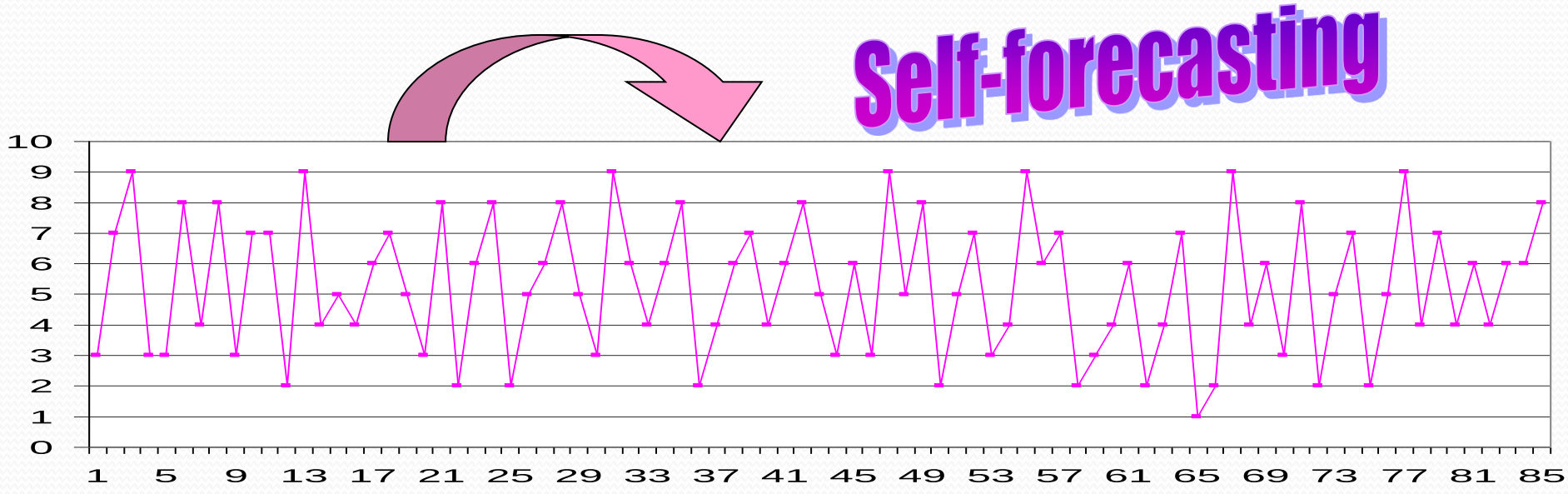


Pattern IV: Cyclical



Box–Jenkins Method Assumption

- In order to use the B/J method, the time series should be stationary.
- B/J main idea: Any stationary time series can self-predict its own future from the past data.



Box–Jenkins Method Assumption

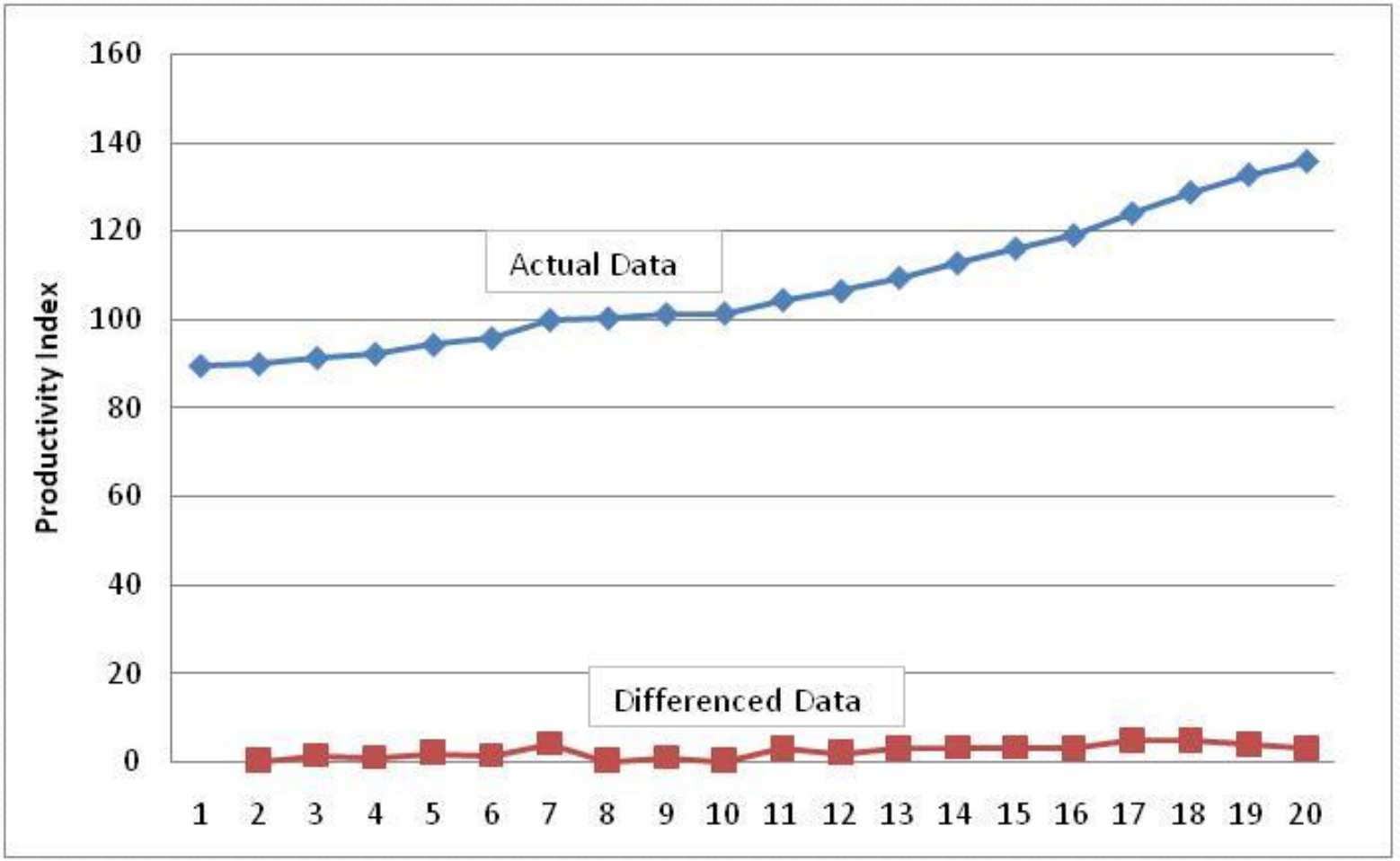
- We know that not all time series are stationary.
- However, it is easy to convert a trend or a seasonal time series to a stationary time series.
- Simply use the concept of “Differencing.”

Example of Differencing

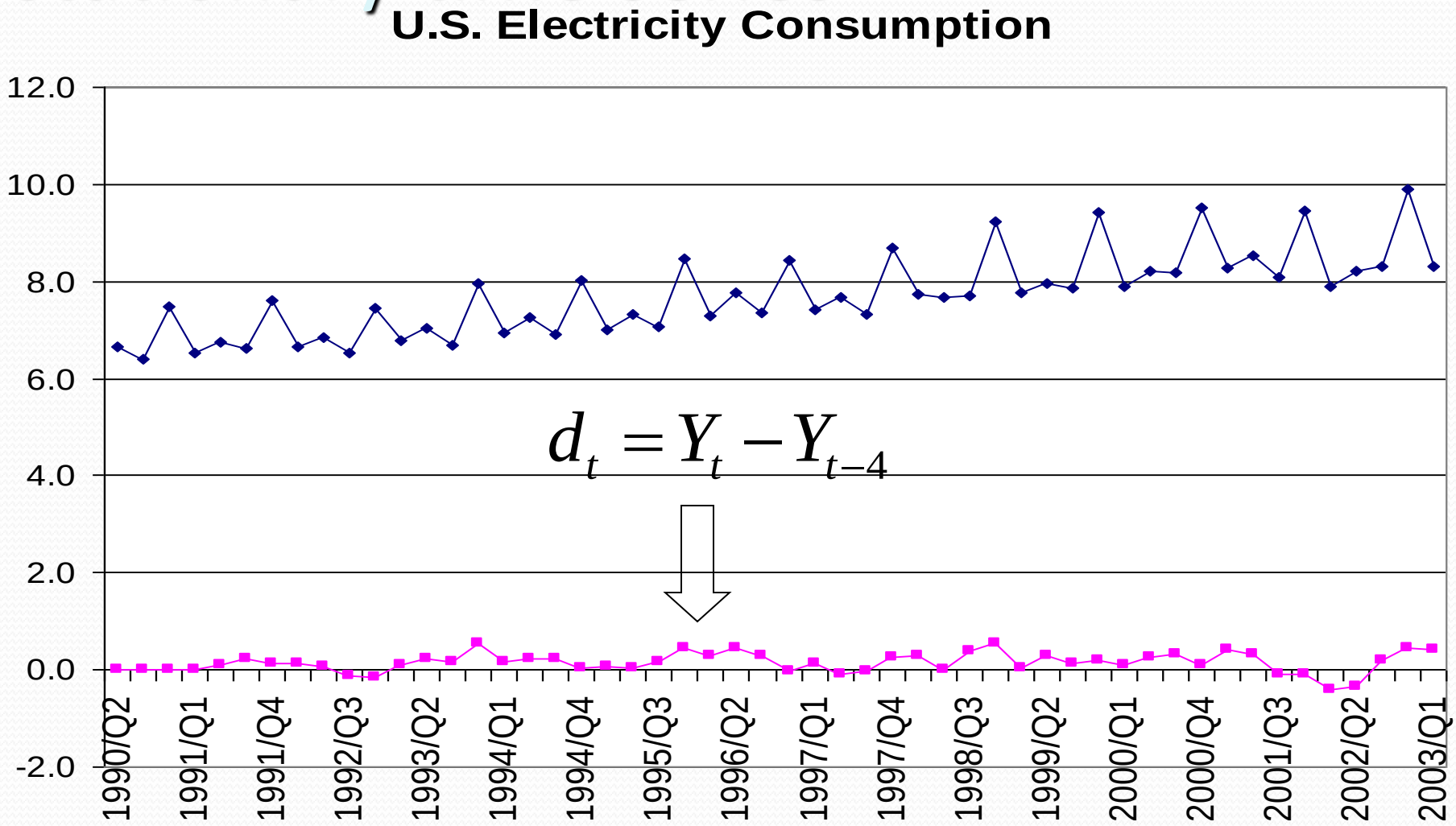
Partial Data from Table 10.6

Time (t) (1)	*Actual Index* Y_t (2)	*Differences* $(Y_t - Y_{t-1})$ (3)
t_{86}	89.7	na
t_{87}	90.1	0.4
t_{88}	91.5	1.4
t_{89}	92.4	0.9
t_{90}	94.4	2.0

Convert a trend time series to stationary time series using the differencing method



Convert a seasonal time series to stationary time series



Differencing Summary

- To convert trend time series to stationary time series:

$$d_t = Y_t - Y_{t-1}$$

- To convert seasonal time series to stationary time series:

$$d_t = Y_t - Y_{t-4}$$

- Both of the above two methods can be applied/combined to remove the cyclical effects.

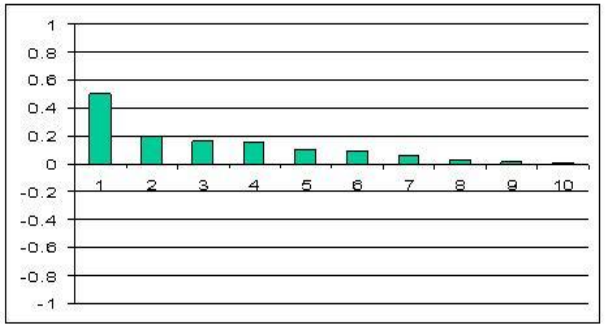
How do we decide the model?

- Use Autocorrelation (AC) and Partial Autocorrelation (PAC)
- First-order autocorrelation is a measure of how correlated an observation is with an observation one period away, that is: (y_t, y_{t-1})
- Second-order autocorrelation is a measure of how correlated an observation is with an observation two periods away (y_t, y_{t-2})
- etc…

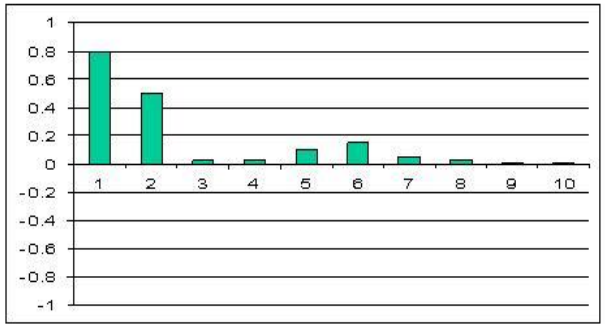
AR Model Fit

- When the autocorrelation coefficients gradually fall to 0, and the partial correlation has spikes, an AR model is appropriate. The order of the model depends on the number of spikes.
- An AR(2) model is shown below.

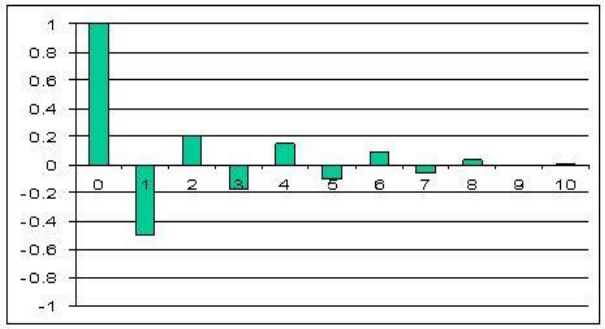
AC



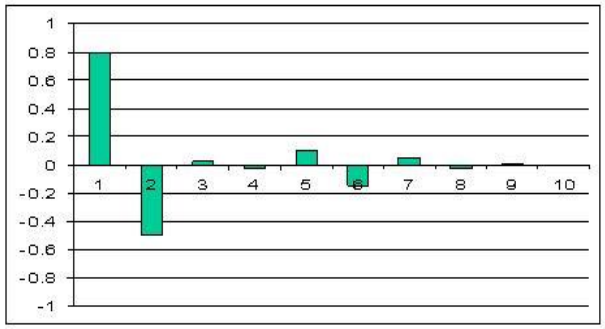
PAC



AC



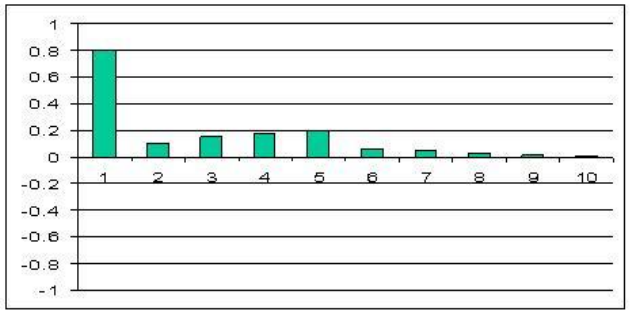
PAC



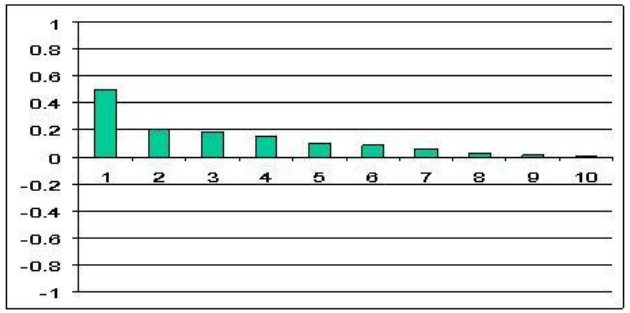
MA Model Fit

- When the partial correlation coefficients gradually fall to 0, and the autocorrelation has spikes, a MA model is appropriate. The order of the model depends on the number of spikes.
- An MA(1) model is shown below.

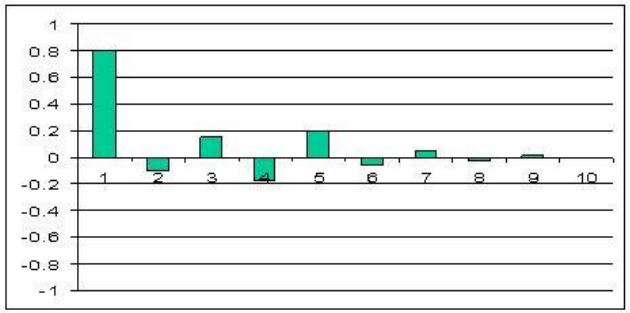
AC



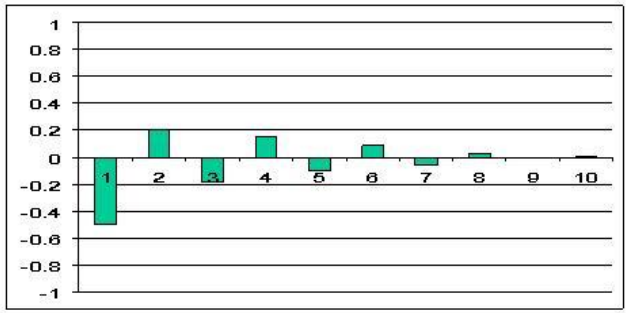
PAC



AC



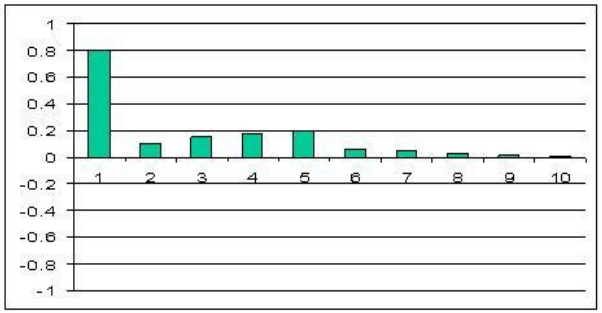
PAC



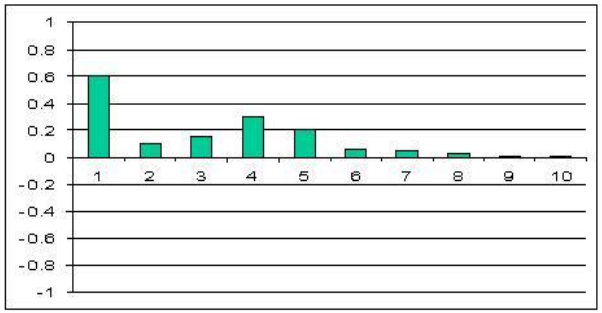
ARIMA Model Fit

- When both the autocorrelation and the partial correlograms show irregular patterns, then an ARIMA model is appropriate. The order of the model depends on the number of spikes.
- An ARIMA(1,0,1) model is shown below.

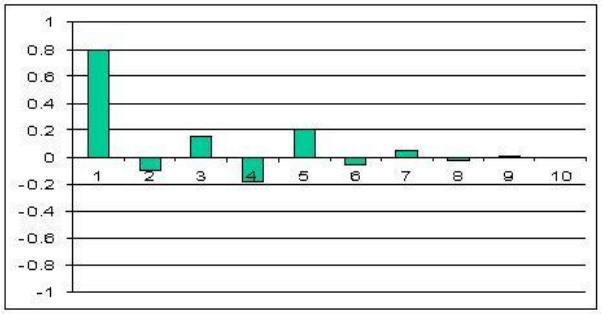
AC



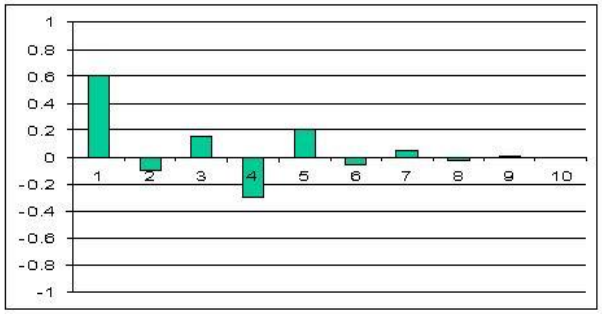
PAC



AC



PAC



Summary

- Box–Jenkins models capture a wide variety of time series patterns.
- When faced with a complicated time series that includes a combination of trend, seasonal factor, cyclical, as well as random fluctuations, use of the Box–Jenkins is appropriate.
- This methodology for forecasting is an iterative process that begins by assuming a tentative pattern that is fitted to the data so that error will be minimized.
- The major assumption of the model is that the data is stationary.

Summary *(continued)*

- "Differencing" could be used to make the data stationary.
- In using the different models of Box–Jenkins, we depend on the autocorrelation (AC) and partial autocorrelation (PAC) as diagnostic tools.
- Computer programs such as Minitab, and SPSS provide all the analysis tools for using the Box–Jenkins.

Business Forecasting

11

Communicating Forecasts to Management

Topics

- Forecasts and Their Use in Managerial Decisions
- Presentation of Forecasts to Management
- The Future of Business Forecasting
- Summary

Use of Forecasts in Managerial Decision

- Allows organizations to make appropriate decisions.
- Essential in providing the decision makers with information on:
  - Forecast of sales
  - Cash flow
  - Inventory
  - Cost projections
  - Implication of tax hikes on profits
  - Effects of monetary policy on the business sector.

Presentation of Forecasts to Management

- Methodologies discussed in this book can effectively be used by small and large business units.
- Analysts for either sized firms can assist management to make good business decisions.
- To be effective in their role as forecasters, the analyst must pay attention to the following:

Presentation of Forecasts to Management

- Why is the forecast needed?
- Who will use the forecast?
- Participation of management is needed in the initial stage.

- The Analyst must understand management's problems and concerns. Specifically, they should try to understand:
  - What level of detail or aggregation is required.
  - What time horizon should be used in the forecast.

Presentation of Forecasts to Management

- A good forecast incorporates feedback from management.
- Forecasters and managers should pay attention to some common mistakes that undermine the forecasting process:
  - Poor or inadequate data system
  - Lack of commitment on the part of the middle management
  - Decision makers may find the data or the forecast are not available in a timely fashion.

Presentation of Forecasts to Management

- If an incorrect model is used, the analyst should inform the management of its consequences.
- The forecasting unit should be an integrated part of the existing corporate structure.
- In communicating the forecast, the analyst has to recognize the political and human relations skills.

Presentation of Forecasts to Management

- To develop the human relations skills and protect the integrity and objectivity of the forecast, the analyst should follow the recommendations of Bails and Pepper (1993):
  - Become familiar with those who use the forecast.
  - Learn about the user's concerns.
  - Before you start your forecast, resolve any concerns of a particular business unit.
  - Defend your forecast against purely political concerns.

The Future of Business Forecasting

- Uses of forecasting are numerous.
- Good decisions are based on good forecasts.
- Forecasts are used for:
  - Budgeting
  - Planning
  - Specific areas such as production, inventory control, marketing, advertising, sales projections, and investment.
- Recent economic downturns around the world point to the need for strategic planning.

The Future of Business Forecasting

- Forecasting tools can effectively be employed in such planning strategies.
- Given the interdependence of nations on trade, resources, and investments, business organizations cannot make choices without good forecasts.

Summary

- Communicating the results of a forecast is just as important as making the forecast.
- The forecasting process calls for a clear understanding of who, how, and when the forecast is used.
- Forecasters need to understand how management wishes to use the forecast—planning or control and budgeting.
- In a globalized world, good forecasts provide strategic tools for management.

Strategic and Operational Cost Analysis Techniques

Building the financial simulation model using deterministic simulation

- Building a simulation model can be done in various ways.
- Excel examples

Building the financial simulation model using probabilistic (Monte Carlo) simulation

Monté Carlo Simulation

Simulation *Defined*

A computer-based model used to run experiments on a real system.

- Typically done on a computer.
- Determines reactions to different operating rules or change in structure.
- Can be used in conjunction with traditional statistical and management science techniques (such as waiting line problems, when the basic assumptions do not hold, or where problems involve multiple phases).

Differences Between Optimization and Simulation

Optimization models

- Yield decision variables as *outputs*
- Promise the best (optimal) solution to the model

Simulation models

- Require the decision variables as *inputs*
- Give only a satisfactory answer

Types of Simulation Models

- Continuous
  - Based on mathematical equations.
  - Used for simulating continuous values for all points in time.
  - Example: The amount of time a person spends in a queue.
- Discrete
  - Used for simulating specific values or specific points.
  - Example: Number of people in a waiting line (queue).

Simulation Methodology:

- Estimate probabilities of future events
- Assign random number ranges to percentages (probabilities)
- Obtain random numbers
- Use random numbers to “simulate” events.

Data Collection and Random Number Interval Example

Suppose you timed 20 athletes running the 100-yard dash and tallied the information into the four time intervals below.

You then count the tallies and make a frequency distribution.

Then convert the frequencies into percentages.

Finally, use the percentages to develop the random number intervals.

Seconds	Tallies	Frequency	%	RN Intervals
0-5.99	𝍸	4	20	01-20
6-6.99	𝍸 𝍸	10	50	21-70
7-7.99	𝍸	4	20	71-90
8 or more	||	2	10	91-100

Sources of Event Probabilities and Random Numbers

Event Probabilities

- From historical data (assuming the future will be like the past)
- From expert opinion (if the future will be unlike the past, or no data is available)

Random Numbers

- From probability distributions that 'fit' the historical data or can be assumed (use Excel functions)
- From manual random number tables
- From your instructor (for homework and tests, so we all get the same answer!)

Probability Distributions

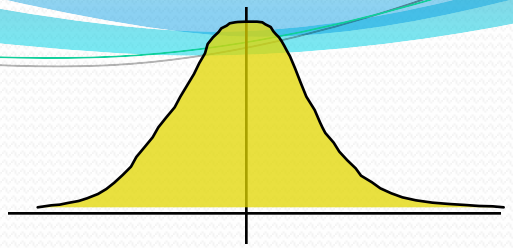
A probability distribution defines the behavior of a variable by defining its limits, central tendency and nature

- Mean
- Standard Deviation
- Upper and Lower Limits
- Continuous or Discrete

Examples are:

- Normal Distribution (continuous)
- Binomial (discrete)
- Poisson (discrete)
- Uniform (continuous or discrete)
- Custom (create your own!)

Normal Distribution



- Conditions:
  - Uncertain variable is symmetric about the mean
  - Uncertain variable is more likely to be in vicinity of the mean than far away
- Use when:
  - Distribution of x is normal (for any sample size)
  - Distribution of x is not normal, but the distribution of sample means (x-bar) will be normally distributed with samples of size 30 or more (Central Limit Theorem)
- Excel function: NORMSDIST() – returns a random number from the cumulative standard normal distribution with a mean of zero and a standard deviation of one [e.g., NORMSDIST(1) = .84]

Uniform Distribution



- All values between minimum and maximum occur with equal likelihood
- Conditions
  - Minimum Value is Fixed
  - Maximum Value is Fixed
  - All values occur with equal likelihood
- Excel function: RAND() – returns a uniformly distributed random number in the range (0,1)

Note on Random Numbers in Excel Spreadsheets

- Once entered in a spreadsheet, a random number function remains "live." A new random number is created whenever the spreadsheet is re-calculated. To re-calculate the spreadsheet, use the F9 key. Note, almost any change in the spreadsheet causes the spreadsheet to be recalculated!
- If you do not want the random number to change, you can freeze it by selecting: tools, options, calculations, and checking "manual."

Evaluating Results

- Conclusions depend on the degree to which the model reflects the real system
- The only true test of a simulation is how well the real system performs after the results of the study have been implemented.

Simulation Applications

- Machine Breakdown problems
- Queuing problems
- Inventory problems
- Many other applications

Many Computer Games Are Simulations!

SimCity, SimFarm, SimIsle, SimCoaster, and others in this family of games have elaborate Monte Carlo models underlying the game exterior. Microsoft has recently released Train Simulator, for which there are numerous additional scenarios available on the Internet. Strategy games such as Civilization and Railroad Tycoon are also based on simulation modeling. Most of these games contain editors, in which the user can create new scenarios, new terrain, and even control the likelihoods of events.

Advantages of Simulation

- Simulation often leads to a better understanding of the real system.
- Years of experience in the real system can be compressed into seconds or minutes.
- Simulation does not disrupt ongoing activities of the real system.
- Simulation is far more general than mathematical models.
- Simulation can be used as a game for training experience (safety!).

Simulation Advantages (cont'd)

- Simulation can be used when data is hard to come by.
- Simulation can provide a more realistic replication of a system than mathematical analysis.
- Simulation can be used to analyze transient conditions, whereas mathematical techniques usually cannot.
- Simulation considers variation and can calculate confidence intervals of model results.

Simulation Advantages (cont'd)

- Simulation can model a system with multiple phases
- Simulation can model a system when it is already in a steady-state (i.e., can initialize the system with the beginning queue, beginning inventory, etc.!).
- Simulation can also test a "range" of inputs to perform what-if/sensitivity analysis.
- Many standard simulation software packages are available commercially (and Excel works fine too!).

Disadvantages of Simulation

- There is no guarantee that the model will, in fact, provide good answers.
- There is no way to prove reliability.
- Simulation may be less accurate than mathematical analysis because it is randomly based.
- Building a simulation model can take a great deal of time (but if the payoff is great, then it is worth it!).
- A significant amount of computer time may be needed to run complex models (old concern - no longer an issue!).
- The technique of simulation still lacks a standardized approach.

Developing Manufacturing Standards

- Material Standard Development
- Labour Standard Development
- Factory and Corporate Overhead Standard Development
- Variance Analysis

Management Accounting & Control Systems

- *Control* = set of procedures, tools, and systems organizations use to monitor activities and to achieve organizational goals

- *Management accounting & control system* = core performance-measurement system of the organization, including both *planning* and *feedback* components:

  - Management Control Systems

  - Operational Control Systems → short-term operating performance

Evaluating Short-Term Operating Performance

- ***Financial Performance Measures:***
  - Standard Cost (and Revenue) Variance Analysis
  - Use of standard costs and flexible budgets
  - Interpretation of variances
- ***Nonfinancial Performance Indicators:***
  - These measures can be leading indicators (predictors) of future financial performance
  - Variance analysis applies here, too!

Short-Term Financial Control

- Master (Static) Budget:
  - Prepared before the start of the period
  - Contains the following items:
    - Budgeted sales volume
    - Budgeted sales price per unit
    - Budgeted variable cost per unit
    - Budgeted total fixed costs

Short-Term Financial Control (continued)

- Flexible (Control) Budget:
  - Prepared at the end of the period (after actual activity is known)
  - Actual sales volume is used, but with budgeted selling price per unit, budgeted variable cost per unit, and budgeted total fixed costs
  - Key to performing *variance analysis* at the end of the period

Short-Term Financial Control

- Essence of short-term financial control—explain the **total operating-income variance** for the period (see Exhibit 14.2)
- Total operating-income variance = master budget operating income – actual operating income
- The total operating-income variance can be subdivided into the following component variances:
  - Flexible-budget variance (with components)
  - Sales volume variance
- Key tool: use of *standard costs* and *flexible budgets*

Master Budget Example

	Per Unit Amounts	Master Budget
Unit sales		1,000
Sales revenue	$800	$ 800,000
Less variable costs:	$450	450,000
Contribution margin	$350	$ 350,000
Less fixed costs		150,000
Operating income		$ 200,000

Actual Operating Profit Generated

During the period the company actual produced and sold 780 units (not 1,000 as was originally planned). The actual operating income was $128,000, as follows:

Unit sales	780
Sales revenue	$ 639,600
Less: variable costs	350,950
Contribution margin	$ 288,650
Less fixed costs	160,650
Operating income	$ 128,000

Total Operating-Income (Master Budget) Variance for the Period = $72,000 U

	Actual	Master Budget	Variances	
Unit sales	780	1,000	220	U
Sales revenue	$ 639,600	$ 800,000	$160,400	U
Less: variable costs	350,950	450,000	99,050	F
Contribution margin	$ 288,650	$ 350,000	$ 61,350	U
Less fixed costs	160,650	150,000	10,650	U
Operating income	$ 128,000	$ 200,000	$ 72,000	U

Explaining the Total Operating-Income Variance ($72,000 U)

- **The total operating-income variance should be traceable to a combination of the following four factors:**
  - Actual sales *volume* was different than planned
  - Actual *variable cost per unit* was different than planned
  - Actual *total fixed costs* were different than planned
  - Actual *selling price per unit* was different than planned
- **The flexible budget allows us to breakdown the total operating-income variance into components related to each of the above four factors**

Flexible Budget Example

To begin the variance-decomposition process at the end of the period we prepare a flexible (control) budget based on the 780-unit level, as follows:

Units	780
Sales ($800/unit)	$624,000
Variable costs ($450/unit)	$351,000
Contribution margin ($350/unit)	$273,000
Fixed costs	$150,000
Operating income	$123,000

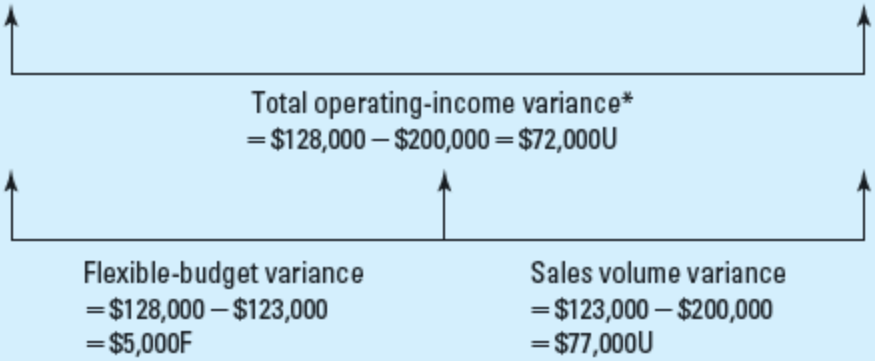
N.B.: Variable cost per unit = $400 manufacturing + $50 selling

Decomposing the Total Operating Income Variance ($72,000 U)

SCHMIDT MACHINERY COMPANY
Analysis of Financial Results
For October 2013

	(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



*Also called the *total master (static) budget variance.*
**Budgeted fixed factory overhead cost = $120,000; budgeted fixed selling and administrative expense = $30,000.

Breakdown of Total Operating Income Variance ($72,000 U)

The difference between actual operating income and the flexible budget operating income = **$5,000 F**:

- This difference is called the *total flexible* (controllable) *budget variance*
- This variance captures the net effect of:
  - Actual selling prices per unit being different than planned
  - Actual variable cost per unit was different than planned
  - Actual total fixed costs were different than planned

Breakdown of Total Operating Income Variance (continued)

The difference between the flexible budget operating income and the master budget operating income = **$77,000 U**:

- This difference is called the *sales volume variance*
- Everything else other than volume is being held constant in calculating this variance; hence, the difference in operating income between the two budget columns is due entirely to sales volume being different than planned
- The sales volume variance can also be calculated as: budgeted cm per unit × (actual – budgeted) units
- In the example: $350/unit × 220 units = **$77,000 U**

Breakdown of Total Operating Income Variance: Summary

- Total Operating Income Variance = Actual Operating Income – Master Budget Operating Income

  = $128,000 – $200,000 = **$72,000 U**

- Flexible (Controllable) Budget Variance = Actual Operating Income – Flexible Budget Operating Income

  = $128,000 – $123,000 = **$5,000 F**

Breakdown of Total Operating Income Variance

- Sales Volume Variance = Flexible-Budget Operating Income – Master Budget Operating Income

  = $123,000 – $200,000 = **$77,000 U**

- Total Operating Income Variance = Flexible-Budget Variance + Sales Volume Variance

  = $5,000F + $77,000U = **$5,300 U**

Breakdown of Total Flexible-Budget Variance ($5,000 F)

Sales Price Variance

= Actual Sales $ – Flexible Budget Sales $

= $639,600 – $624,000 = **$15,600 F**

or, = AQ × (AP – SP)

= 220 units × ($820 – $800)/unit = **$15,600 F**

Breakdown of Total Flexible-Budget Variance ($5,000 F)

- Total Fixed Cost Variance = Actual Fixed Costs – Flexible Budget Fixed Cost

  = $160,650 – $150,000 = **$10,650 U**

- Note that this budget (spending) variance on fixed costs can be further broken down:
  - First, by functional categories (e.g., Marketing)
  - Second, by individual costs within categories (e.g., Sales Manager Salaries)

Breakdown of Total Flexible-Budget Variance ($5,000F)

- Total Variable Cost Variance = Actual Variable Costs – Flexible Budget Variable Costs

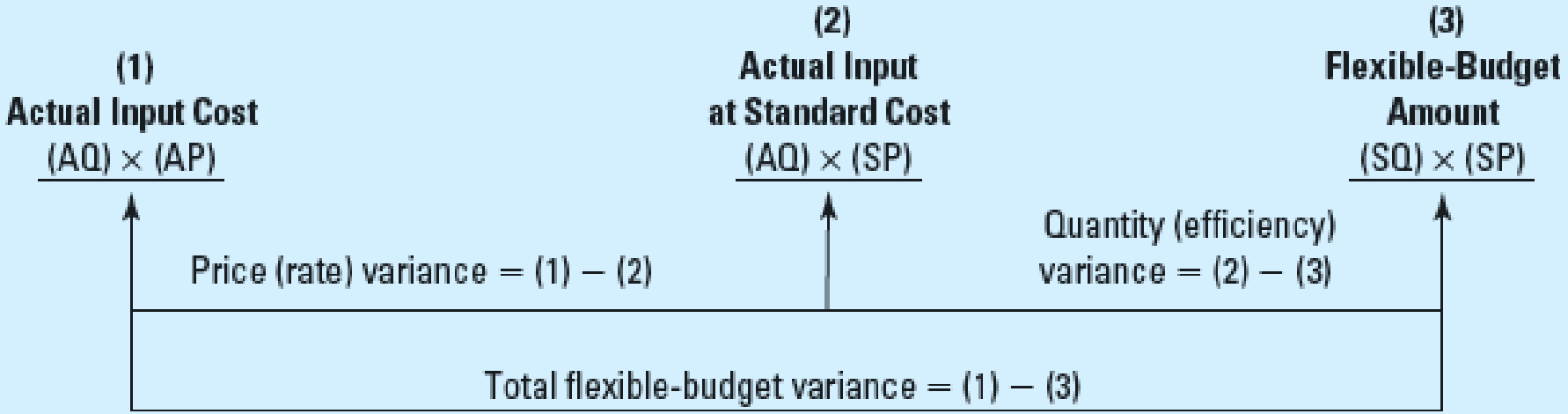
$$= \$350{,}950 - \$351{,}000 = \mathbf{\$50\ F}$$

or, $= AQ \times (AP - SP)$

$$= 780 \text{ units} \times (\$449.9359 - \$450.00)/\text{unit} = \mathbf{\$50\ F}$$

- This total variance can be further broken down:
  - First, by functional categories (e.g., Manufacturing)
  - Second, by individual costs within categories (e.g., Direct Materials Cost)

General Model for Analyzing Variable Cost Flexible Budget Variances



Legend:

AQ = Actual quantity of the resource (e.g., DM) purchased or used

AP = Actual cost per unit of the resource (e.g., per lb.)

SP = Standard cost per unit of the resource

SQ = Standard quantity of the resource that should have been used to produce the output for the period = Units of output × Standard resource input per unit of output

Formulas for Decomposing Variable Cost Flexible Budget Variances into Price and Quantity Components

- **Variable Cost Variance = Actual Variable Costs – Flexible Budget Variable Costs**

  = (AQ × AP) × (SQ × SP)

- **Breakdown of total variance:**
  - Price (Rate) Variance = AQ × (AP – SP)
  - Quantity (Efficiency) Variance = SP × (AQ – SQ)

Formulas for Decomposing Variable Cost Flexible Budget Variances into Price and Quantity Components

Notes:

- For DM: AQ in the Price Variance formula represents "actual quantity *purchased*"
- SQ = "standard quantity of resource input (e.g., DL) for the output of the period"
- In a standard cost system, these variances are recorded in the formal accounting records (i.e., each in a descriptive account, such as "Direct Labor Rate Variance")

Developing Manufacturing Standards

- These standards and developed and made up all the individual items like materials, labour etc

Material Standard Development

Example: Direct Materials (DM) Variance Decomposition

Hanson Inc. has the following direct material standard to manufacture one unit of "Jerf":

1.5 pounds per Jerf at $4.00 per pound

Last month 1,700 pounds of material were purchased and used to make 1,000 Jerfs. The material cost a total of $6,630.

Direct Materials (DM) Variance: Question 1

What is the actual price per pound (AP) paid for the material?

a. $4.00 per pound.
b. $4.10 per pound.
c. $3.90 per pound.
d. $6.63 per pound.

Answer: Question 1

What is the actual price per pound (AP) paid for the material?

a. $4.00 per pound.
b. $4.10 per pound.
c. $3.90 per pound.
d. $6.63 per pound.

AP = $6,630 ÷ 1,700 lbs. = $3.90 per lb.

Direct Materials (DM) Variance: Question 2

Hanson's materials price variance (PV) for the month was:

a. $170 unfavorable.

b. $170 favorable.

c. $800 unfavorable.

d. $800 favorable.

Answer: Question 2

Hanson's materials price variance (PV) for the month was:

a. $170 unfavorable.
b. $170 favorable.
c. $800 unfavorable.
d. $800 favorable.

$$PV = AQ \times (AP - SP)$$
$$PV = 1{,}700 \text{ lbs.} \times (\$3.90 - 4.00)/\text{lb.} = \$170 \text{ Favorable}$$

Direct Materials (DM) Variance: Question 3

The standard quantity (SQ) of material that should have been used to produce 1,000 Jerfs is:

a. 1,700 pounds.

b. 1,500 pounds.

c. 2,550 pounds.

d. 2,000 pounds.

Answer: Question 3

The standard quantity of material (SQ) that should have been used to produce 1,000 Jerfs is:

a. 1,700 pounds.
b. 1,500 pounds.
c. 2,550 pounds.
d. 2,000 pounds.

SQ = 1,000 units × 1.5 lbs./unit = 1,500 lbs.

Direct Materials (DM) Variance: Question 4

Hanson's material usage variance (UV) for the month was:

a. $170 unfavorable.

b. $170 favorable.

c. $800 unfavorable.

d. $800 favorable.

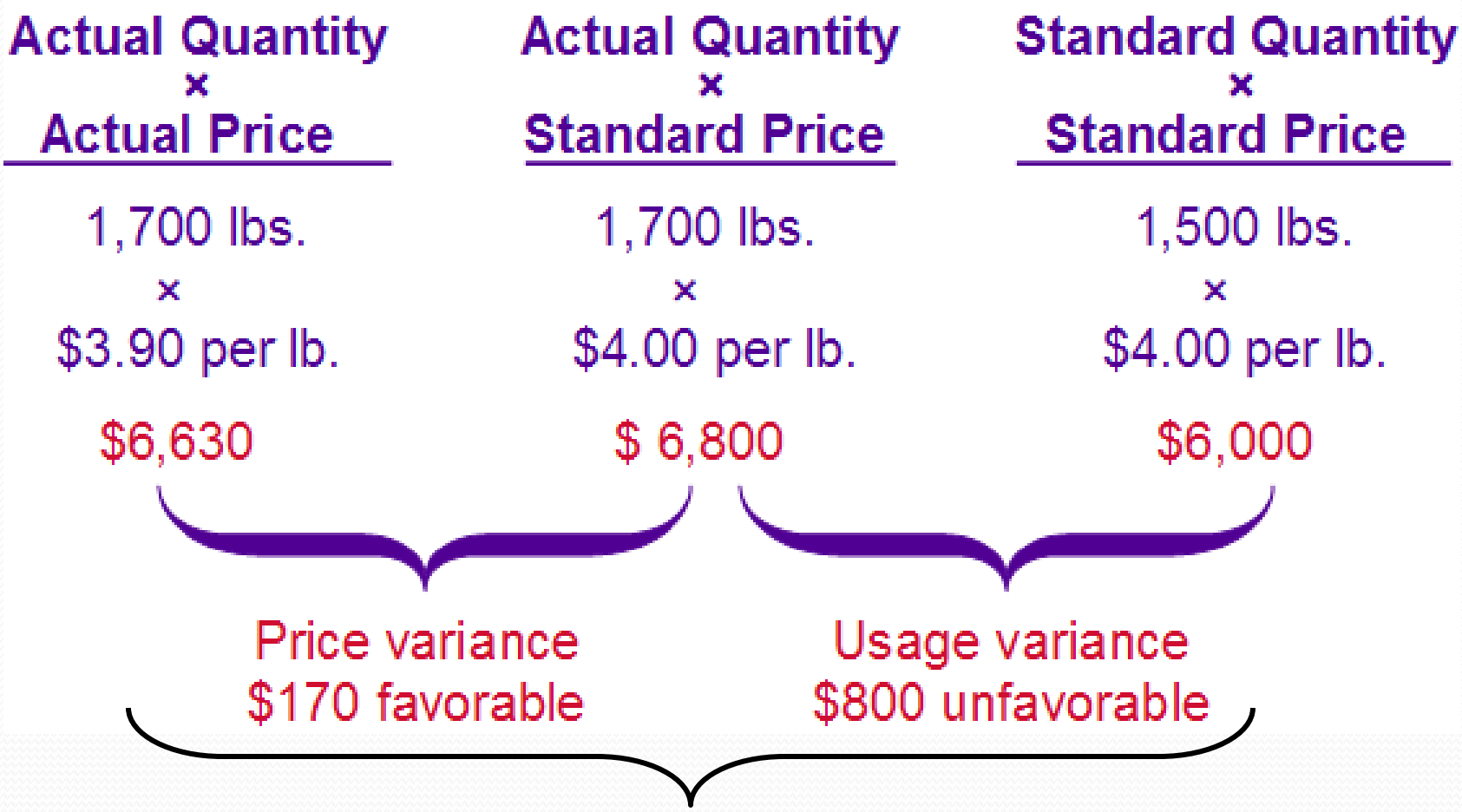
Answer: Question 4

Hanson's material usage variance (UV) for the month was:

a. $170 unfavorable.
b. $170 favorable.
c. $800 unfavorable.
d. $800 favorable.

UV = SP × (AQ − SQ)
UV = $4.00 × (1,700 − 1,500) lbs. = $800 unfavorable

Hanson, Inc. Example: Summary



Total Flexible Budget Variance = $6,630 - $6,000 = $630U

Causes of DM Variances

- **Price Variances:**
  - Purchase of materials of different grade
  - Quantity discounts
  - Freight/delivery expediting cost (“rush orders”)
- **Quantity Variances:**
  - Purchase of non-standard quality materials
  - Poorly trained or poorly supervised workers
  - Poorly maintained machinery (not calibrated properly)

Labour Standard Development

Causes of DL Variances

- **Price (Rate) Variances:**
  - Labor substitution
  - Out-of-date standards (e.g., new labor contract)
- **Quantity (Efficiency) Variances:**
  - Poorly trained workers
  - Poor quality raw materials used in production
  - Poorly maintained equipment
  - Poor supervision of workers
  - Out-of-date standards

Standard Costs

Standard Costs vs. a *Standard Cost System?*

- Standard Costs = costs that should be incurred under efficient operating conditions
- Standard Cost System = standard costs recorded in the formal accounting records
- Regardless of whether a standard cost system is used, standard costs can be useful at the end of the period for *financial control purposes* (i.e., conducting variance analysis)

Standard Costs

- Types of Standards:
  - Ideal (Perfection) Standards
  - Continuous-Improvement Standards
  - Currently Attainable Standards
- Standard-Setting Procedures:
  - Authoritative Standards
  - Participative Standards
- Standard Cost Sheet:
  - Contains both price and quantity components of each cost

Recording Standard Costs: Hanson, Inc. Example

Recording DM Purchases:

Materials Inventory (AQ × SP)	$6,800	
Materials Purchase Price Variance	$ 170	
Accounts Payable (AQ × AP)		$6,630

Recording DM Usage:

Work-in-process Inventory (SQ × SP)	$6,000	
Materials Usage Variance	$ 800	
Materials Inventory (AQ × SP)		$6,800

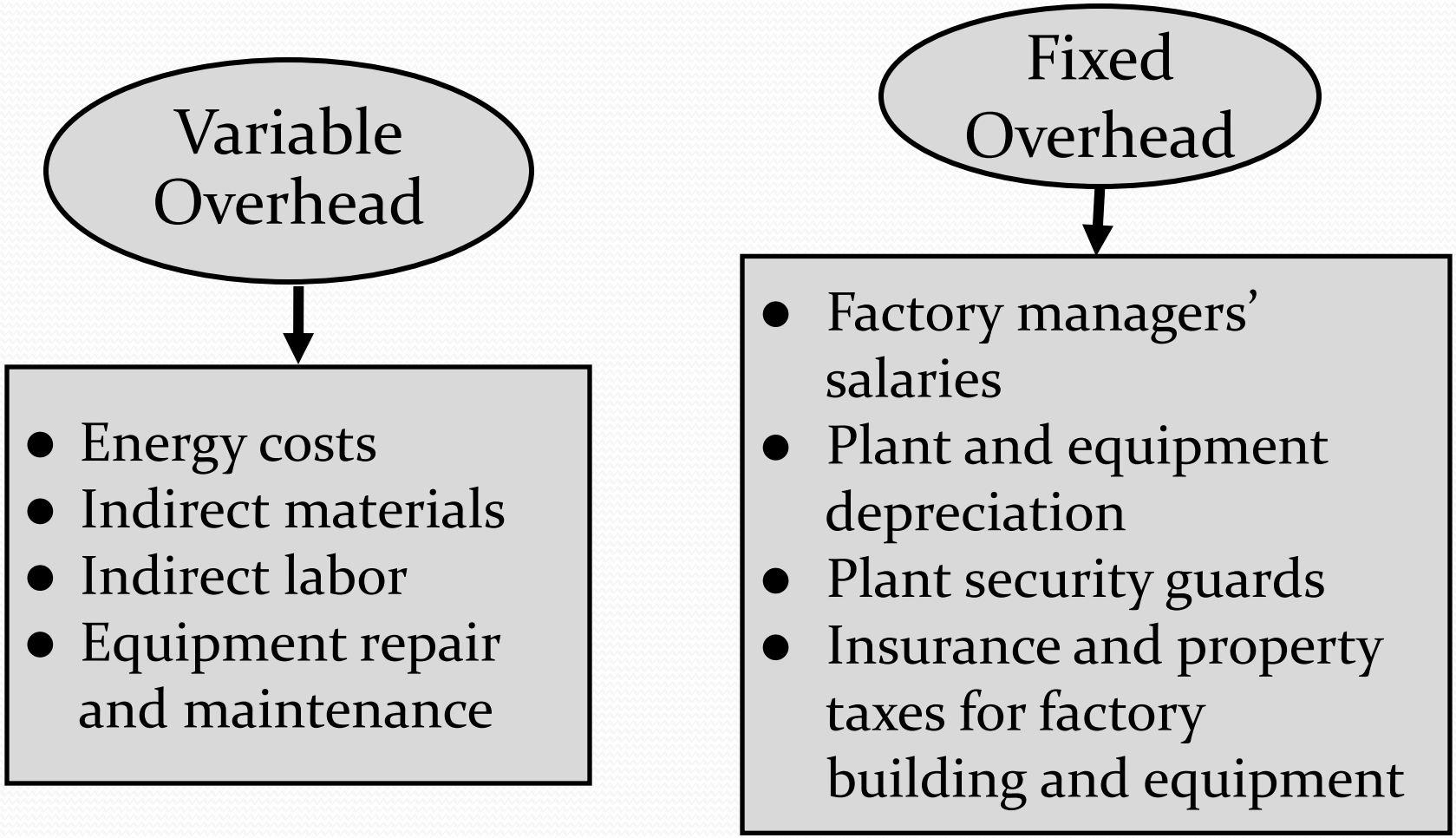
The Strategic Role of Nonfinancial Performance Indicators

- Limitations of short-term financial-performance indicators?
- Need to focus on business processes, including:
  - operating processes
  - customer-management processes
  - innovation processes
  - social/regulatory processes

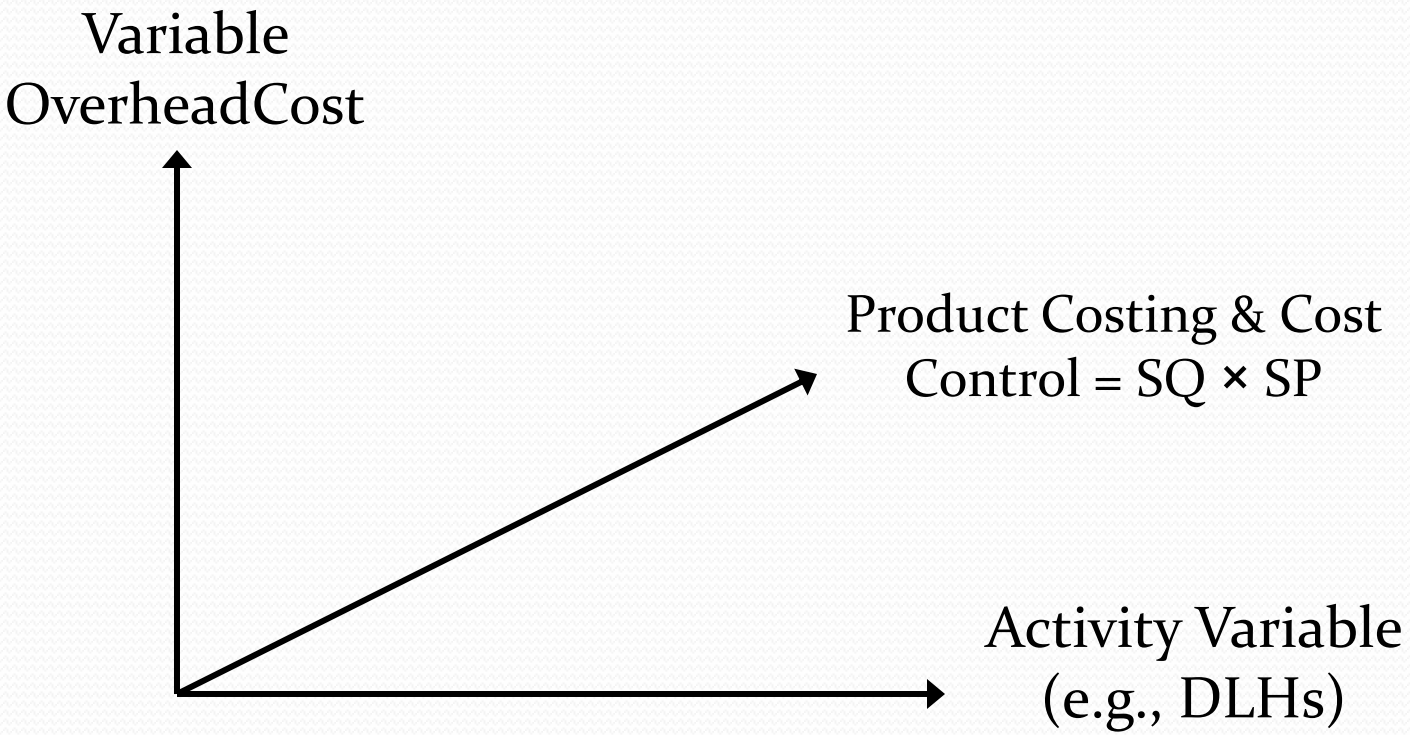
The Strategic Role of Nonfinancial Performance Indicators

- Example: Operating Process—Assessing the Move to JIT
- *Costs* of Implementing JIT?
- *Benefits* of Implementing JIT:
  - reduction in out-of-pocket inventory carrying costs
  - reduction in inventory holding (i.e., opportunity) costs
  - increases in sales, productivity, and market share
  - decreased production costs
- Relevant *nonfinancial performance indicators*:
  - customer-response time (CRT)
  - process cycle efficiency

Manufacturing (Factory) Overhead Costs: Examples



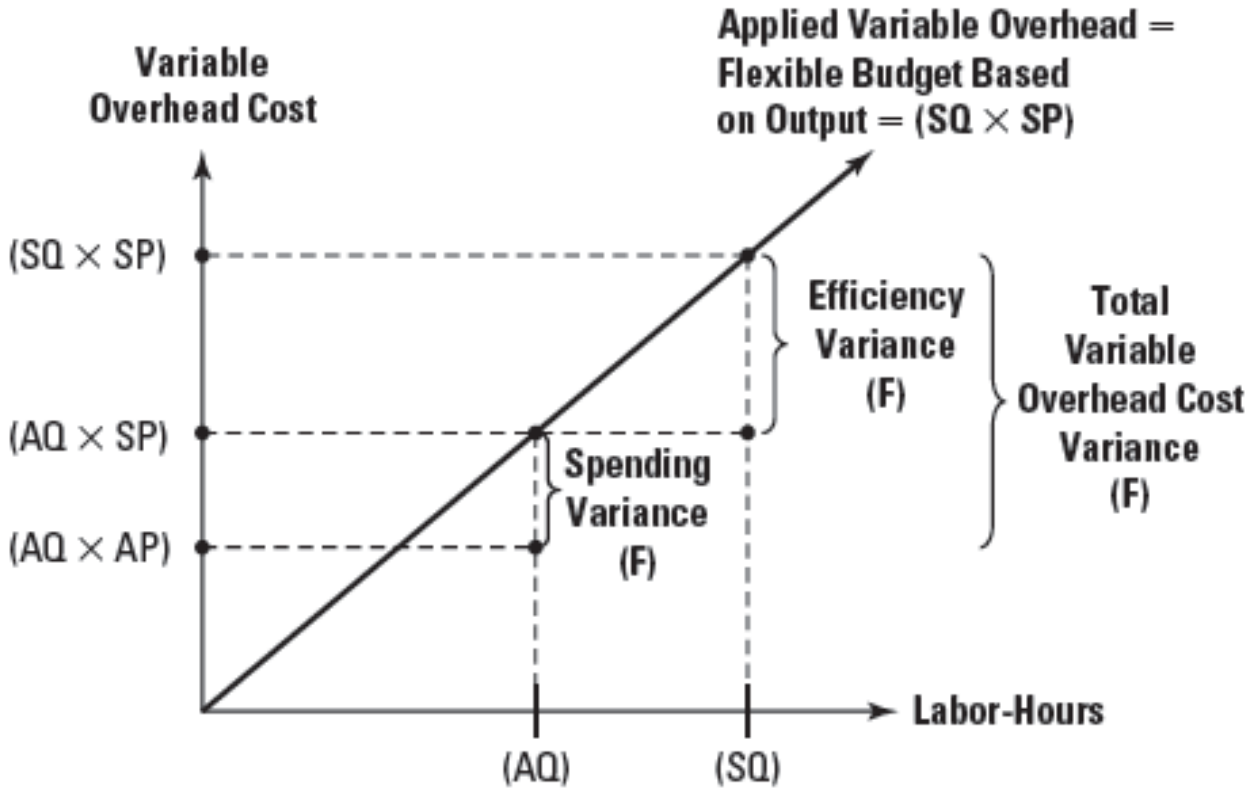
Standard Variable Overhead Costs: Product Costing vs. Control



SQ = Standard allowed DLHs for units produced; SP = Standard *variable* overhead cost/DLH

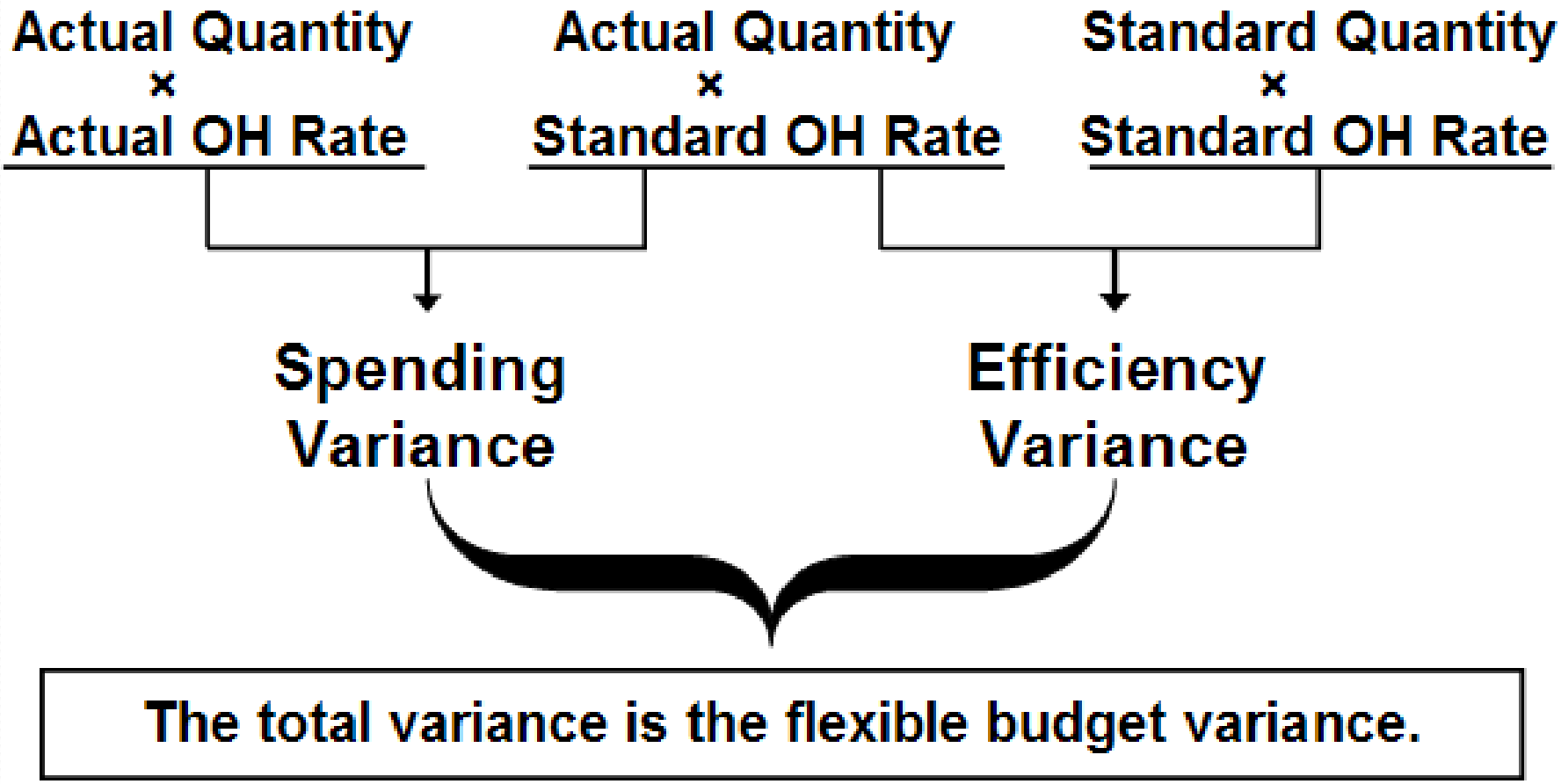
Variance Analysis

Variable Overhead Variance Analysis

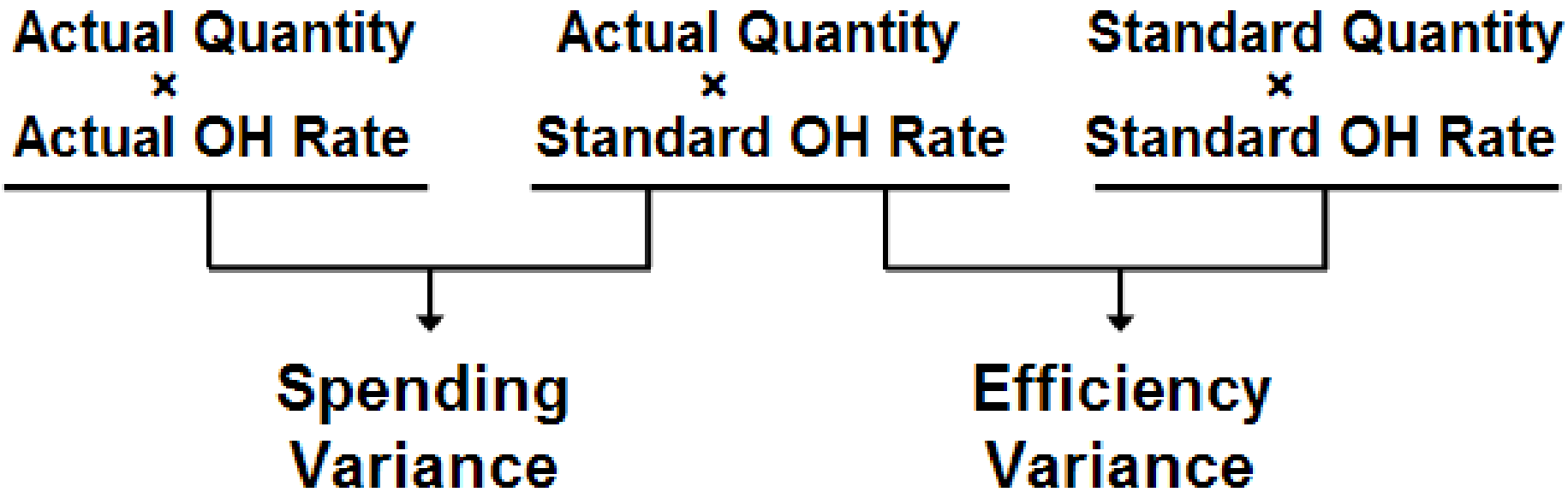


Legend: SQ = Standard direct labor-hours allowed for units produced = 5 hours/unit × 780 units = 3,900 hours
SP = Standard variable overhead cost per labor-hour = $12 (see Exhibit 15.2)
AQ = Actual labor-hours worked = 3,510 hours (Exhibit 14.6)
AP = Actual variable overhead cost per labor-hour worked = $40,630 ÷ 3,510 = $11.5755 (rounded)
Total variable overhead variance = Spending variance + Efficiency variance
F = A favorable effect on operating income

Variable Overhead Variance Analysis: Equation Approach



Variable Overhead Variance Analysis: Equation Approach



AQ x (AR - SR)	SR x (AQ - SQ)
AQ = Actual Quantity AR = Actual Rate	SR = Standard Rate SQ = Standard Quantity

Variable Overhead Variance Analysis: Example Calculations

Schmidt Machinery Co. applies variable factory overhead on the basis of DLHs. Hanson has the following variable factory overhead standard to manufacture one unit of product:

5.0 standard DLHs per unit @ a standard variable overhead rate of $12.00 per DLH

In October 2010, 3,510 hours were worked to make 780 units, and $40,630 was spent for variable factory overhead

Variable Overhead Variance Analysis: Example Calculations (continued)

Actual Hours	Actual Hours	Standard Hours
x	x	x
Actual Rate	Standard Rate	Standard Rate
3,510 DLHs	3,510 DLHs	3,900 DLHs
x	x	x
$11.5755/DLH	$12.00/DLH	$12.00/DLH
$40,630	**$42,120**	**$46,800**



Spending Variance	Efficiency Variance
$1,490 F	**$4,680 F**

Variable Overhead Variance Analysis: Alternative Presentation Format

Total Variable Overhead Variance = Actual Variable Overhead – Flexible Budget for Variable Overhead

= $40,630 – $46,800 = **$6,170 F**

Variable Overhead *Spending* Variance = AQ × (AP – SP)

= 3,510 DLHs × ($11.5755 – $12.00)/DLH = **$1,490 F**

Variable Overhead *Efficiency* Variance = SP x (AQ – SQ)

= $12.00/DLH x (3,510 – 3,900) DLHs = **$4,680 F**

Interpretation of Variable Overhead Cost Variances

Spending Variance

Results from spending more or less than expected for overhead items such as supplies and utilities.

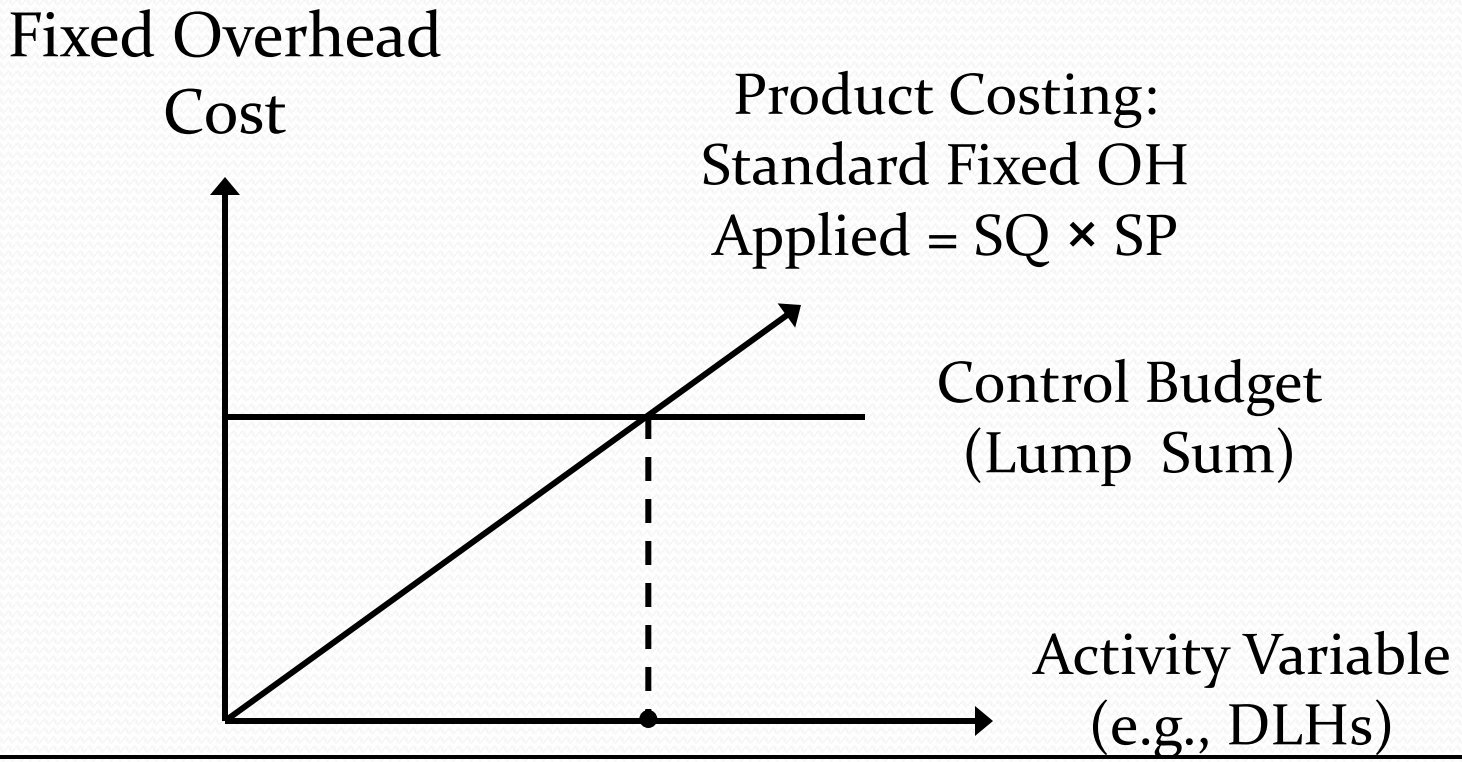


Efficiency Variance

Reflects efficiency or inefficiency in the use of the selected activity measure; does *not* reflect overhead control.



Standard Fixed Overhead Cost: Planning vs. Control



SQ = Standard allowed DLHs for units produced; SP = Standard *fixed* overhead cost/DLH; denominator volume = no. of DLHs used to set the fixed overhead application rate.

Product Costing: Determining the Standard Fixed Overhead Application Rate

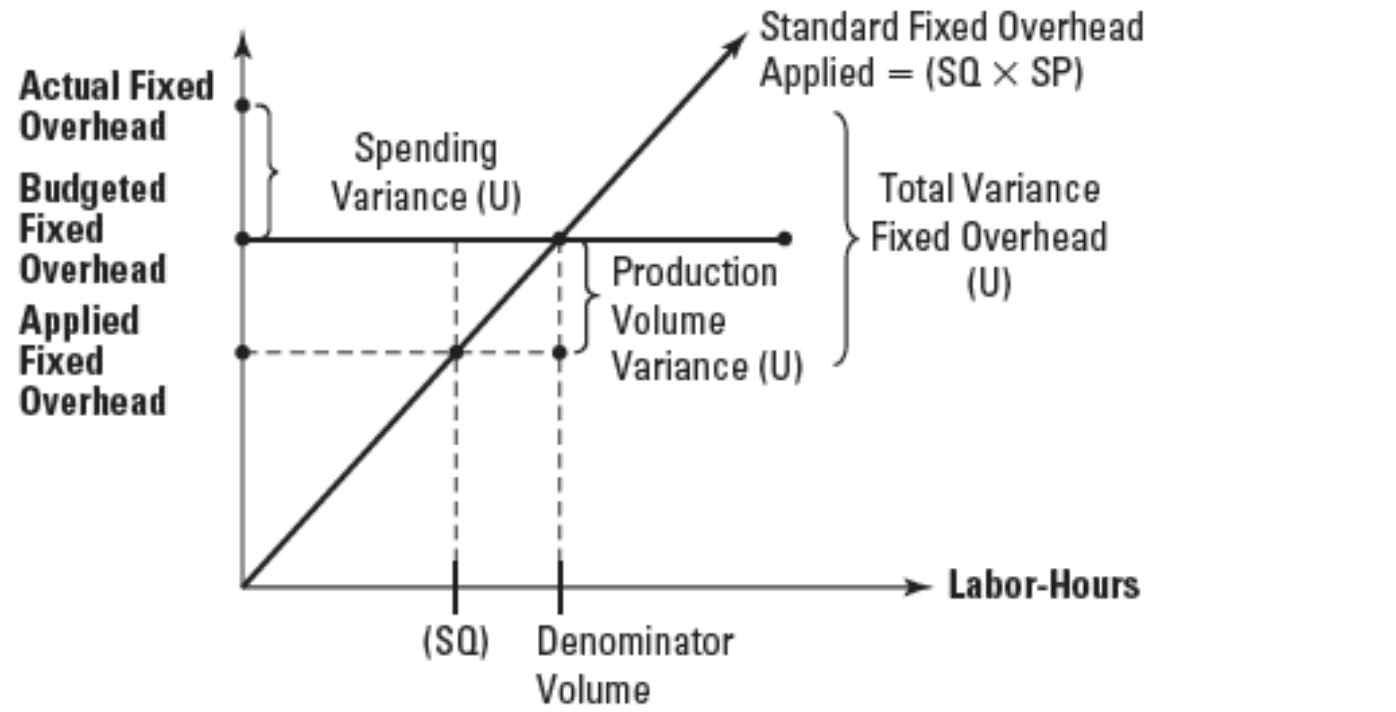
❶ Determine the total budgeted fixed manufacturing overhead for the upcoming period

❷ Select an activity variable for applying fixed factory overhead costs to outputs

❸ Choose a denominator volume level for the selected activity variable(e.g., “practical capacity”)

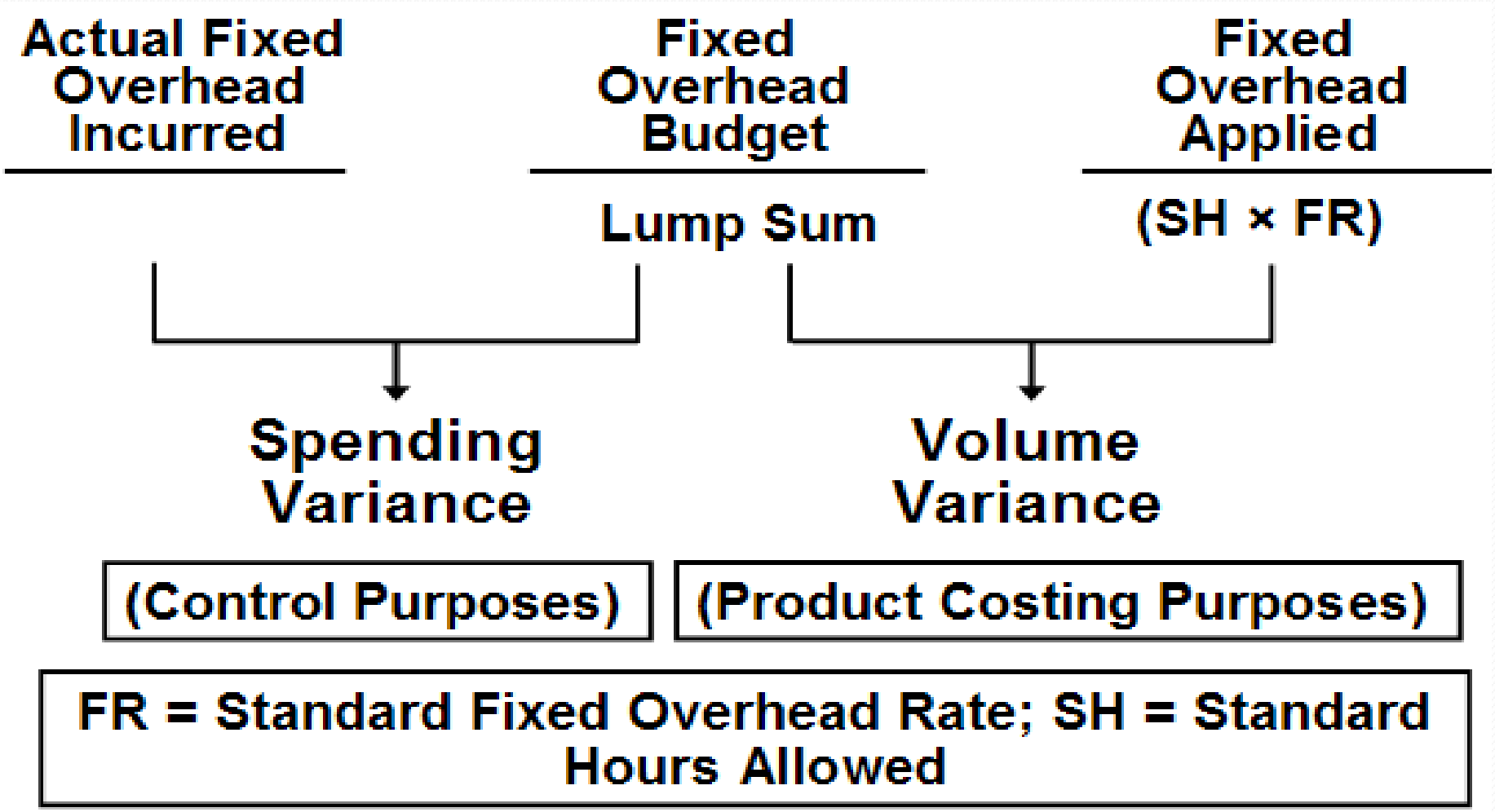
❹ Divide the amount in Step 1 by the amount in Step 3 to determine the standard fixed overhead application rate for product-costing purposes

Fixed Overhead Variance Analysis



Legend: SQ = Standard labor-hours allowed for units produced = 5 × 780 = 3,900 hours
Denominator volume = Number of labor-hours used to determine the fixed overhead application rate = 5,000 (i.e., 1,000 units × 5 hours/unit)
Budgeted fixed overhead = $120,000 (assumed)
SP = Standard fixed overhead cost per labor-hour = $120,000 ÷ 5,000 = $24 (see Exhibit 15.2)
Actual fixed overhead = $130,650 (assumed)
Total fixed overhead variance = Spending variance + Production volume variance

Calculating Fixed Overhead Variances



Example: Calculating Fixed Overhead Variances

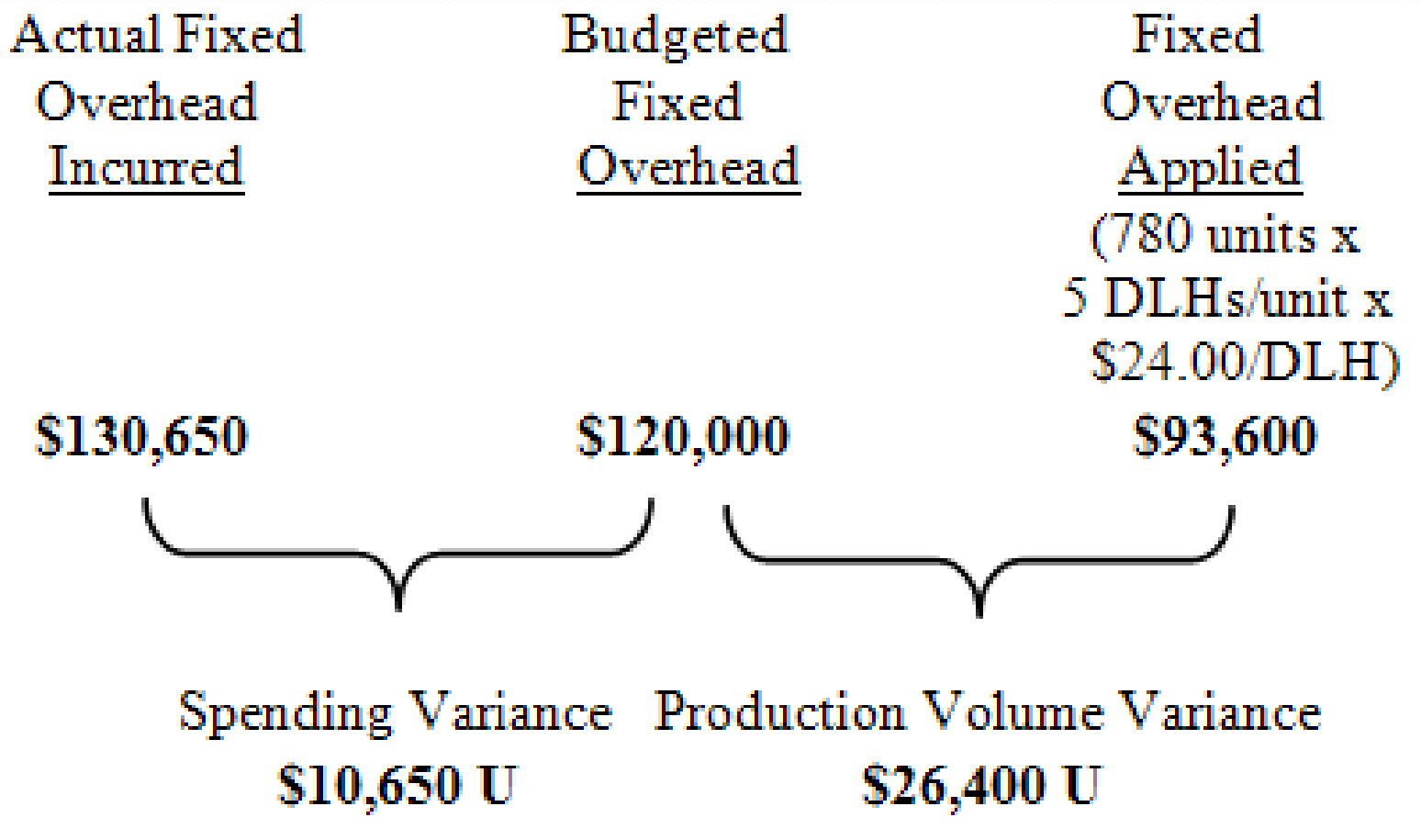
Schmidt's budgeted fixed manufacturing overhead cost is $120,000 for October 2010. The budgeted activity measure for the month is 1,000 units (@ 5 DLHs/unit).

Actual production is 780 units and actual fixed overhead is $130,650 for the month.

Compute the fixed overhead *spending* and *production volume* variances.

$$FR = \frac{\$120{,}000 \text{ budgeted fixed overhead}}{5{,}000 \text{ DLHs}} = \$24.00/\text{DLH}$$

Example: Calculating Fixed Overhead Variances



Fixed Overhead Variance Analysis: Alternative Presentation Format

Total Fixed Overhead Variance = Actual Fixed Overhead – Fixed Overhead Applied to Production

= $130,650 – $93,600 = **$26,400 U** (also called *Under*applied fixed overhead)

Fixed Overhead Spending (Budget) Variance

= Actual Fixed Overhead – Budgeted Fixed Overhead
= $130,650 – $120,000 = **$10,650 U**

Fixed Overhead Production Volume Variance

= Budgeted Fixed Overhead – Applied Fixed Overhead
= $120,000 - $93,600 = **$26,400 U**

Fixed Overhead Production Volume Variance: Alternative Calculation

Fixed Overhead Production Volume Variance = Standard Fixed Overhead Application Rate × (Actual Units Produced – Denominator Volume, in units)

= $120.00/unit × (780 – 1,000) units

= **$26,400 U** (i.e., *under*applied fixed overhead)

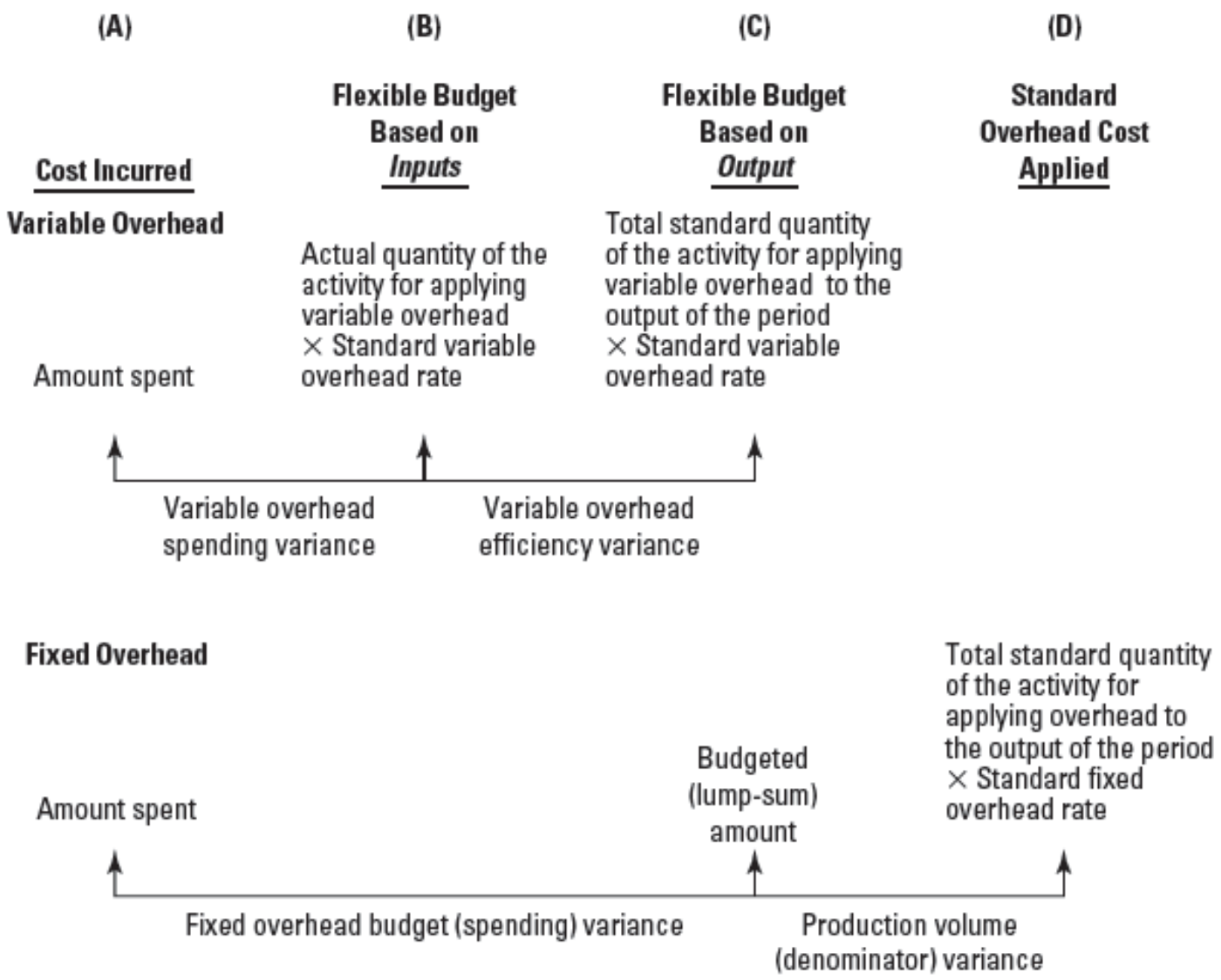
Interpretation of Fixed Overhead Variances

Spending (Budget) Variance	Production Volume Variance
Results from spending more or less than expected for individual fixed overhead items. That is, spending on individual fixed overhead items was different than planned.	Results from operating at a level other than the denominator volume level. Arises because of the *product-costing* purpose of fixed overhead. Not of direct interest for control purposes.

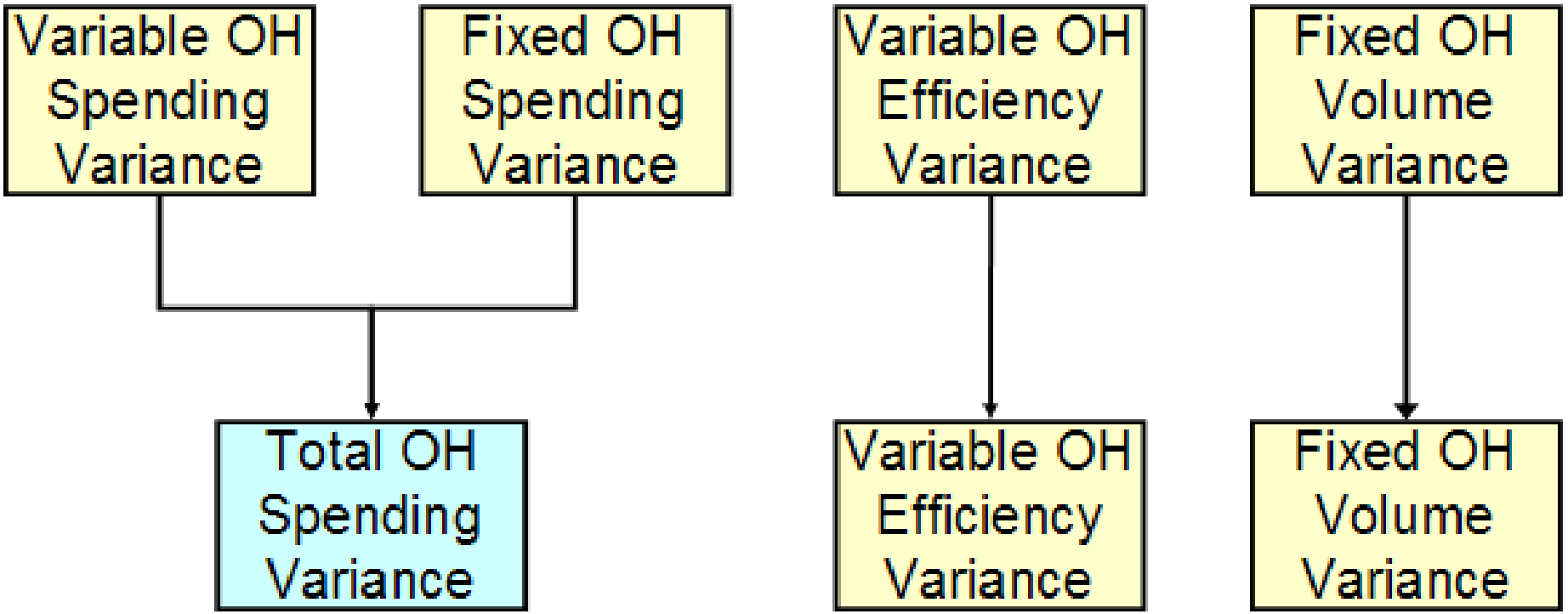
Causes of Fixed Overhead Variances

- Spending (Budget) Variance:
  - Ineffective budget procedures
  - Inadequate control of costs
  - Misclassification of cost items
- Production Volume Variance:
  - Management decisions
  - Unexpected changes in market demand
  - Unforeseen problems in manufacturing operations

Four-Way Breakdown of the Total Overhead Variance: Summary

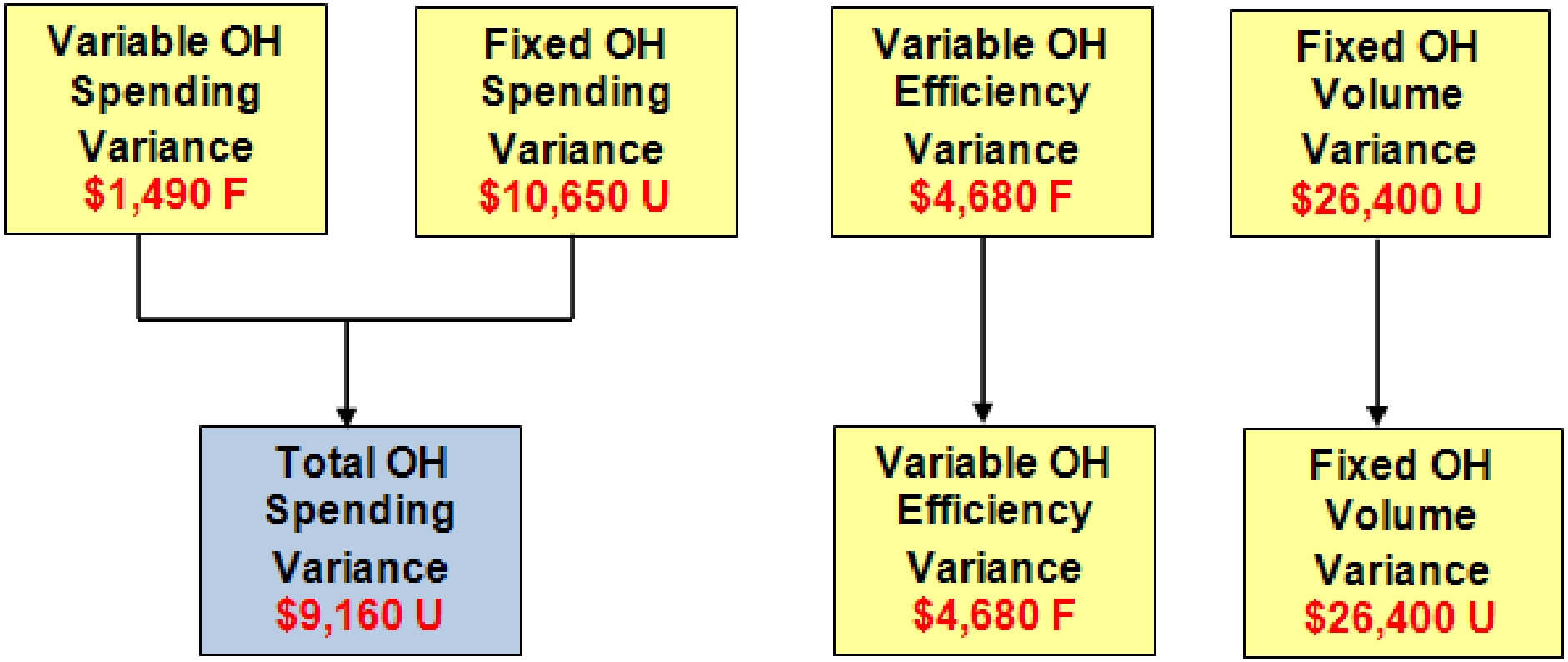


Alternative Analysis: Three-Way Breakdown of the Total Overhead Variance

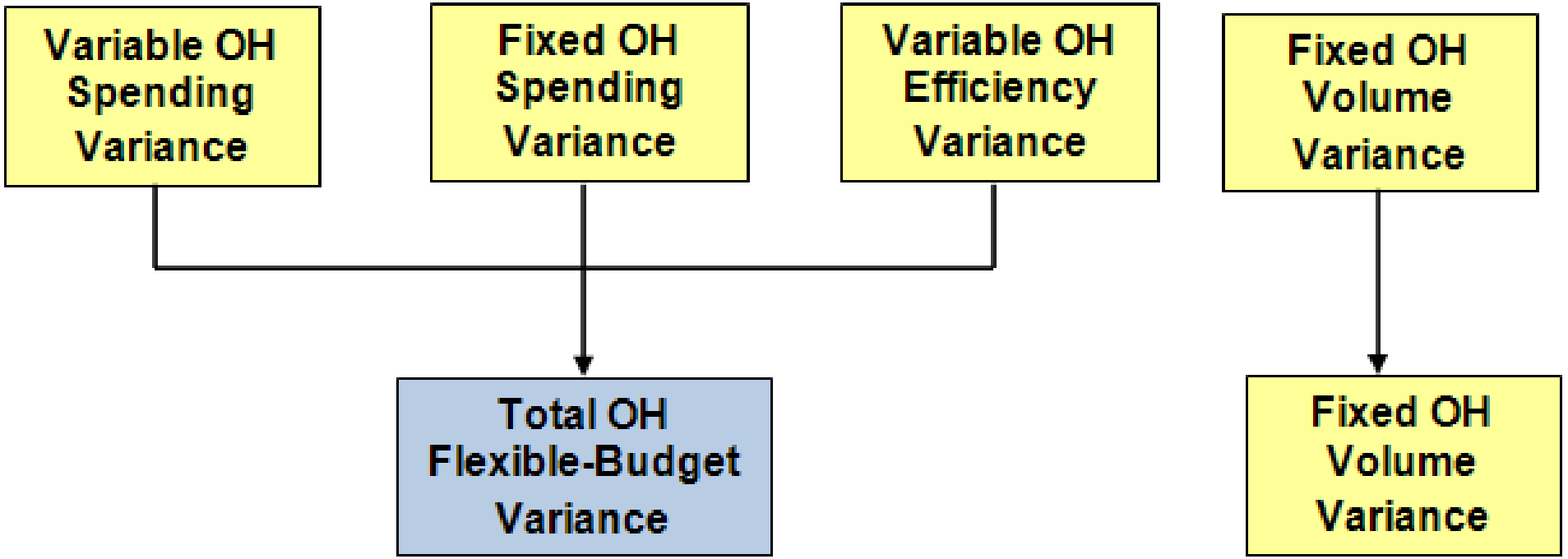


Factory and Corporate Overhead Standard Development

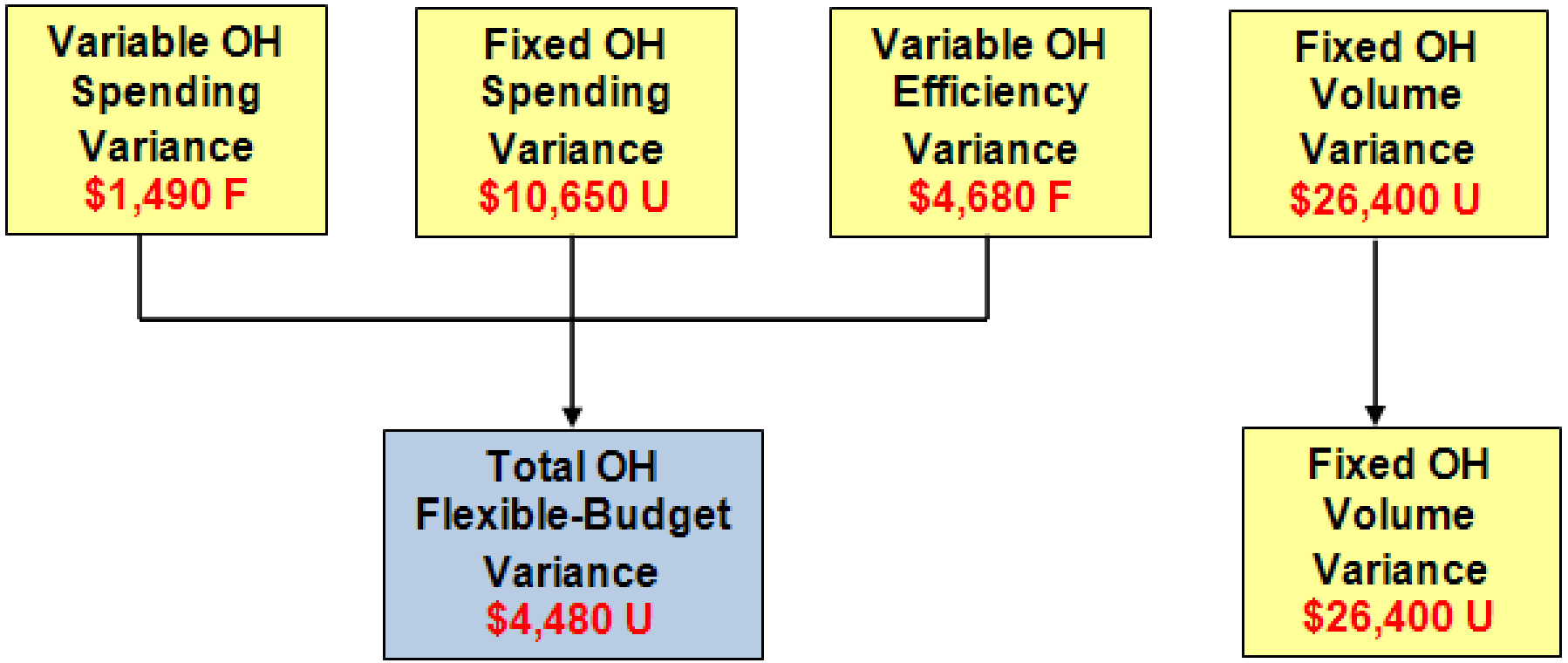
Schmidt Company: Three-Way vs. Four-Way Analysis of Total Factory Overhead Variance



Two-Way Analysis of Total Factory Overhead Variance



Schmidt Company: Two-Way Analysis of Total Factory Overhead Variance



Disposition of Standard Manufacturing Cost Variances

Schmidt Company
Manufacturing Cost Variances

From Chapter 14:	
DM purchase price variance	$ 4,350 U
DM usage variance	10,350 U
DL rate variance	7,020 U
DL efficiency variance	15,600 F
From Chapter 15:	
Variable factory overhead spending variance	1,490 F
Variable factory overhead efficiency variance	4,680 F
Fixed overhead spending variance	10,650 U
Fixed overhead production volume variance	26,400 U
Net manufacturing cost variance	$ 37,000 U

Alternative 1: Close Net Manufacturing Cost Variance to CGS

Dr. CGS (net variance)	**$37,000**	
Dr. DL Efficiency Variance	15,600	
Dr. VOH Efficiency Variance	4,680	
Dr. VOH Spending Variance	1,490	
Cr. DM Purchase Price Variance		$4,350
Cr. DM Quantity (Efficiency) Variance		10,350
Cr. DL rate variance		7,020
Cr. FOH spending variance		10,650
Cr. FOH Production Volume Variance		26,400

Income Statement after Disposition of Net Manufacturing Cost Variance

SCHMIDT MACHINERY COMPANY
Income Statement
For 2013

Sales (Exhibit 14.4), at standard selling price	$624,000	
Add: Selling price variance (Exhibit 14.4)	15,600F	
Net sales, at actual selling price		$639,600
Cost of goods sold (at standard: 780 units × $520/unit) (Exhibit 15.2)	$405,600	
Add: Net manufacturing cost variance	+37,000U[†]	
Total cost of goods sold		442,600
Gross margin		$197,000
Selling and administrative expenses ($39,000 variable + $30,000 fixed)		69,000
Operating income (before disposition of sales volume variance)		$128,000

Alternative 2: Prorate (Allocate) Net Manufacturing Cost Variance

- If the net variance is considered *material*, then the variance should be allocated (prorated) to the Inventory and CGS accounts
- Allocation should be based on the relative amount of this period's standard cost in the end-of-period balance of each affected account
- For external-reporting purposes, the provisions of FAS #151 regarding the treatment of "abnormal amounts" of idle-capacity expense must be followed

Effects on Absorption Costing Income of Denominator-Level Choice for Allocating Fixed Overhead Costs

- The issue: management's ability to *manage (or "smooth") reporting earnings*
- This ability is related to alternative treatments (dispositions) of the production volume variance
- The amount of fixed overhead cost absorbed into inventory or released as an expense on the income statement is affected by the denominator chosen for the fixed overhead application rate
- Income manipulation can occur if the production-volume variance is written off entirely to CGS

Standard Costs Applied to Service Organizations

- Jobs with repetitive tasks lend themselves to efficiency measures
- Computing non-manufacturing efficiency variances requires some assumed relationship between input and output activity



Examples

Service Applications (continued)

Department	Input	Output
Mailing	Labor hours	Number of pieces mailed
Personnel	Labor hours	Number of personnel changes processed
Food service	Labor hours	Number of meals served
Consulting	Billable hours	Customer revenues
Nursing	Labor hours	Number of patients and/or procedures
Check Processing	Computer hours	Number of checks processed

Overhead Cost Variances in ABC Systems

Traditional Approach to Product Costing :

Cost Item	Variable	Per	Fixed
Direct materials	$20	Unit	
Direct labor	30	DLH	
Indirect materials	2	DLH	
Repair and Maintenance	5	DLH	
Receiving			$5,000
Engineering Support			30,000
Setup			75,000

Traditional Financial-Performance Report

Cost Item	Actual Cost	Flexible Budget Based on Output	Flexible Budget Variance	
Direct materials	$50,000	$40,000	$10,000	U
Direct labor	36,000	30,000	6,000	U
Indirect materials	3,000	2,000	1,000	U
Repair and Maintenance	6,500	5,000	1,500	U
Receiving	3,000	5,000	2,000	F
Engineering Support	30,000	30,000	30,000	
Setup	50,000	75,000	25,000	F
Total	$178,500	$187,000	$8,500	F

Flexible Budget Using ABC

Cost Item	Flexible Budget	
Direct materials	$40,000	(2,000 × $20)
Direct labor	30,000	(2,000 × 0.5 × $30)
Indirect materials	2,000	(1,000 × $2)
Repair and Maintenance	6,000	(300,000 × $0.01) + $3,000
Receiving	3,500	(2 × $1,500) + $500
Engineering Support	30,000	($30,000 per period)
Setup	50,000	(2 × $25,000)
Total	$161,500	

Financial-Performance Report Using ABC

Cost Item	Actual Cost	Flexible Budget	Variance	
Direct materials	$50,000	$40,000	$10,000	U
Direct labor	36,000	30,000	6,000	U
Indirect materials	3,000	2,000	1,000	U
Repair and Maintenance	6,500	6,000	500	U
Receiving	3,000	3,500	500	F
Engineering Support	30,000	30,000		
Setup	50,000	50,000		
Total	$178,500	$161,500	$17,000	U

Flexible-Budget Analysis under ABC When There is a Standard Batch Size for Production Activity

- this situation provides the opportunity for a more detailed analysis

- variable setup costs under ABC:
  - convert actual output to standard # of batches
  - convert the above to standard setup hours

Flexible-Budget Analysis under ABC When There is a Standard Batch Size for Production Activity (continued)

- flexible budget cost for variable overhead =
- standard allowed hours × standard variable overhead cost per setup hour
- calculate flexible-budget variance for variable setup cost
- decompose flexible-budget variance into *spending* and *efficiency* components

Extensions of ABC Analysis: GPK and Resource Consumption Accounting (RCA)

- GPK (~ flexible standard costing) is a detailed German cost-accounting system
- RCA = comprehensive cost-management system represented (approximately) as a cross between GPK and ABC
- These systems rely on a large number of cost centers and cost pools
- Most appropriate with highly routine and repetitive operations

The Variance-Investigation Decision



How do I know which variances to investigate?



Larger variances, in dollar amount or as a percentage of the standard, are investigated first.

The Variance Investigation Decision

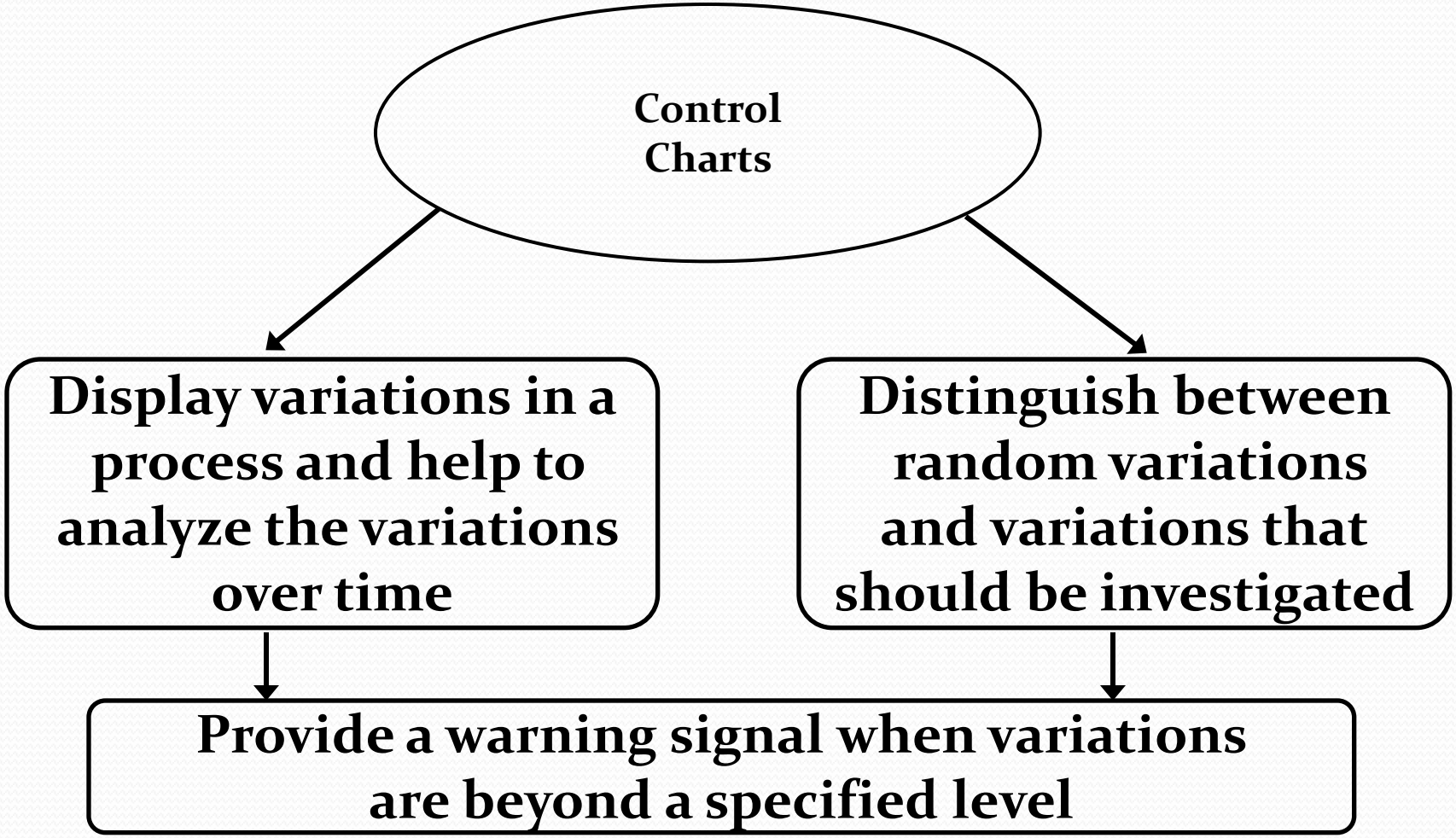
Uncontrollable (random) variances:

- Random Error

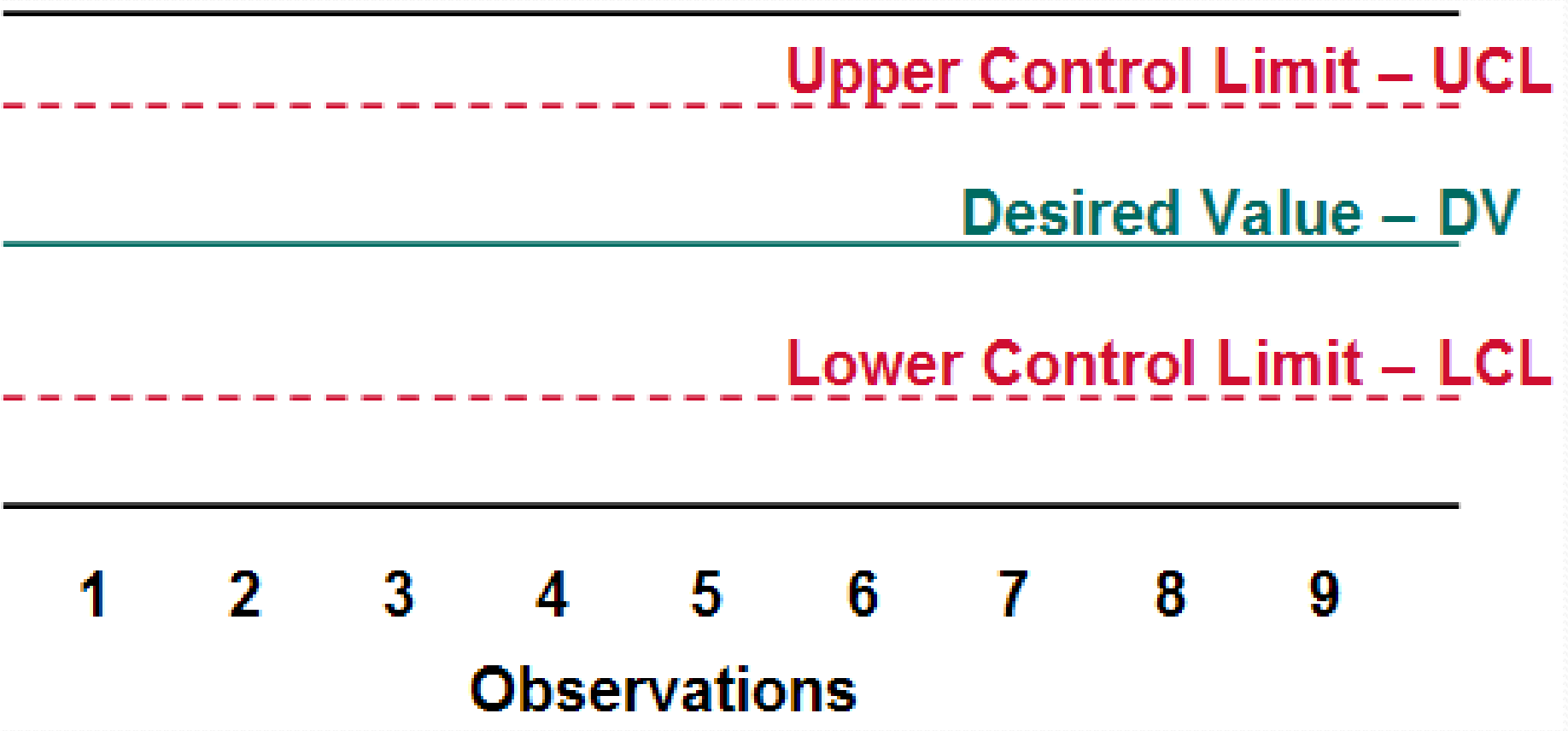
Controllable (systematic) variances:

- Prediction error
- Modeling error
- Measurement error
- Implementation error

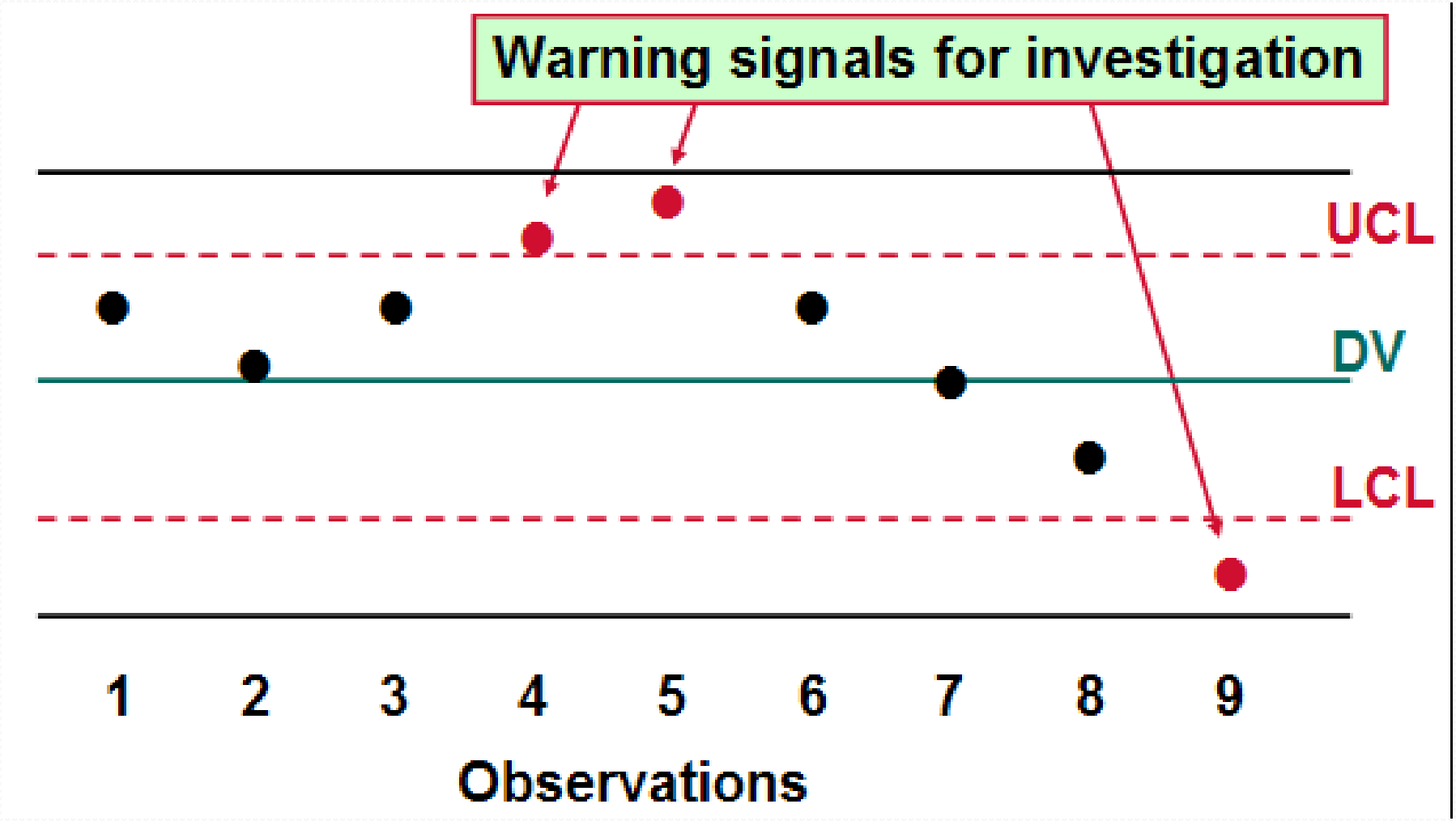
Role of Control Charts to Help Distinguish Random vs. Systematic Cost Variances



Control Charts



Control Charts (continued)



Variance Investigation Decisions Under Uncertainty

	States of Nature	
Action	**Random**	**Nonrandom**
Investigate	I	$I + C$
Do not investigate	none	L

Where: I = cost of an investigation

C = the cost to correct a variance

L = present value of losses by not correcting the variance

Variance Investigation Decisions—Indifference Probability

$$E(\text{Investigate}) = [(\text{I} + (1 - p)] + [(\text{I} + \text{C}) \times p]$$

$$E(\text{Do not investigate}) = \text{L} \times p$$

Set the above two equations equal, solve for p, the indifference probability:

$$p = \text{I} \div (\text{L} - \text{C})$$

Variance Investigation Decisions—Expected Value of Perfect Information

EVPI = Expected cost with perfect information – Expected cost without perfect information

EVPI = Expected cost with perfect information – Expected value of cost-minimizing choice under uncertainty

EVPI = Maximum amount a rational manager would pay for perfect information

DAY 5

Defining and Testing Optimisation Techniques in Models Using Excel®

- Basic Structure of All Optimisation Models
- Different Forms and Applications of Optimization Models
- Developing a Financial Optimisation Model
- Performing Sensitivity Analysis of an Optimisation Model
- Interpreting the Solution of an Optimisation Model to a Non-technical Manager
- Lessons Learned and Lessons to be Learned

Defining and Testing Optimisation Techniques in Models Using Excel®

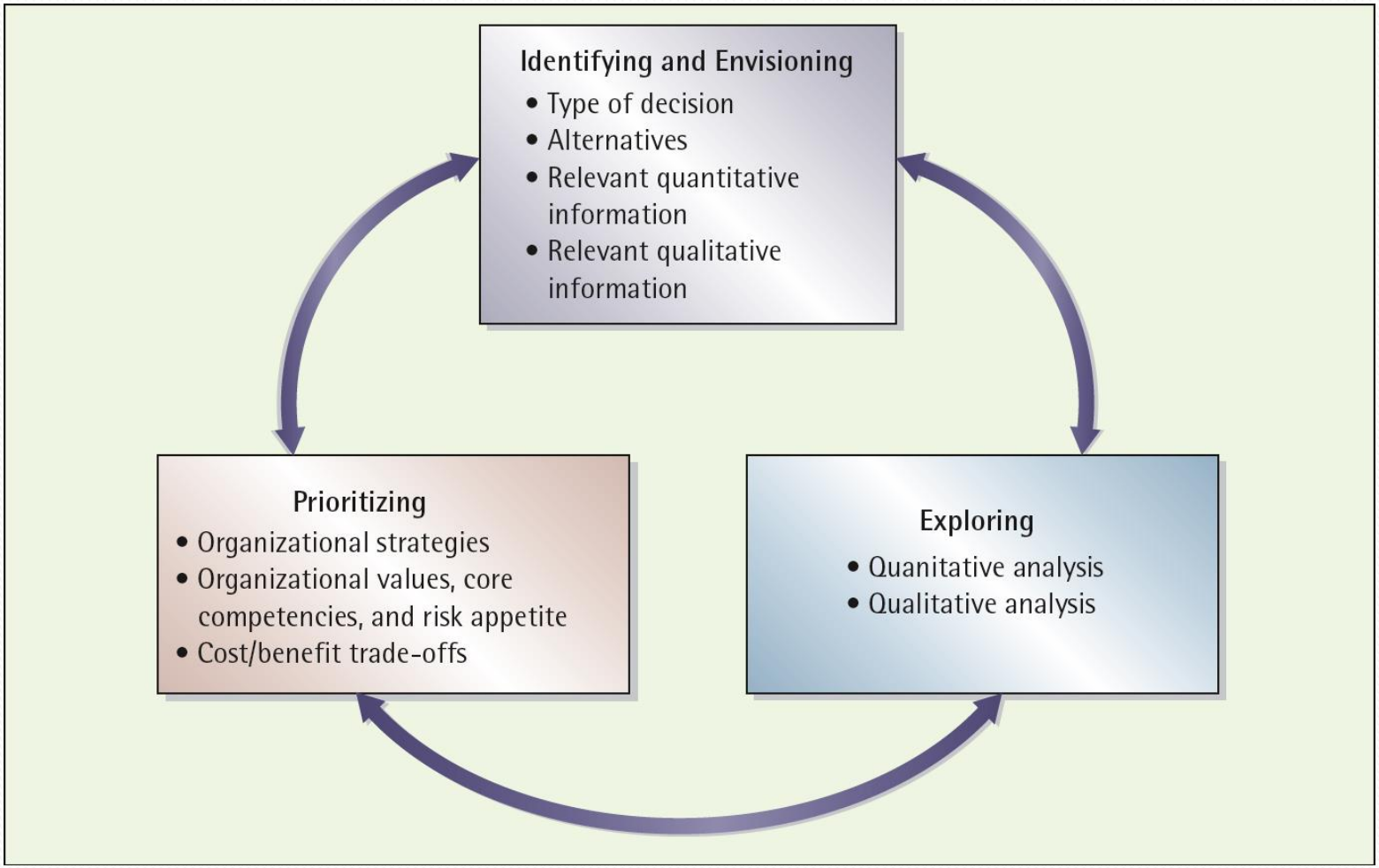
Defining and Testing Optimisation Techniques in Models Using Excel®

- Excel Models

Q1: Nonroutine Operating Decisions

- Routine operating decisions are those made on a regular schedule. Examples include:
  - annual budgets and resource allocation decisions
  - monthly production planning
  - weekly work scheduling issues
- Nonroutine operating decisions are not made on a regular schedule. Examples include:
  - accept or reject a customer's special order
  - keep or drop business segments
  - insource or outsource a business activity
  - constrained (scarce) resource allocation issues

Q1: Nonroutine Operating Decisions



Q1: Process for Making Nonroutine Operating Decisions

1. Identify the type of decision to be made.
2. Identify the relevant quantitative analysis technique(s).
3. Identify and analyze the qualitative factors.
4. Perform quantitative and/or qualitative analyses
5. Prioritize issues and arrive at a decision.

Q1: Identify the Type of Decision

- Special order decisions
  - determine the pricing
  - accept or reject a customer's proposal for order quantity and pricing
  - identify if there is sufficient available capacity
- Keep or drop business segment decisions
  - examples of business segments include product lines, divisions, services, geographic regions, or other distinct segments of the business
  - eliminating segments with operating losses will not always improve profits

Q1: Identify the Type of Decision

- Outsourcing decisions
  - make or buy production components
  - perform business activities “in-house” or pay another business to perform the activity
- Constrained resource allocation decisions
  - determine which products (or business segments) should receive allocations of scarce resources
  - examples include allocating scarce machine hours or limited supplies of materials to products
- Other decisions may use similar analyses

Q1: Identify and Apply the Relevant Quantitative Analysis Technique(s)

- Regression, CVP, and linear programming are examples of quantitative analysis techniques.
- Analysis techniques require input data.
  - Data for some input variables will be known and for other input variables estimates will be required.
- Many nonroutine decisions have a general decision rule to apply to the data.
- The results of the general rule need to be interpreted.
  - The quality of the information used must be considered when interpreting the results of the general rule.

Q2-Q5 : Identify and Analyze Qualitative Factors

- Qualitative information cannot easily be valued in dollars.
  - can be difficult to identify
  - can be every bit as important as the quantitative information
- Examples of qualitative information that may be relevant in some nonroutine decisions include:
  - quality of inputs available from a supplier
  - effects of decision on regular customers
  - effects of decision on employee morale
  - effects of production on the environment or the community

Q1: Consider All Information and Make a Decision

- Before making a decision:
  - Consider all quantitative and qualitative information.
    - Judgment is required when interpreting the effects of qualitative information.
  - Consider the quality of the information.
    - Judgment is also required when user lower-quality information.

Q2: Special Order Decisions

- A new customer (or an existing customer) may sometimes request a special order with a lower selling price per unit.
- The general rule for special order decisions is:
  - accept the order if incremental revenues exceed incremental costs.
  - subject to qualitative considerations.

Price	**>=**	**Relevant Variable Costs**	**+**	**Relevant Fixed Costs**	**+**	**Opportunity Cost**

- If the special order replaces a portion of normal operations, then the opportunity cost of accepting the order must be included in incremental costs.

Q2: Special Order Decisions

RobotBits, Inc. makes sensory input devices for robot manufacturers. The normal selling price is $38.00 per unit. RobotBits was approached by a large robot manufacturer, U.S. Robots, Inc. USR wants to buy 8,000 units at $24, and USR will pay the shipping costs. The per-unit costs traceable to the product (based on normal capacity of 94,000 units) are listed below. Which costs are relevant to this decision?

Direct materials	yes	$6.20	Relevant?
Direct labor	yes	8.00	Relevant?
Variable mfg. overhead	yes	5.80	Relevant?
Fixed mfg. overhead	no	3.50	Relevant?
Shipping/handling	yes	2.50	Relevant?
Fixed administrative costs	no	0.88	Relevant?
Fixed selling costs	no	0.36	Relevant?
		$27.24	

$20.00

Q2: Special Order Decisions

Suppose that the capacity of RobotBits is 107,000 units and projected sales to regular customers this year total 94,000 units. Does the quantitative analysis suggest that the company should accept the special order?

First determine if there is sufficient idle capacity to accept this order without disrupting normal operations:

Projected sales to regular customers	94,000 units
Special order	8,000 units
	102,000 units

RobotBits still has 5,000 units of idle capacity if the order is accepted. Compare incremental revenue to incremental cost:

Incremental profit if accept special order =

($24 selling price - $20 relevant costs) x 8,000 units = $32,000

Q2: Qualitative Factors in Special Order Decisions

What qualitative issues, in general, might RobotBits consider before finalizing its decision?

- Will USR expect the same selling price per unit on future orders?
- Will other regular customers be upset if they discover the lower selling price to one of their competitors?
- Will employee productivity change with the increase in production?
- Given the increase in production, will the incremental costs remain as predicted for this special order?
- Are materials available from its supplier to meet the increase in production?

Q2: Special Order Decisions and Capacity Issues

Suppose instead that the capacity of RobotBits is 100,000 units and projected sales to regular customers this year totals 94,000 units. Should the company accept the special order?

Here the company does not have enough idle capacity to accept the order:

Projected sales to regular customers	94,000 units
Special order	8,000 units
	102,000 units

If USR will not agree to a reduction of the order to 6,000 units, then the offer can only be accepted by denying sales of 2,000 units to regular customers.

Q2: Special Order Decisions and Capacity Issues

Suppose instead that the capacity of RobotBits is 100,000 units and projected sales to regular customers this year total 94,000 units. Does the quantitative analysis suggest that the company should accept the special order?

Direct materials	$6.20
Direct labor	8.00
Variable mfg. overhead	5.80
Fixed mfg. overhead	3.50
Shipping/handling	2.50
Fixed administrative costs	0.88
Fixed selling costs	0.36
	$27.24

Variable cost/unit for regular sales = $22.50.

CM/unit on regular sales = $38.00 - $22.50 = $15.50.

The opportunity cost of accepting this order is the lost contribution margin on 2,000 units of regular sales.

Incremental profit if accept special order =

$32,000 incremental profit under idle capacity – opportunity cost =

$32,000 - $15.50 x 2,000 = $1,000

Q2: Qualitative Factors in Special Order Decisions

What additional qualitative issues, in this case of a capacity constraint, might RobotBits consider before finalizing its decision?

- What will be the effect on the regular customer(s) that do not receive their order(s) of 2,000 units?
- What is the effect on the company's reputation of leaving orders from regular customers of 2,000 units unfilled?
- Will any of the projected costs change if the company operates at 100% capacity?
- Are there any methods to increase capacity? What effects do these methods have on employees and on the community?
- Notice that the small incremental profit of $1,000 will probably be outweighed by the qualitative considerations.

Q3: Keep or Drop Decisions

- Managers must determine whether to keep or eliminate business segments that appear to be unprofitable.
- The general rule for keep or drop decisions is:
  - keep the business segment if its contribution margin covers its avoidable fixed costs,
  - subject to qualitative considerations.

Drop if: Contribution Margin	<	Relevant Fixed Costs	+	Opportunity Cost

- If the business segment's elimination will affect continuing operations, the opportunity costs of its discontinuation must be included in the analysis.

Q3: Keep or Drop Decisions

Starz, Inc. has 3 divisions. The Gibson and Quaid Divisions have recently been operating at a loss. Management is considering the elimination of these divisions. Divisional income statements (in 1000s of dollars) are given below. According to the quantitative analysis, should Starz eliminate Gibson or Quaid or both?

	Gibson	Quaid	Russell	Total
Revenues	$390	$433	$837	$1,660
Variable costs	247	335	472	1,054
Contribution margin	143	98	365	606
Traceable fixed costs	166	114	175	455
Division operating income	($23)	($16)	$190	151
Unallocated fixed costs				81
Operating income				$70

Breakdown of traceable fixed costs:			
Avoidable	$154	$96	$139
Unavoidable	12	18	36
	$166	$114	$175

Q3: Keep or Drop Decisions

	Gibson	Quaid	Russell	Total
Revenues	$390	$433	$837	$1,660
Variable costs	247	335	472	1,054
Contribution margin	143	98	365	606
Traceable fixed costs	166	114	175	455
Division operating income	($23)	($16)	$190	151
Unallocated fixed costs				81
Operating income				$70
Breakdown of traceable fixed costs:				
Avoidable	$154	$96	$139	
Unavoidable	12	18	36	
	$166	$114	$175	

Use the general rule to determine if Gibson and/or Quaid should be eliminated.

	Gibson	Quaid
Contribution margin	$143	$98
Avoidable fixed costs	154	96
Effect on profit if keep	($11)	$2

The general rule shows that we should keep Quaid and drop Gibson.

Q3: Keep or Drop Decisions

	Gibson	Quaid	Russell	Total
Revenues	$390	$433	$837	$1,660
Variable costs	247	335	472	1,054
Contribution margin	143	98	365	606
Traceable fixed costs	166	114	175	455
Division operating income	($23)	($16)	$190	151
Unallocated fixed costs				81
Operating income				$70
Breakdown of traceable fixed costs:				
Avoidable	$154	$96	$139	
Unavoidable	12	18	36	
	$166	$114	$175	

Using the general rule is easier than recasting the income statements:

Quaid & Russell only

	Gibson	Quaid	Russell	Total
Revenues	$390	$433	$837	$1,270
Variable costs	247	335	472	807
Contribution margin	143	98	365	$463
Traceable fixed costs	166	114	175	289
Division operating income	($23)	($16)	$190	$174
Unallocated fixed costs				81
Gibson's unavoidable fixed costs				12
Operating income				$81

Profits increase by $11 when Gibson is eliminated.

Q3: Keep or Drop Decisions

Suppose that the Gibson & Quaid Divisions use the same supplier for a particular production input. If the Gibson Division is dropped, the decrease in purchases from this supplier means that Quaid will no longer receive volume discounts on this input. This will increase the costs of production for Quaid by $14,000 per year. In this scenario, should Starz still eliminate the Gibson Division?

Effect on profit if drop Gibson before considering impact on Quaid's production costs	$11
Opportunity cost of eliminating Gibson	(14)
Revised effect on profit if drop Gibson	($3)

Profits decrease by $3 when Gibson is eliminated.

Q3: Qualitative Factors in Keep or Drop Decisions

What qualitative issues should Starz consider before finalizing its decision?

- What will be the effect on the customers of Gibson if it is eliminated? What is the effect on the company's reputation?
- What will be the effect on the employees of Gibson? Can any of them be reassigned to other divisions?
- What will be the effect on the community where Gibson is located if the decision is made to drop Gibson?
- What will be the effect on the morale of the employees of the remaining divisions?

Q4: Insource or Outsource (Make or Buy) Decisions

- Managers often must determine whether to
  - make or buy a production input
  - keep a business activity in house or outsource the activity
- The general rule for make or buy decisions is:
  - choose the alternative with the lowest relevant (incremental cost), subject to qualitative considerations
- If the decision will affect other aspects of operations, these costs (or lost revenues) must be included in the analysis.

Outsource if: Cost to Outsource < Cost to Insource

Where: **Cost to Insource** = **Relevant FC** + **Relevant VC** + **Opportunity Cost**

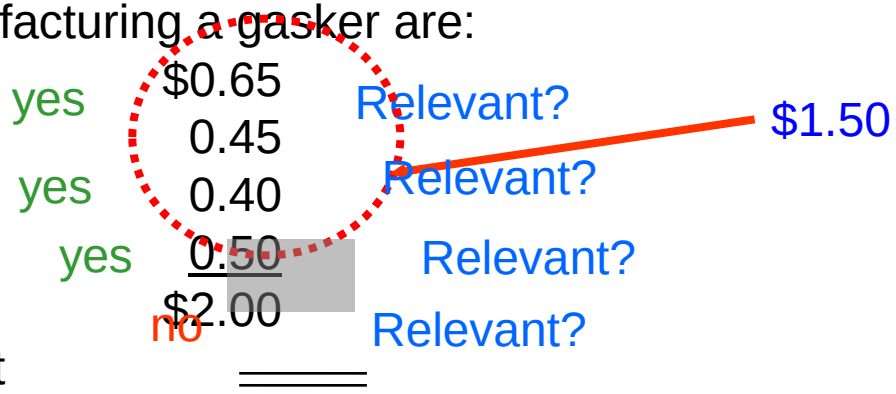
Q4: Make or Buy Decisions

Graham Co. currently of our main product manufactures a part called a gasker used in the manufacture of its main product. Graham makes and uses 60,000 gaskers per year. The production costs are detailed below. An outside supplier has offered to supply Graham 60,000 gaskers per year at $1.55 each. Fixed production costs of $30,000 associated with the gaskers are unavoidable. Should Graham make or buy the gaskers?

The production costs per unit for manufacturing a gasker are:

Direct materials	yes	$0.65	Relevant?
Direct labor		0.45	
Variable manufacturing overhead	yes	0.40	Relevant?
Fixed manufacturing overhead*	yes	0.50	Relevant?
	no	$2.00	Relevant?

*$30,000/60,000 units = $0.50/unit



Advantage of "make" over "buy" = [$1.55 - $1.50] x 60,000 = $3,000

Q4: Qualitative Factors in Make or Buy Decisions

The quantitative analysis indicates that Graham should continue to make the component. What qualitative issues should Graham consider before finalizing its decision?

- Is the quality of the manufactured component superior to the quality of the purchased component?
- Will purchasing the component result in more timely availability of the component?
- Would a relationship with the potential supplier benefit the company in any way?
- Are there any worker productivity issues that affect this decision?

Q3: Make or Buy Decisions

Suppose the potential supplier of the gasker offers Graham a discount for a different sub-unit required to manufacture Graham's main product if Graham purchases 60,000 gaskers annually. This discount is expected to save Graham $15,000 per year. Should Graham consider purchasing the gaskers?

Advantage of "make" over "buy" before considering discount (slide139)	$3,000
Discount	15,000
Advantage of "buy" over "make"	$12,000

Profits increase by $12,000 when the gasker is purchased instead of manufactured.

Q5: Constrained Resource (Product Emphasis) Decisions

- Managers often face constraints such as
  - production capacity constraints such as machine hours or limits on availability of material inputs
  - limits on the quantities of outputs that customers demand
- Managers need to determine which products should first be allocated the scarce resources.
- The general rule for constrained resource allocation decisions with only one constraint is:
  - allocate scarce resources to products with the highest contribution margin per unit of the constrained resource,
  - subject to qualitative considerations.

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

Urban's Umbrellas makes two types of patio umbrellas, regular and deluxe. Suppose there is unlimited customer demand for each product. The selling prices and variable costs of each product are listed below.

	Regular	Deluxe
Selling price per unit	$40	$110
Variable cost per unit	20	44
Contribution margin per unit	$20	$ 66
Contribution margin ratio	50%	60%
Required machine hours/unit	0.4	2.0

Urban has only 160,000 machine hours available per year.

Write Urban's machine hour constraint as an inequality.

$0.4R + 2D \leq 160{,}000$ machine hours

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

Suppose that Urban decides to make all Regular umbrellas. What is the total contribution margin? Recall that the CM/unit for R is $20.

The machine hour constraint is: $0.4R + 2D \leq 160{,}000$ machine hours

If D=0, this constraint becomes $0.4R \leq 160{,}000$ machine hours, or $R \leq 400{,}000$ units

Total contribution margin = $20*400,000 = $8 million

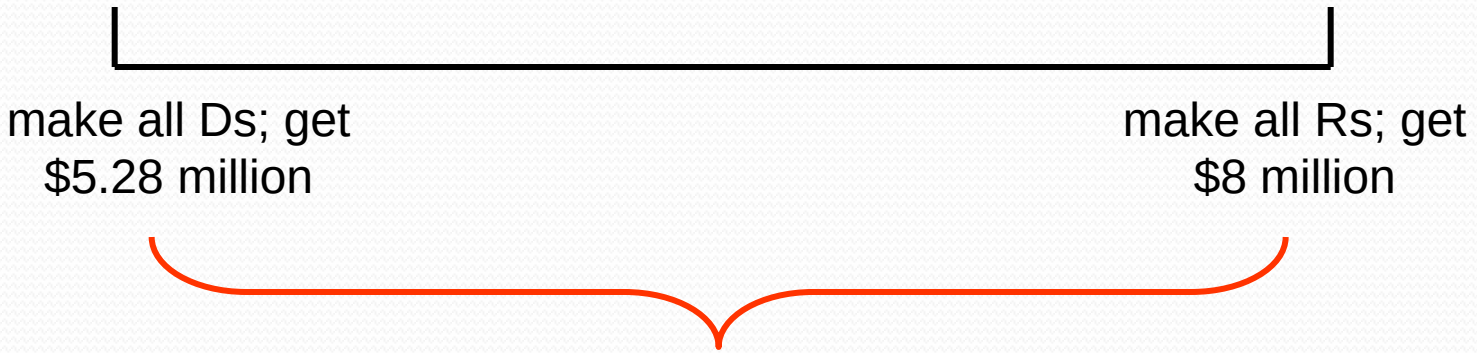
Suppose that Urban decides to make all Deluxe umbrellas. What is the total contribution margin? Recall that the CM/unit for D is $66.

If R=0, this constraint becomes $2D \leq 160{,}000$ machine hours, or $D \leq 80{,}000$ units

Total contribution margin = $66*80,000 = $5.28 million

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

If the choice is between all Ds or all Rs, then clearly making all Rs is better. But how do we know that some combination of Rs and Ds won't yield an even higher contribution margin?



In a one constraint problem, a combination of Rs and Ds will yield a contribution margin between $5.28 and $8 million. Therefore, Urban will only make one product, and clearly R is the best choice.

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

The general rule for constrained resource decisions with one scarce resource is to first make only the product with the highest contribution margin per unit of the constrained resource.

In Urban's case, the sole scarce resource was machine hours, so Urban should make only the product with the highest contribution margin per machine hour.

R: CM/mach hr = $20/0.4mach hrs = $50/mach hr

D: CM/mach hr = $66/2mach hrs = $33/mach hr

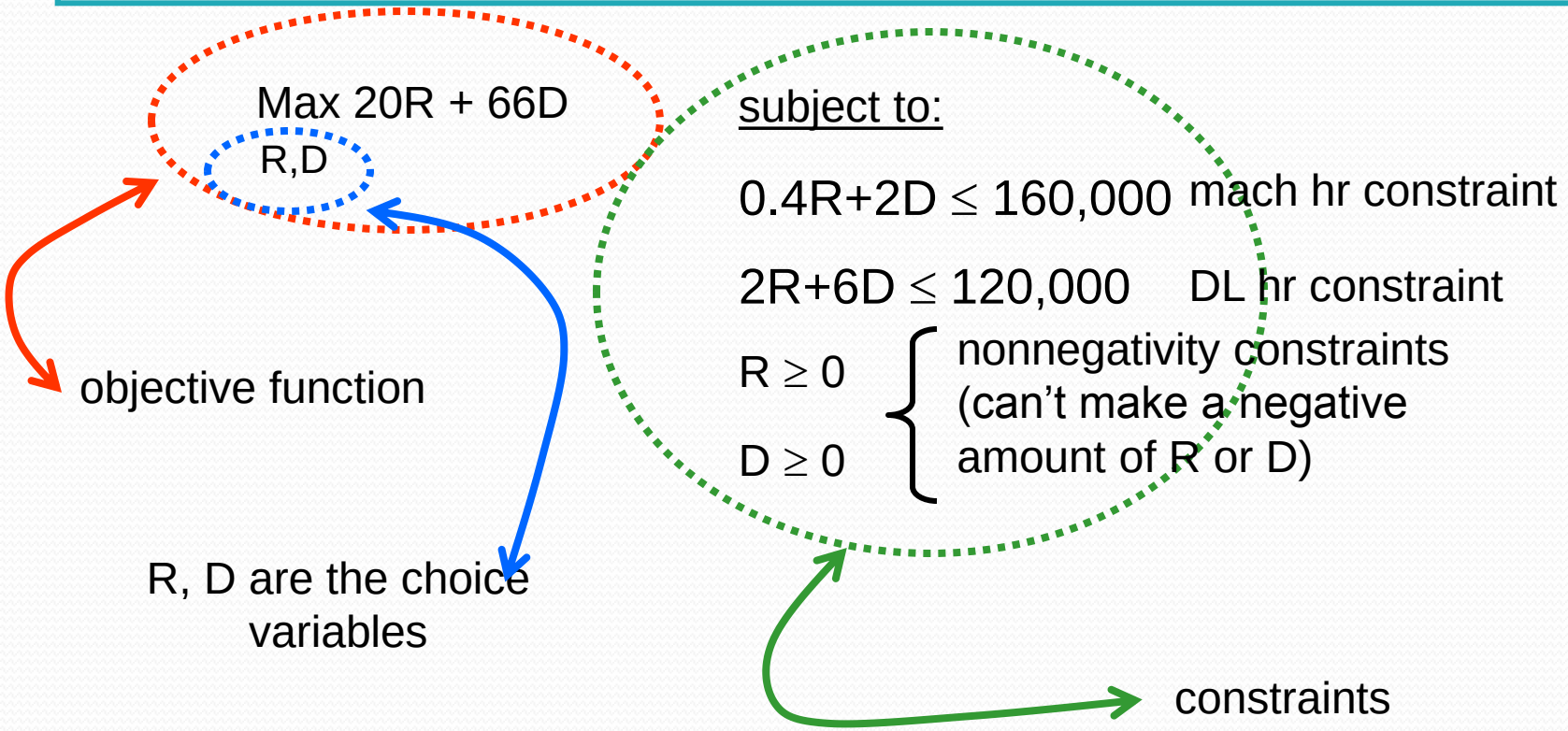
Notice that the total contribution margin from making all Rs is $50/mach hr x 160,000 machine hours to be used producing Rs = $8 million.

Q5: Constrained Resource Decisions (Multiple Scarce Resources)

- Usually managers face more than one constraint.
- Multiple constraints are easiest to analyze using a quantitative analysis technique known as linear programming.
- A problem formulated as a linear programming problem contains
  - an algebraic expression of the company's goal, known as the objective function
    - for example "maximize total contribution margin" or "minimize total costs"
  - a list of the constraints written as inequalities

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

Suppose Urban also need 2 and 6 hours of direct labor per unit of R and D, respectively. There are only 120,000 direct labor hours available per year. Formulate this as a linear programming problem.



Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

Draw a graph showing the possible production plans for Urban.

Every R, D ordered pair is a production plan.

But which ones are feasible, given the constraints?

To determine this, graph the constraints as inequalities.

$0.4R+2D \leq 160{,}000$ mach hr constraint

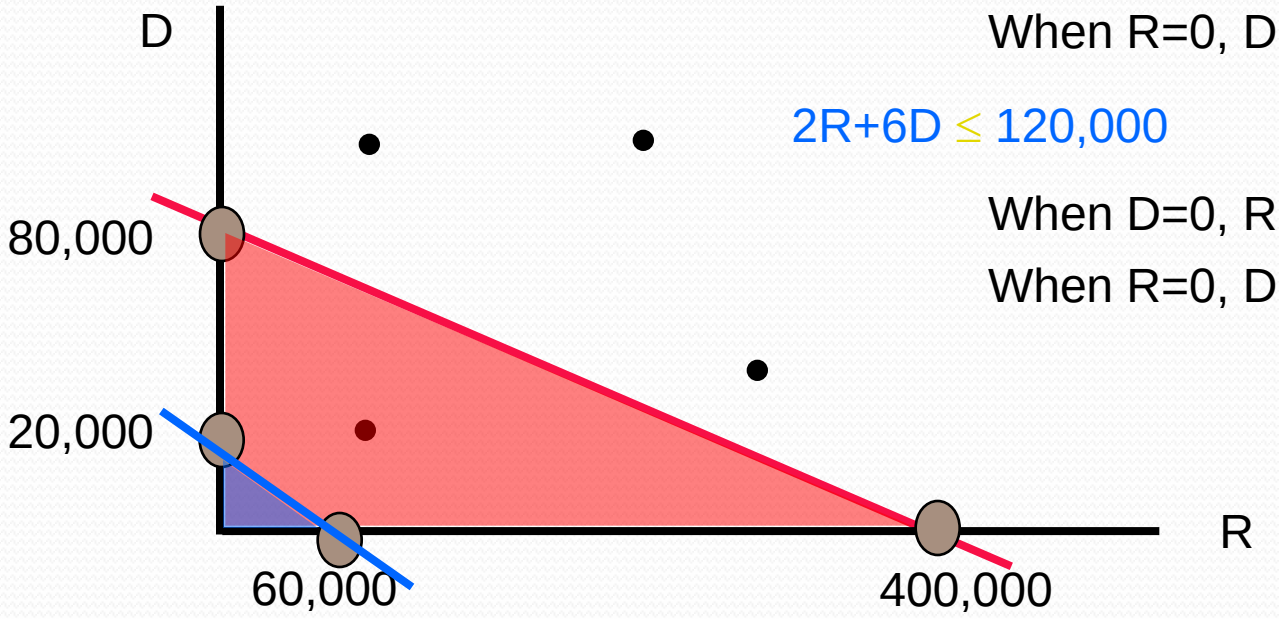
When D=0, R=400,000

When R=0, D=80,000

$2R+6D \leq 120{,}000$ DL hr constraint

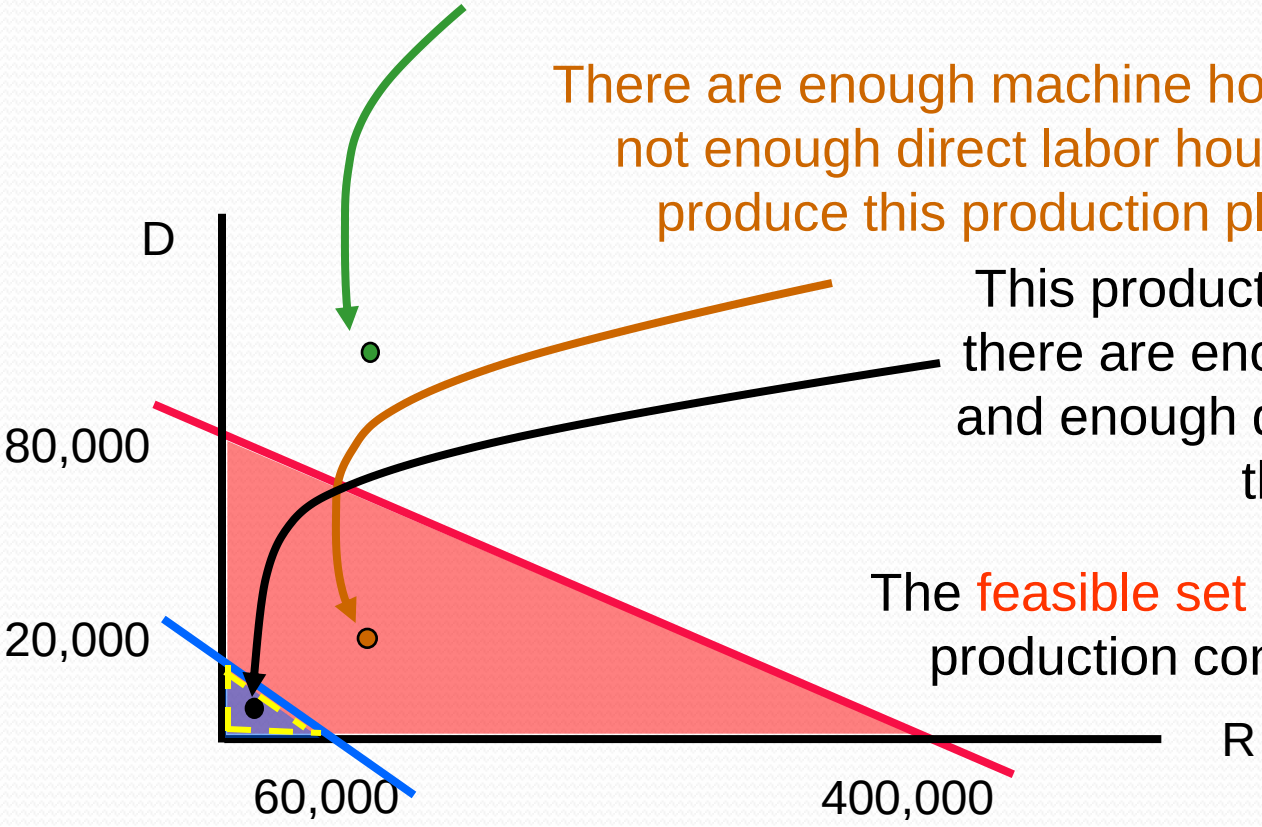
When D=0, R=60,000

When R=0, D=20,000



Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

There are not enough machine hours or enough direct labor hours to produce this production plan.



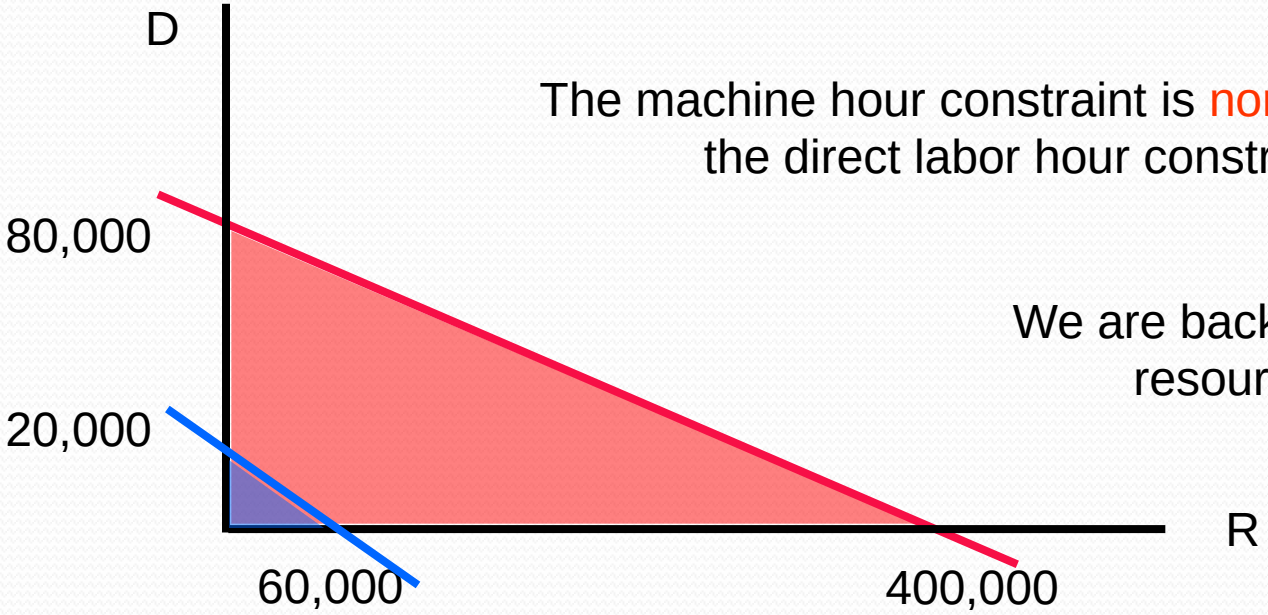
This production plan is feasible; there are enough machine hours and enough direct labor hours for this plan.

The feasible set is the area where all the production constraints are satisfied.

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

The graph helped us realize an important aspect of this problem – we thought there were 2 constrained resources but in fact there is only one.

For every feasible production plan, Urban will never run out of machine hours.



The machine hour constraint is non-binding, or slack, but the direct labor hour constraint is binding.

We are back to a one-scarce-resource problem.

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

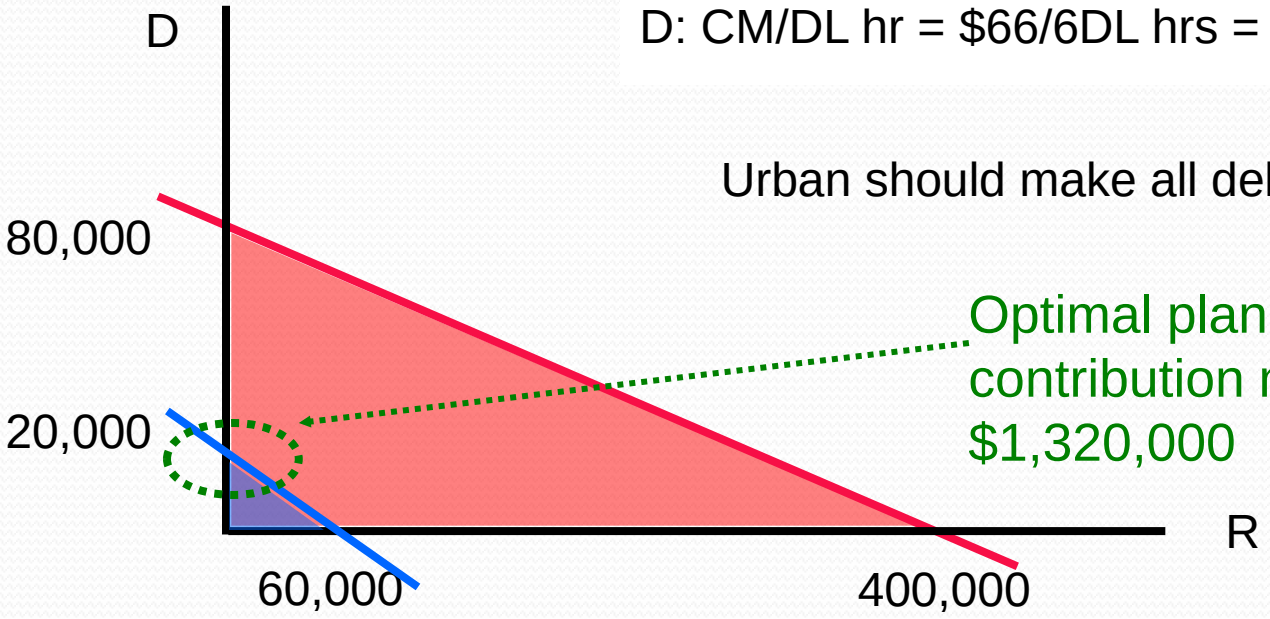
Here direct labor hours is the sole scarce resource.

We can use the general rule for one-constraint problems.

R: CM/DL hr = $20/2DL hrs = $10/DL hr

D: CM/DL hr = $66/6DL hrs = $11/DL hr

Urban should make all deluxe umbrellas.



Optimal plan is R=0, D=20,000. Total contribution margin = $66 x 20,000 = $1,320,000

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

Suppose Urban has been able to train a new workforce and now there are 600,000 direct labor hours available per year. Formulate this as a linear programming problem, graph it, and find the feasible set.

$$\max_{R,D} 20R + 66D$$

subject to:

$0.4R+2D \leq 160{,}000$ mach hr constraint

$2R+6D \leq 600{,}000$ DL hr constraint

$R \geq 0$

$D \geq 0$

The formulation of the problem is the same as before; the only change is that the right hand side (RHS) of the DL hour constraint is larger.

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

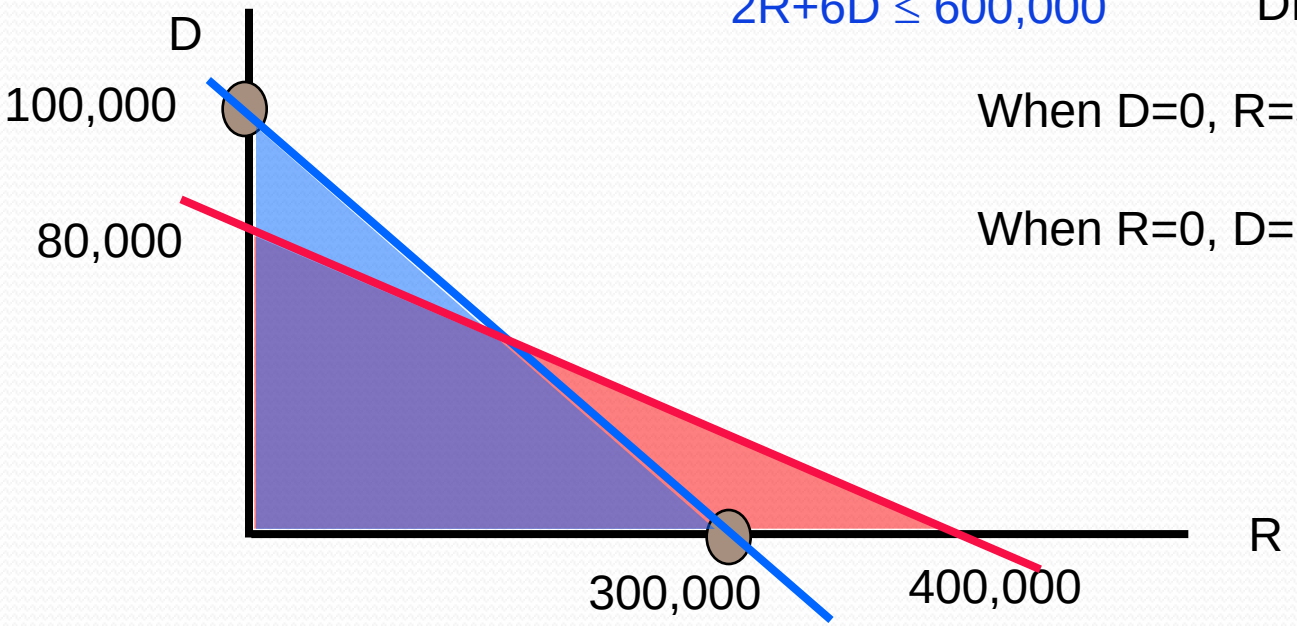
The machine hour constraint is the same as before.

$0.4R+2D \leq 160{,}000$ mach hr constraint

$2R+6D \leq 600{,}000$ DL hr constraint

When D=0, R=300,000

When R=0, D=100,000

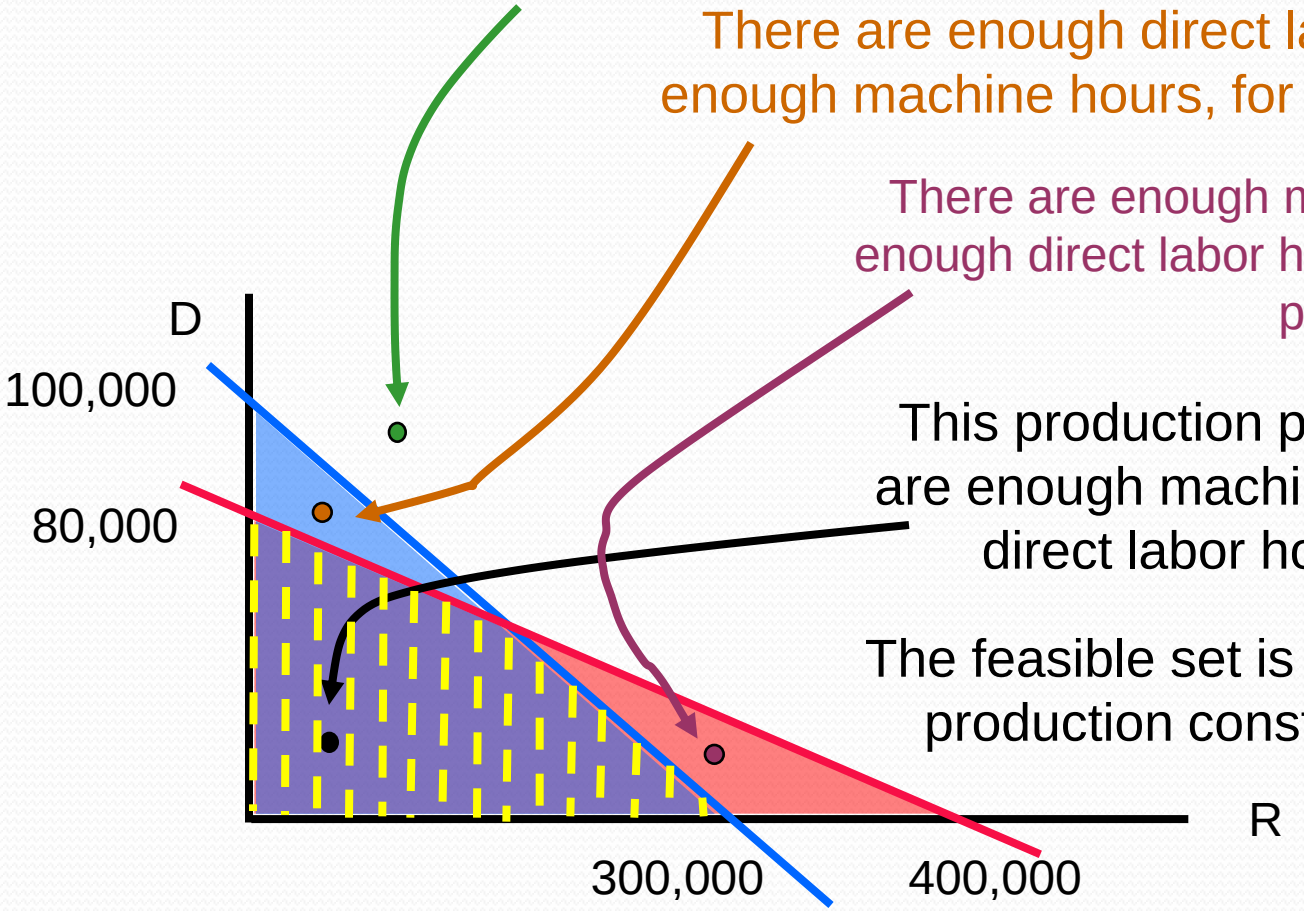


Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

There are not enough machine hours or enough direct labor hours for this production plan.

There are enough direct labor hours, but not enough machine hours, for this production plan.

There are enough machine hours, but not enough direct labor hours, for this production plan.



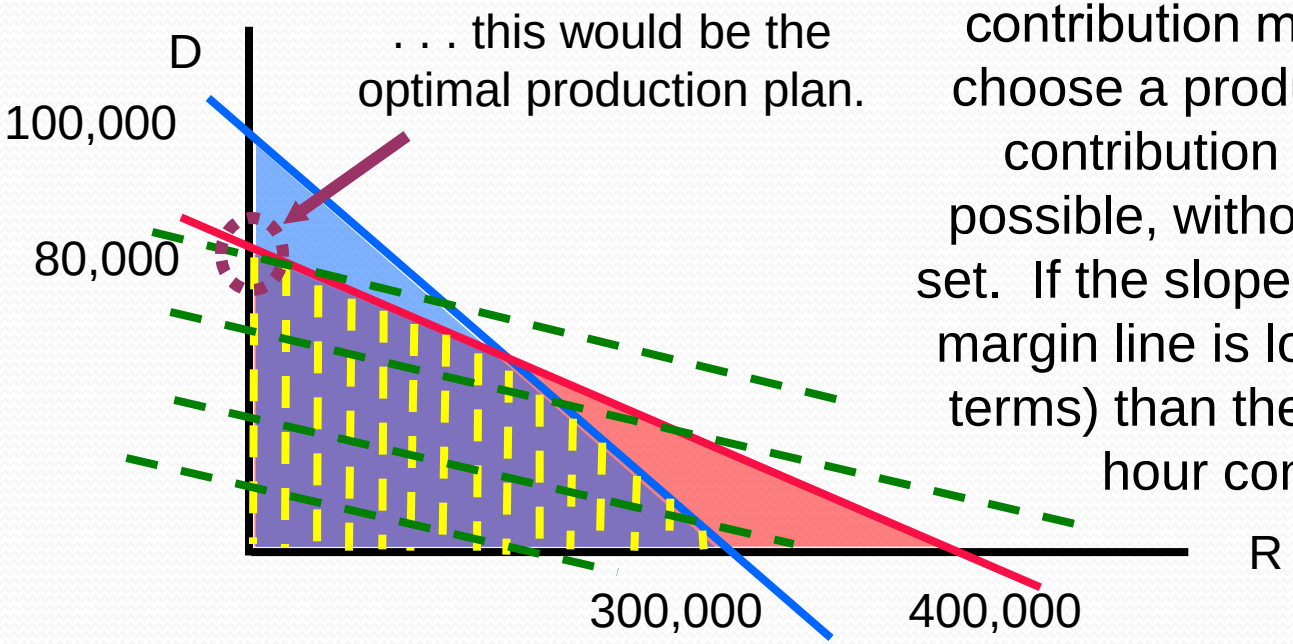
This production plan is feasible; there are enough machine hours and enough direct labor hours for this plan.

The feasible set is the area where all the production constraints are satisfied.

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

How do we know which of the feasible plans is optimal?
We can't use the general rule for one-constraint problems.

We can graph the total contribution margin line, because its slope will help us determine the optimal production plan.

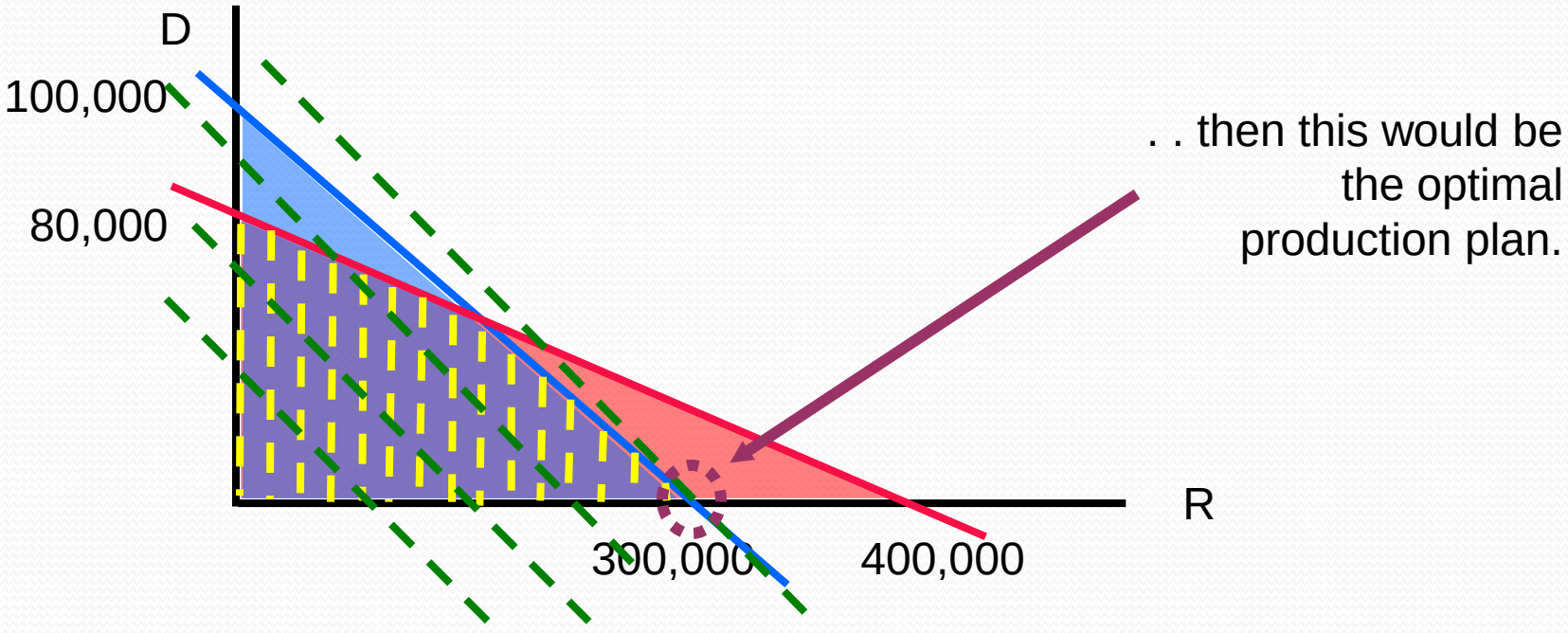


The objective "maximize total contribution margin" means that we choose a production plan so that the contribution margin is a large as possible, without leaving the feasible set. If the slope of the total contribution margin line is lower (in absolute value terms) than the slope of the machine hour constraint, then. . .

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

What if the slope of the total contribution margin line is higher (in absolute value terms) than the slope of the direct labor hour constraint?

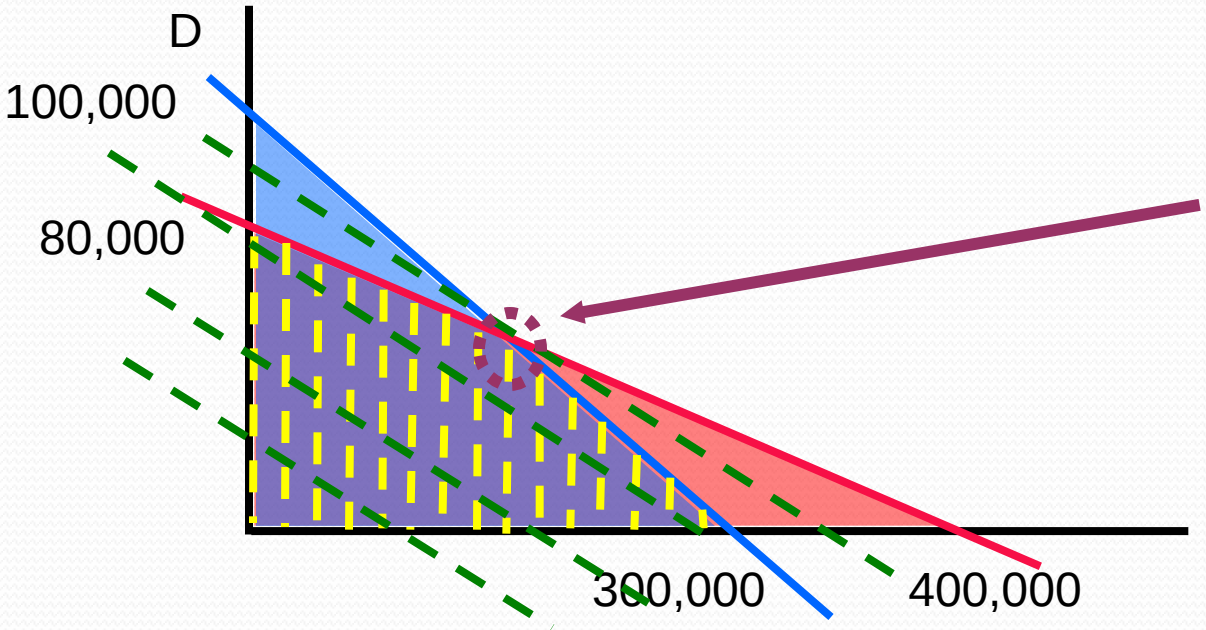
If the total CM line had this steep slope, . .



Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

What if the slope of the total contribution margin line is between the slopes of the two constraints?

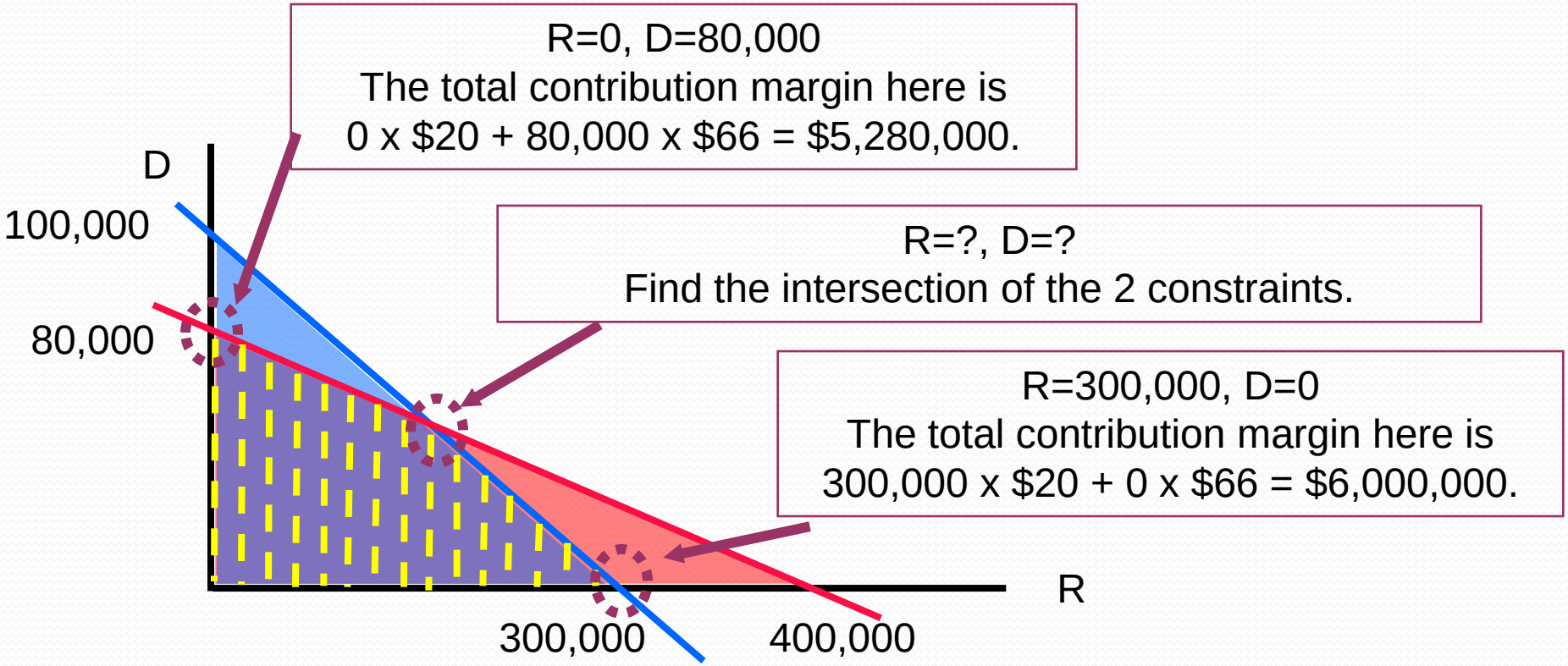
If the total CM line had this slope, . .



. . then this would be the optimal production plan.

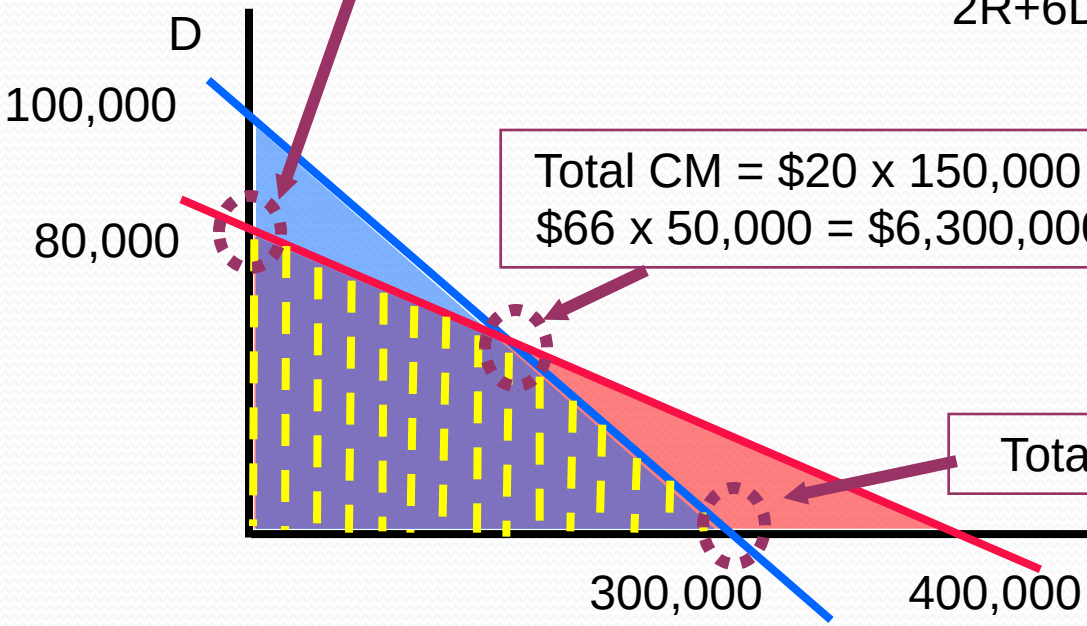
Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

The last 3 slides showed that the optimal production plan is always at a corner of the feasible set. This gives us an easy way to solve 2 product, 2 or more scarce resource problems.



Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

To find the intersection of the 2 constraints, use substitution or subtract one constraint from the other.



multiply each side by 5

0.4R+2D = 160,000 → 2R+10D = 800,000

2R+6D = 600,000 — 2R+6D = 600,000

subtract 0R+4D = 200,000

D = 50,000

2R+6(50,000) = 600,000

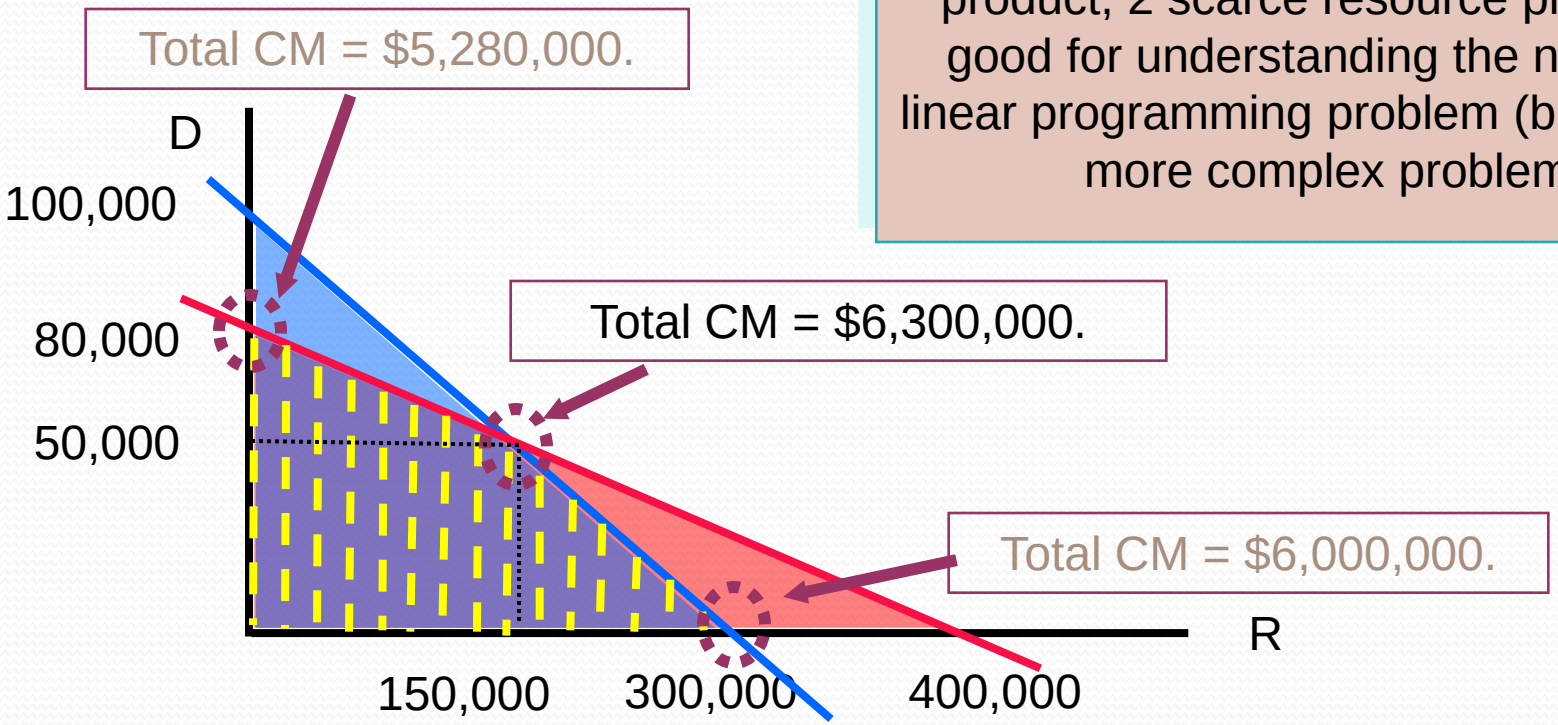
2R = 300,000

R = 150,000

Q5: Constrained Resource Decisions (Two Products; Two Scarce Resources)

By checking the total contribution margin at each corner of the feasible set (ignoring the origin), we can see that the optimal production plan is R=150,000, D=50,000.

Knowing how to graph and solve 2 product, 2 scarce resource problems is good for understanding the nature of a linear programming problem (but difficult in more complex problems).



Q5: Qualitative Factors in Scarce Resource Allocation Decisions

The quantitative analysis indicates that Urban should produce 150,000 regular umbrellas and 50,000 deluxe umbrellas. What qualitative issues should Urban consider before finalizing its decision?

- The assumption that customer demand is unlimited is unlikely; can this be investigated further?
- Are there any long-term strategic implications of minimizing production of the deluxe umbrellas?
- What would be the effects of attempting to relax the machine hour or DL hour constraints?
- Are there any worker productivity issues that affect this decision?

Q5: Constrained Resource Decisions (Multiple Products; Multiple Constraints)

- Problems with multiple products, one scarce resource, and one constraint on customer demand for each product are easy to solve.
- The general rule is to make the product with the highest contribution margin per unit of the scarce resource:
  - until its customer demand is satisfied
  - then move to the product with the next highest contribution margin per unit of the scarce resource, etc.
- Problems with multiple products and multiple scarce resources are too cumbersome to solve by hand – Excel solver is a useful tool here.

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

Urban's Umbrellas makes two types of patio umbrellas, regular and deluxe. Suppose customer demand for regular umbrellas is 300,000 units and for deluxe umbrellas customer demand is limited to 60,000. Urban has only 160,000 machine hours available per year. What is his optimal production plan? How much would he pay (above his normal costs) for an extra machine hour?

	Regular	Deluxe
Selling price per unit	$40	$110
Variable cost per unit	20	44
Contribution margin per unit	$20	$ 66
Required machine hours/unit	0.4	2.0
CM/machine hour	$50	$33

Urban should first concentrate on making Rs. He can make enough to satisfy customer demand for Rs: 300,000 Rs x 0.4 mach hr/R = 120,000 mach hrs.

Q5: Constrained Resource Decisions (Two Products; One Scarce Resource)

	Regular	Deluxe
Selling price per unit	$40	$110
Variable cost per unit	20	44
Contribution margin per unit	$20	$ 66
Required machine hours/unit	0.4	2.0
CM/machine hour	$50	$33

The 40,000 remaining hours will make 20,000 Ds.

The optimal plan is 300,000 Rs and 20,000 Ds. The CM/mach hr shows how much Urban would be willing to pay, above his normal costs, for an additional machine hour.

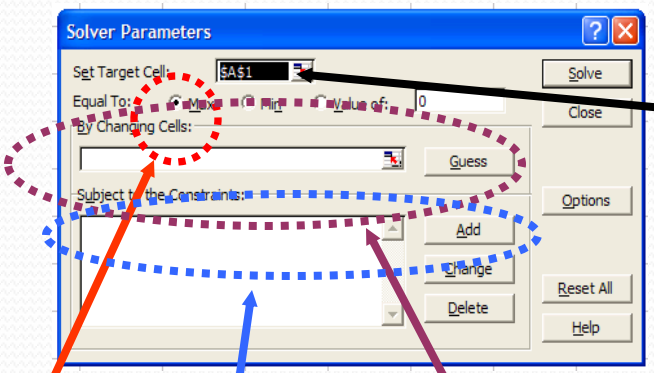
Here Urban will be producing Ds when he runs out of machine hours so he'd be willing to pay up to $33 for an additional machine hour.

If customer demand for Rs exceeded 400,000 units, Urban would be willing to pay up to an additional $50 for a machine hour.

If customer demand for Rs and Ds could be satisfied with the 160,000 available machine hours, then Urban would not be willing to pay anything to acquire an additional machine hour.

Q5: Constrained Resource Decisions Using Excel Solver

To obtain the solver dialog box, choose "Solver" from the Tools pull-down menu.



The "target cell" will contain the maximized value for the objective (or "target") function.

Choose "max" for the types of problems.

Choose one cell for each choice variable (product). It's helpful to "name" these cells.

Add constraint formulas by clicking "add".

Click "solve" to obtain the next dialog box.

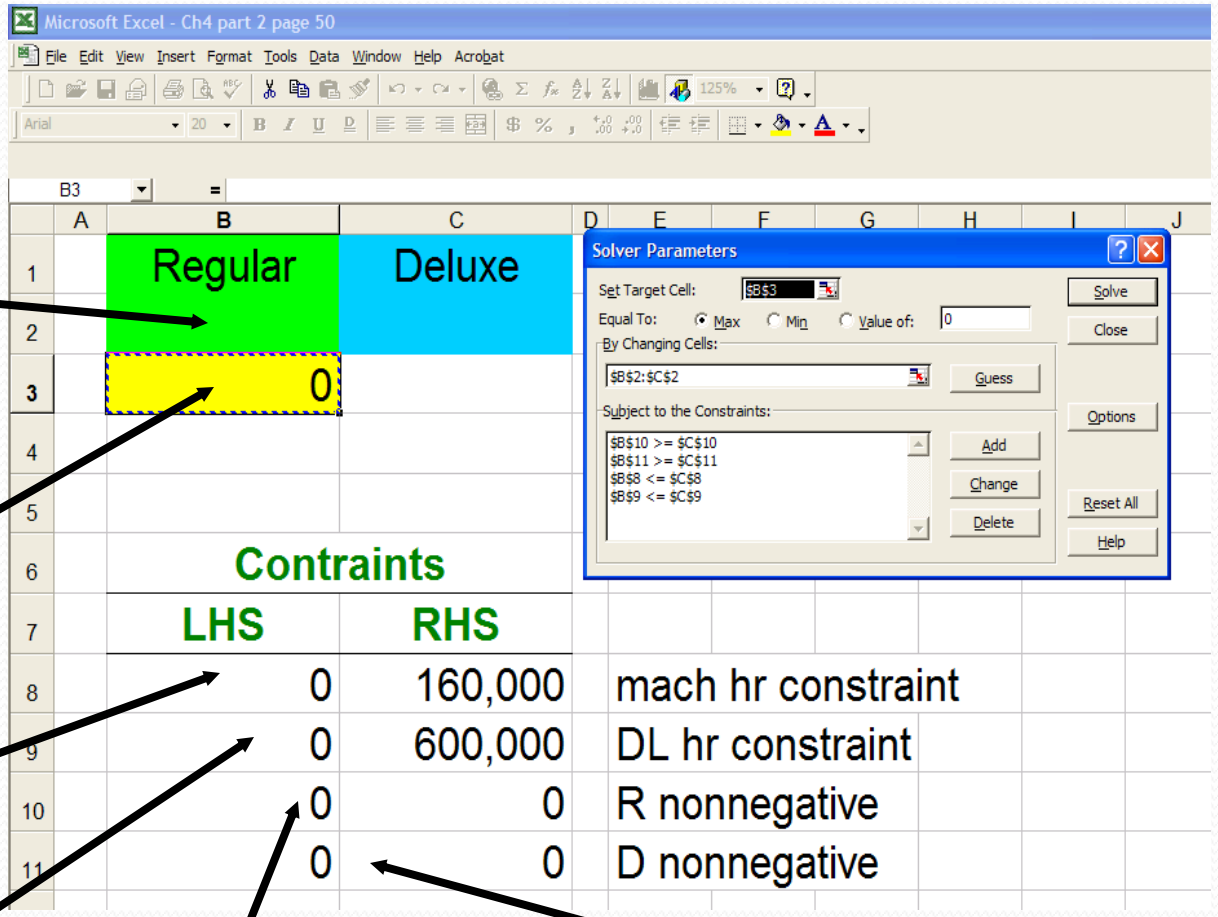
Q5: Constrained Resource Decisions Using Excel Solver

Cell B2 was named "Regular" and cell C2 was named Deluxe.

=20*Regular + 66*Deluxe

=0.4*Regular+ 2*Deluxe

=2*Regular+ 6*Deluxe



=Regular (cell B2)

=Deluxe (cell C2)

Then click "solve" and choose all 3 reports.

Q5: Excel Solver Answer Report

Microsoft Excel 9.0 Answer Report

Refer to the problem on Slide #164.

Target Cell (Max)

Cell	Name	Original Value	Final Value
$B$3	Regular	0	6,300,000

The total contribution margin for the optimal plan was $6.3 million.

Adjustable Cells

Cell	Name	Original Value	Final Value
$B$2	Regular	0	150,000
$C$2	Deluxe	0	50000

The optimal production plan was 150,000 Rs and 50,000 Ds.

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$B$9	DL hr	600,000	$B$9<=$C$9	Binding	0
$B$8	mach hr	160,000	$B$8<=$C$8	Binding	0
$B$11	D>0	50,000	$B$11>=$C$11	Not Binding	50,000
$B$10	R>0	150,000	$B$10>=$C$10	Not Binding	150,000

The machine and DL hour constraints are binding – the plan uses all available machine and DL hours.

The nonnegativity constraints for R and D are not binding; the slack is 50,000 and 150,000 units respectively.

Q5: Excel Solver Sensitivity Report

Microsoft Excel 9.0 Sensitivity Report

Refer to the problem on Slide #164.

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$2	Regular	150,000	0	20	2	6.8
$C$2	Deluxe	50000	0	66	34	6

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$B$9	DL hr	600,000	9	600000	200000	120000
$B$8	mach hr	160,000	8	160000	40000	40000
$B$11	D>0	50,000	0	0	50000	1E+30
$B$10	R>0	150,000	0	0	150000	1E+30

This shows how much the slope of the total CM line can change before the optimal production plan will change.

The CM per unit for Regular can drop to $13.20 or increase to $22 (all else equal) before the optimal plan will change. The CM per unit for Deluxe can drop to $60 or increase to $100 (all else equal) before the optimal plan will change.

Q5: Excel Solver Sensitivity Report

Microsoft Excel 9.0 Sensitivity Report

Refer to the problem on Slide #164.

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$2	Regular	150,000	0	20	2	6.8
$C$2	Deluxe	50000	0	66	34	6

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$B$9	DL hr	600,000	8.50	600000	200000	120000
$B$8	mach hr	160,000	7.50	160000	40000	40000
$B$11	D>0	50,000	0.00	0	50000	1E+30
$B$10	R>0	150,000	0.00	0	150000	1E+30

This shows how much the RHS of each constraint can change before the shadow price will change.

The available DL hours could decrease to 480,000 or increase to 800,000 (all else equal) before the shadow price for DL would change. The available machine hours could decrease to 120,000 or increase to 200,000 (all else equal) before the shadow price for machine hours would change.

Q5: Excel Solver Sensitivity Report

Microsoft Excel 9.0 Sensitivity Report

Refer to the problem on Slide #164.

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$2	Regular	150,000	0	20	2	6.8
$C$2	Deluxe	50000	0	66	34	6

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$B$9	DL hr	600,000	8.50	600000	200000	120000
$B$8	mach hr	160,000	7.50	160000	40000	40000
$B$11	D>0	50,000	0.00	0	50000	1E+30
$B$10	R>0	150,000	0.00	0	150000	1E+30

The shadow price shows how much a one unit increase in the RHS of a constraint will improve the total contribution margin.

Urban would be willing to pay up to $8.50 to obtain one more DL hour and up to $7.50 to obtain one more machine hour.

Q7: Impacts to Quality of Nonroutine Operating Decisions

- The quality of the information used in nonroutine operating decisions must be assessed.
  - There may be more information quality issues (and more uncertainty) in nonroutine decisions because of the irregularity of the decisions.
- Three aspects of the quality of information available can affect decision quality.
  - Business risk (changes in economic condition, consumer demand, regulation, competitors, etc.)
  - Information timeliness
  - Assumptions in the quantitative and qualitative analyses

Q7: Impacts to Quality of Nonroutine Operating Decisions

- Short term decision must align to company's overall strategic plans
- Must watch for decision maker bias
  - Predisposition for specific outcome
  - Preference for one type of analysis without considering other options
- Opportunity costs are often overlooked
- Performing sensitivity analysis can help assess and minimize business risk
- Established control system incentives (performance bonuses, etc.) can encourage sub-obtimal decision making

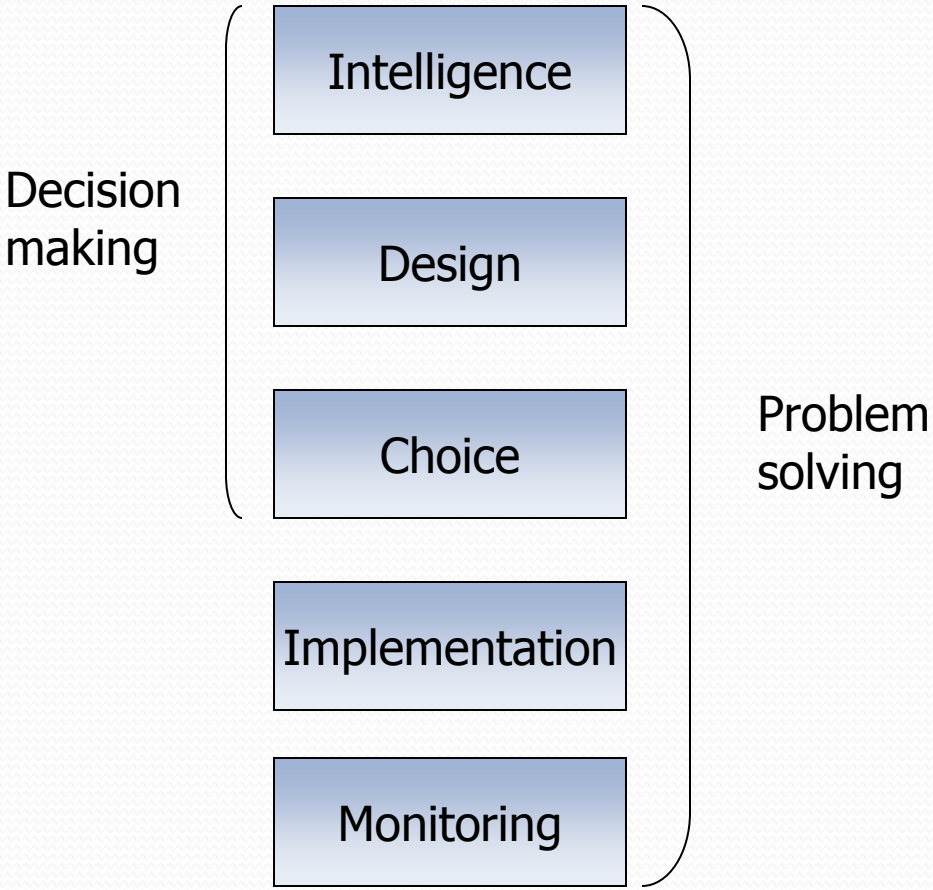
Decision Support Systems

Using Excel like Goal Seek

Decision Support Systems

- Decision support systems (DSS)
  - Offer potential to assist in solving both semi-structured and unstructured problems

Decision Making as a Component of Problem Solving



Solution Types

- Optimization model
  - Finding the best solution
- Satisficing model
  - Finding a good -- but not necessarily the best -- solution to a problem
- Heuristics
  - Commonly accepted guidelines or procedures that usually find a good solution

Problem Solving Factors

- Multiple decision objectives
- Increased alternatives
- Increased competition
- The need for creativity
- Social and political actions
- International aspects
- Technology
- Time compression

Characteristics of a DSS (1)

- Handles large amounts of data from different sources
- Provides report and presentation flexibility
- Offers both textual and graphical orientation

Characteristics of a DSS (2)

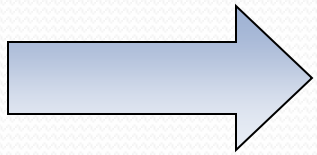
- Supports drill down analysis
- Performs complex, sophisticated analysis and comparisons using advanced software packages
- Supports optimization, satisficing, and heuristic approaches

Characteristics of a DSS (3)

- Performs different types of analyses
  - "What-if" analysis
    - Makes hypothetical changes to problem and observes impact on the results
  - Simulation
    - Duplicates features of a real system
  - Goal-seeking analysis
    - Determines problem data required for a given result

Goal Seeking Example

- You know the desired result
- You want to know the required input(s)
- Example:
  - Microsoft Excel's "Goal Seek" and "Solver" functions



Goal Seek

When you know the desired result of a single formula but not the input value the formula needs to determine the result, you can use the **Goal Seek** feature. When goal seeking, Microsoft Excel varies the value in one specific cell until a formula that's dependent on that cell returns the result you want.

The value in cell B4 is the result of the formula =PMT(B3/12,B2,B1).

	A	B
1	Loan Amount	$ 100,000
2	Term in Months	180
3	Interest Rate	7.02%
4	Payment	($900.00)

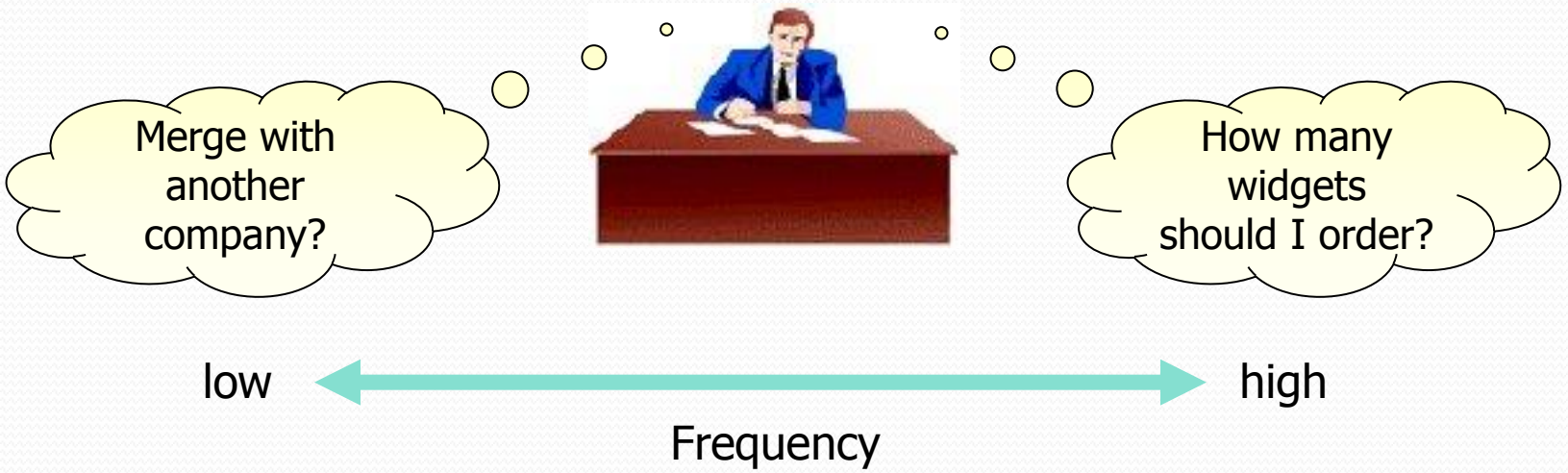
Goal seek to determine the interest rate in cell B3 based on the payment in cell B4.

Excel demo

For example, use **Goal Seek** to change the interest rate in cell B3 incrementally until the payment value in B4 equals $900.00.

Capabilities of a DSS (1)

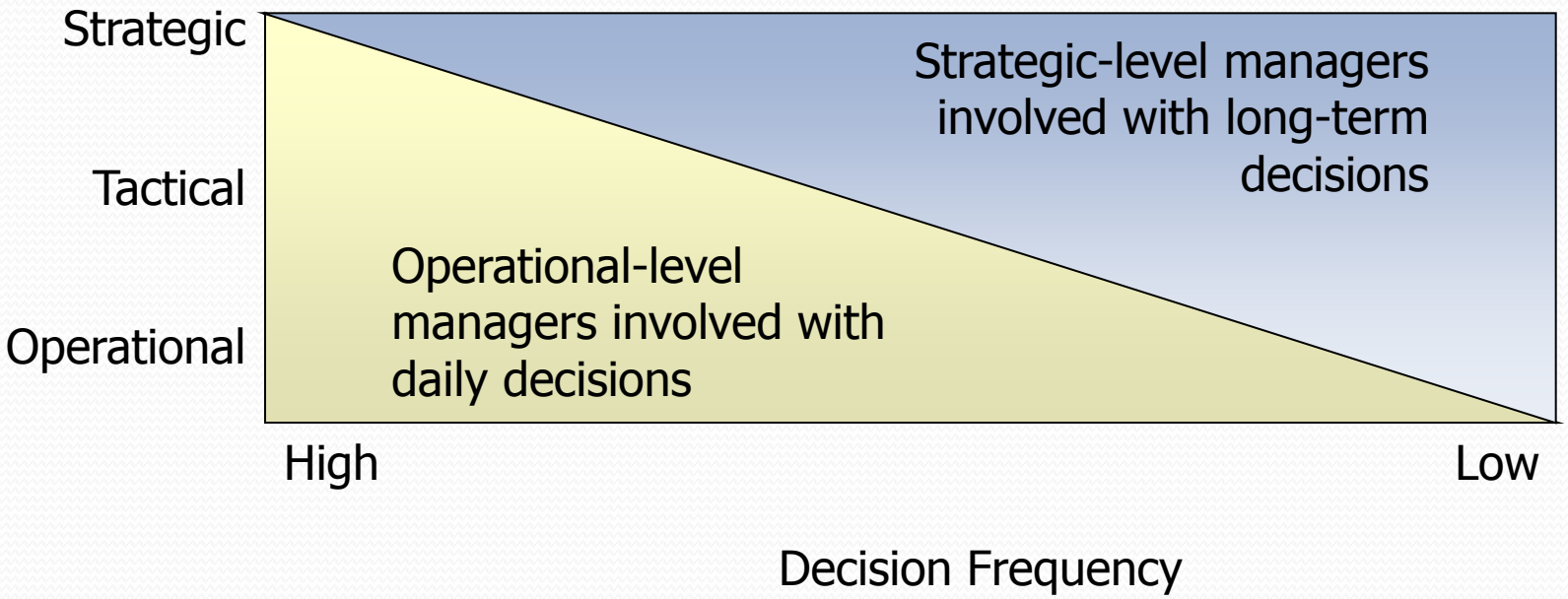
- Supports
  - Problem solving phases
  - Different decision frequencies



Capabilities of a DSS (2)

- Highly structured problems
  - Straightforward problems, requiring known facts and relationships.
- Semi-structured or unstructured problems
  - Complex problems wherein relationships among data are not always clear, the data may be in a variety of formats, and are often difficult to manipulate or obtain

Decision Making Levels



Integration of TPS, MIS, and DSS

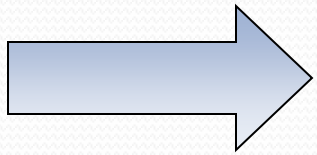
- In many organizations they are integrated through a common database
- Separation of DSS transactions in the database from TPS and MIS transactions may be important for performance reasons

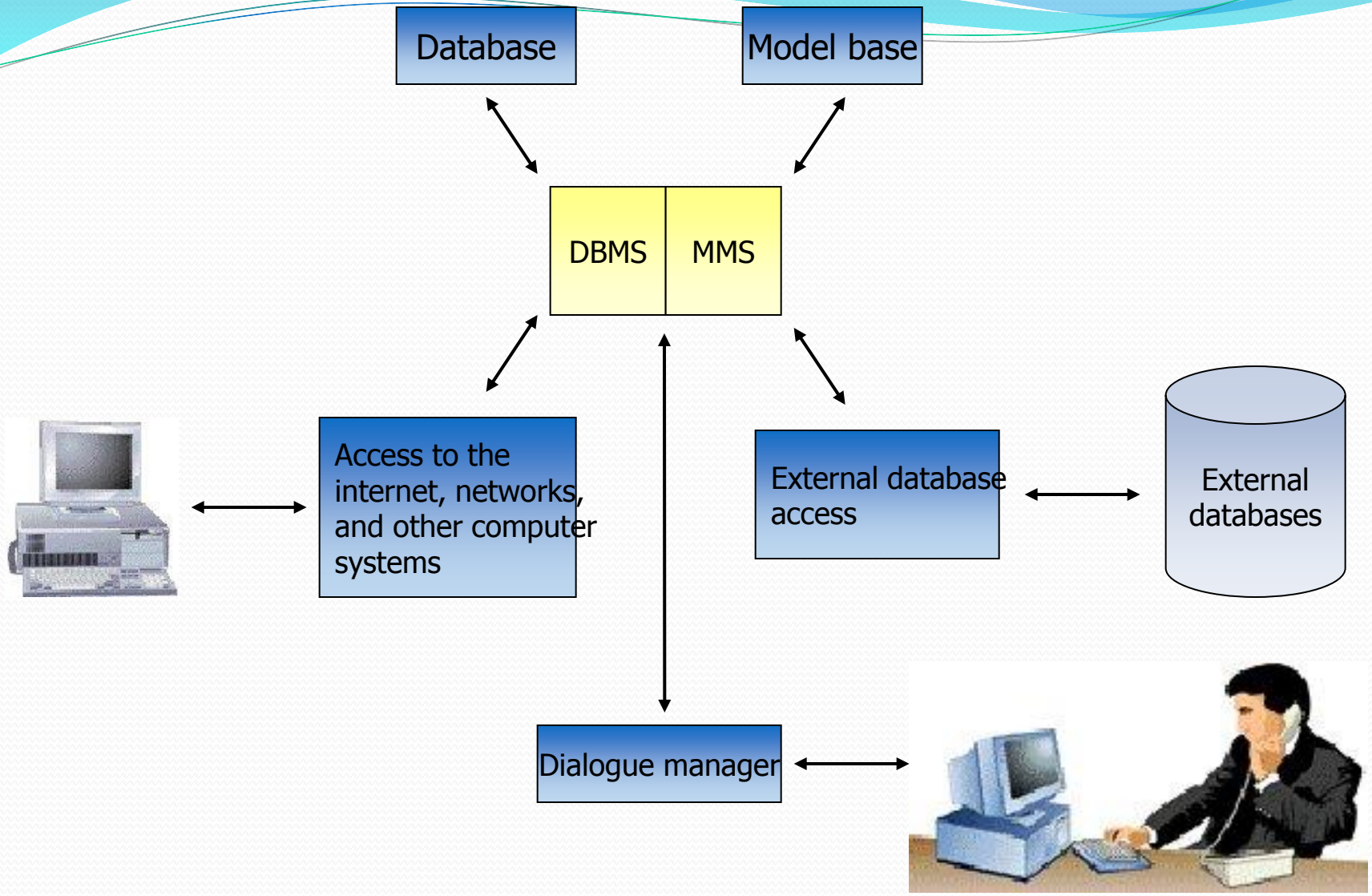
Web-Based Decision Support Systems

- Web-based decision support systems
  - Decision support system software provides business intelligence through web browser clients that access databases either through the Internet or a corporate intranet

Components of a DSS

- Model management software (MMS)
  - Coordinates the use of models in the DSS
- Model base
  - Provides decision makers with access to a variety of models
- Dialogue manager
  - Allows decision makers to easily access and manipulate the DSS




Database
Model base
DBMS
MMS
Access to the internet, networks, and other computer systems
External database access
External databases
Dialogue manager

Model Base

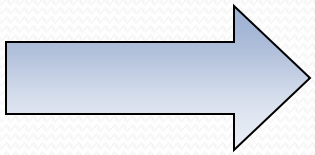
- Model Base
  - Provides decision makers with access to a variety of models and assists them in decision making
- Models
  - Financial models
  - Statistical analysis models
  - Graphical models
  - Project management models

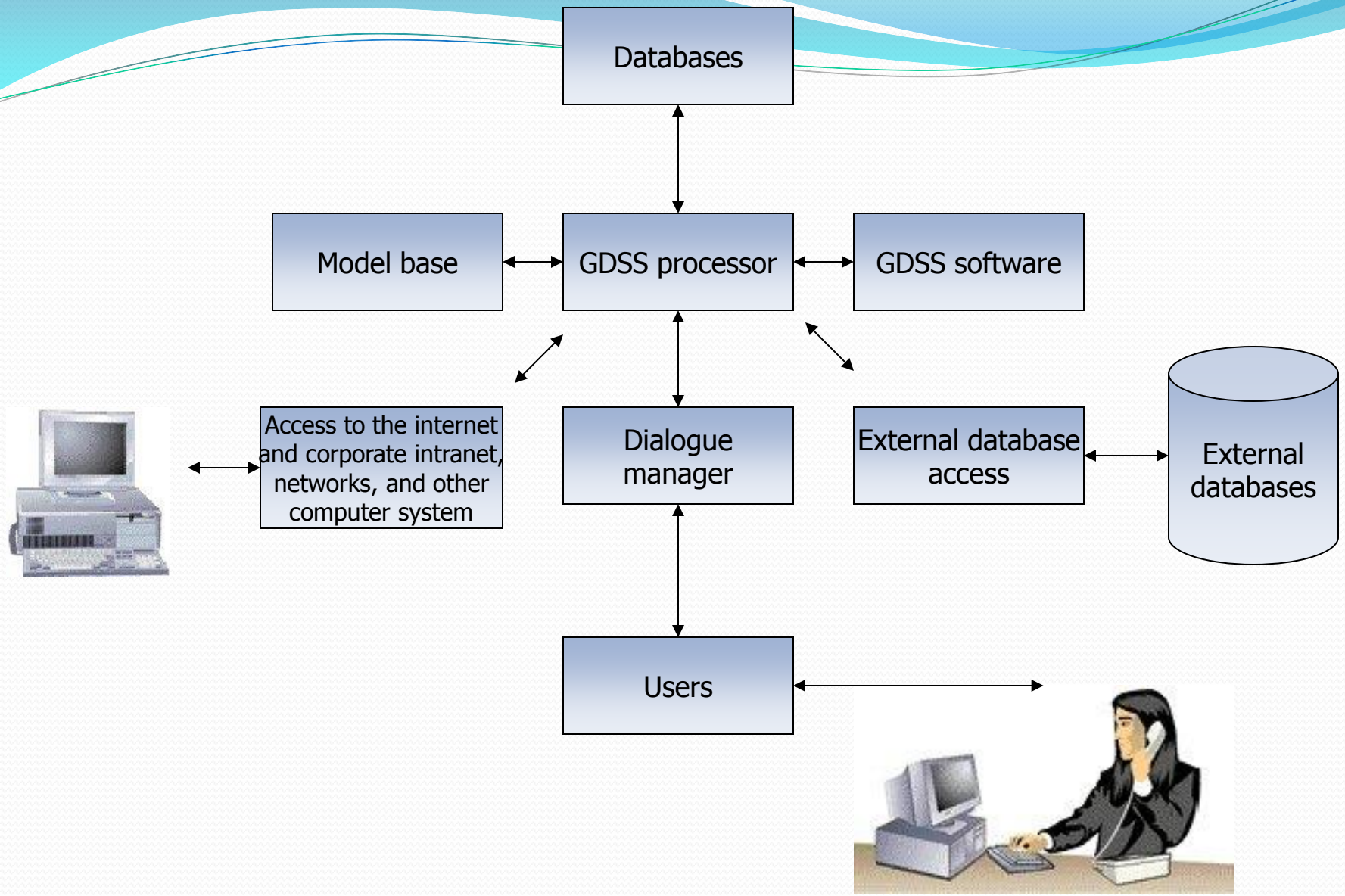
Advantages and Disadvantages of Modeling

- Advantages
  - Less expensive than custom approaches or real systems.
  - Faster to construct than real systems
  - Less risky than real systems
  - Provides learning experience (trial and error)
  - Future projections are possible
  - Can test assumptions
- Disadvantages
  - Assumptions about reality may be incorrect
  - Accuracy of predications often unreliable
  - Requires abstract thinking

Group Decision Support System

- Group Decision Support System (GDSS)
  - Contains most of the elements of DSS plus software to provide effective support in group decision-making settings




Databases
Model base
GDSS processor
GDSS software
Access to the internet and corporate intranet, networks, and other computer system
Dialogue manager
External database access
External databases
Users

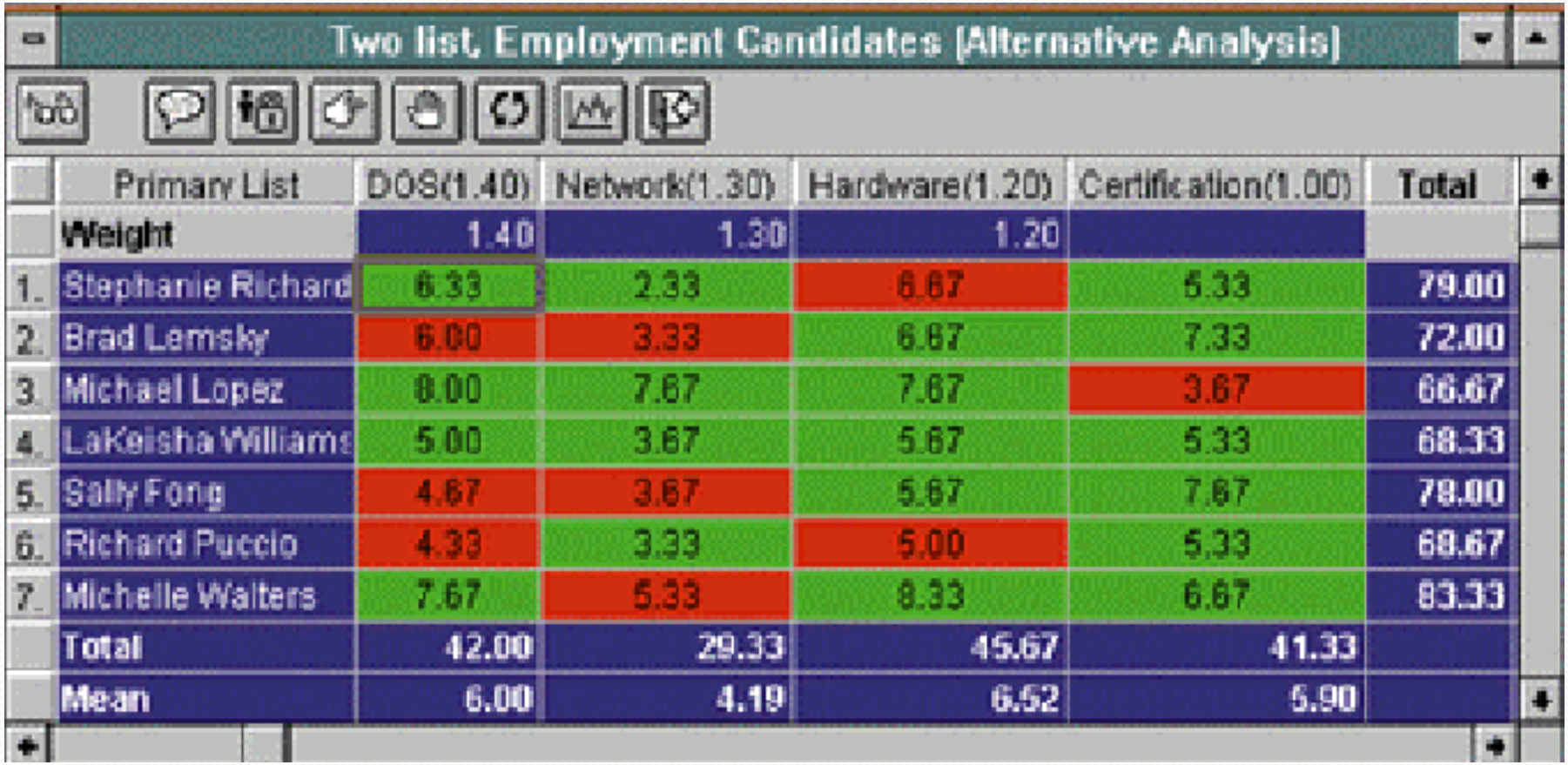
Characteristics of a GDSS (1)

- Special design
- Ease of use
- Flexibility
- Decision-making support
  - Delphi approach (decision makers are geographically dispersed)
  - Brainstorming
  - Group consensus
  - Nominal group technique

Characteristics of a GDSS (2)

- Anonymous input
- Reduction of negative group behaviour
- Parallel communication
- Automated record keeping
- Cost, control, complexity factors

Group Results Matrix



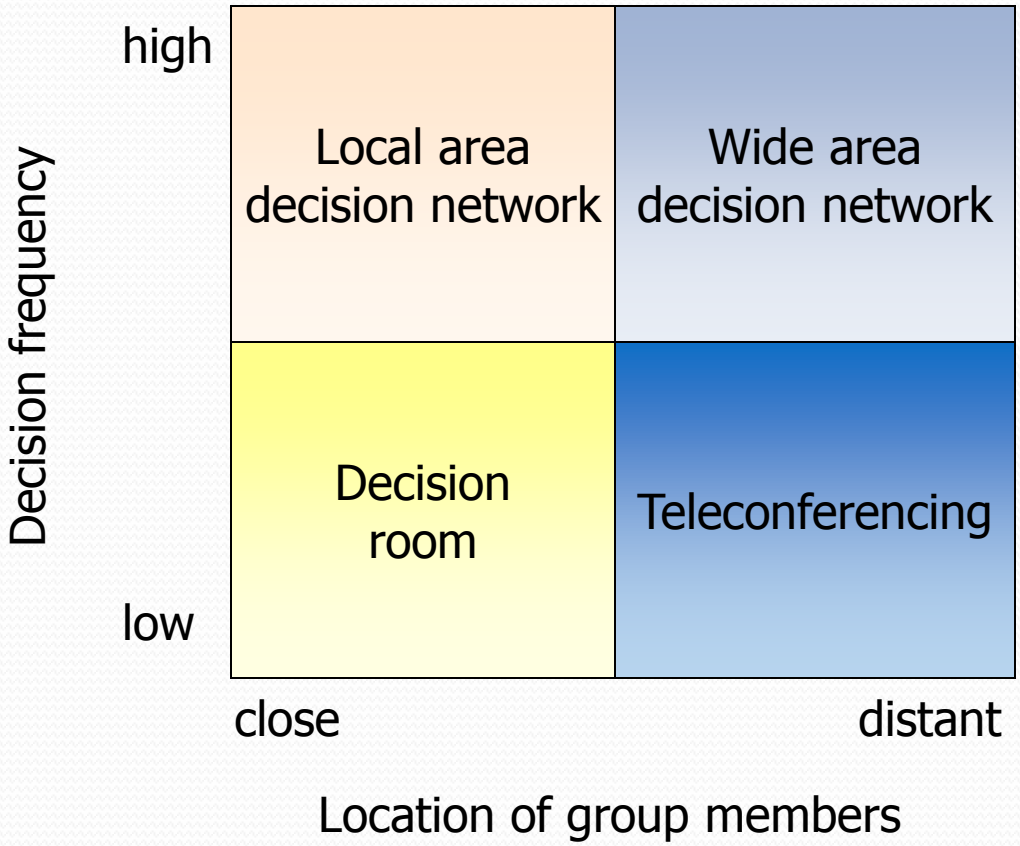
Two list, Employment Candidates [Alternative Analysis]

	Primary List	DOS(1.40)	Network(1.30)	Hardware(1.20)	Certification(1.00)	Total
	Weight	1.40	1.30	1.20		
1.	Stephanie Richard	6.33	2.33	6.67	5.33	79.00
2.	Brad Lemsky	6.00	3.33	6.67	7.33	72.00
3.	Michael Lopez	8.00	7.67	7.67	3.67	66.67
4.	LaKeisha Williams	5.00	3.67	5.67	5.33	68.33
5.	Sally Fong	4.67	3.67	5.67	7.67	78.00
6.	Richard Puccio	4.33	3.33	5.00	5.33	68.67
7.	Michelle Walters	7.67	5.33	8.33	6.67	83.33
	Total	42.00	29.33	45.67	41.33	
	Mean	6.00	4.19	6.52	5.90	

Components of a GDSS and GDSS Software

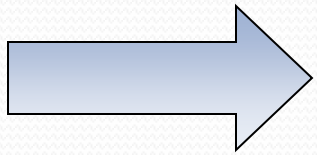
- Database
- Model base
- Dialogue manager
- Communication capability
- Special software (also called GroupWare)
- E.g., Lotus Notes
  - people located around the world work on the same project, documents, and files, efficiently and at the same time

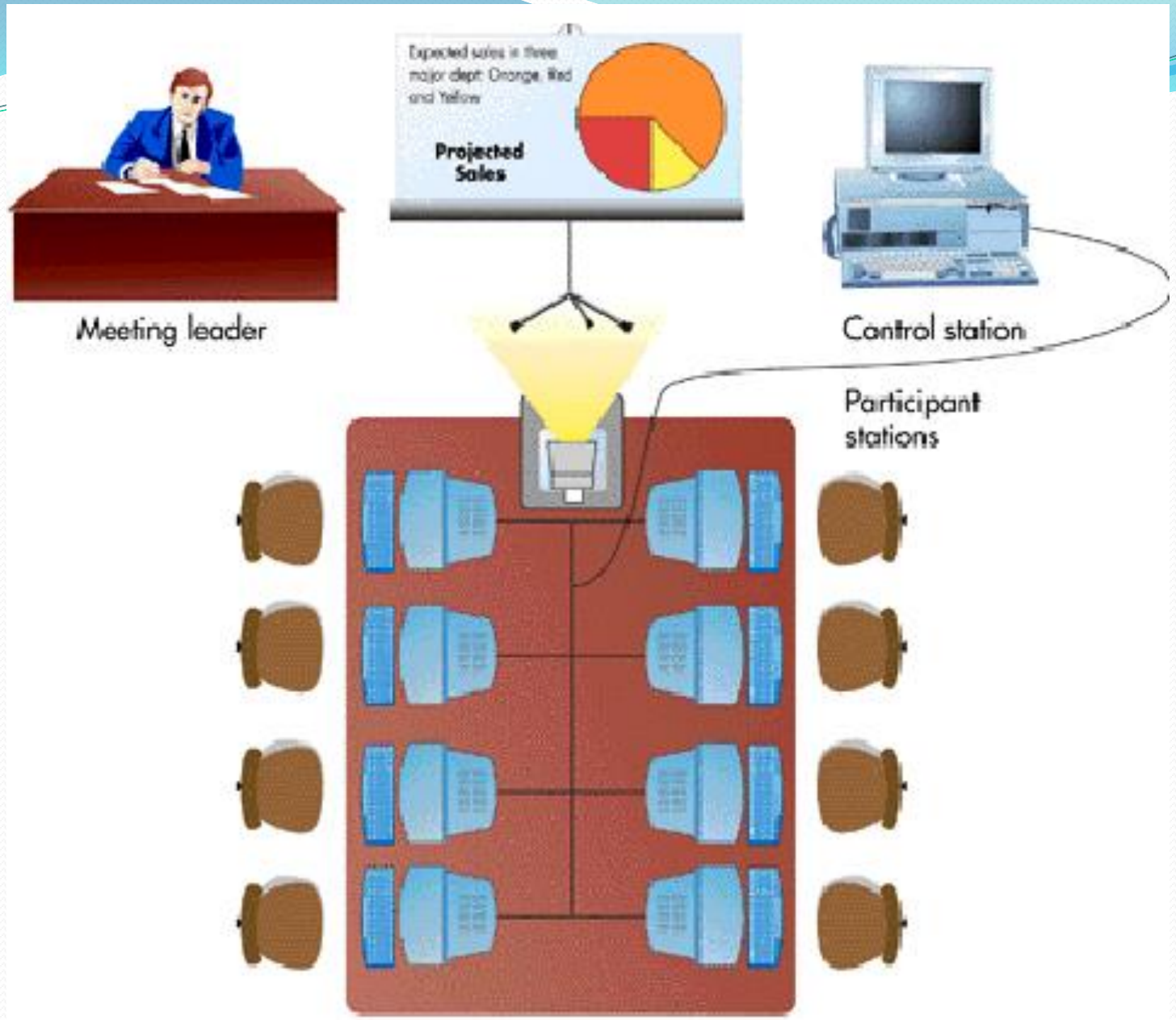
GDSS Alternatives



Decision Room

- Decision Room
  - For decision makers located in the same geographic area or building
  - Use of computing devices, special software, networking capabilities, display equipment, and a session leader
  - Collect, coordinate, and feed back organized information to help a group make a decision
  - Combines face-to-face verbal interaction with technology-aided formalization



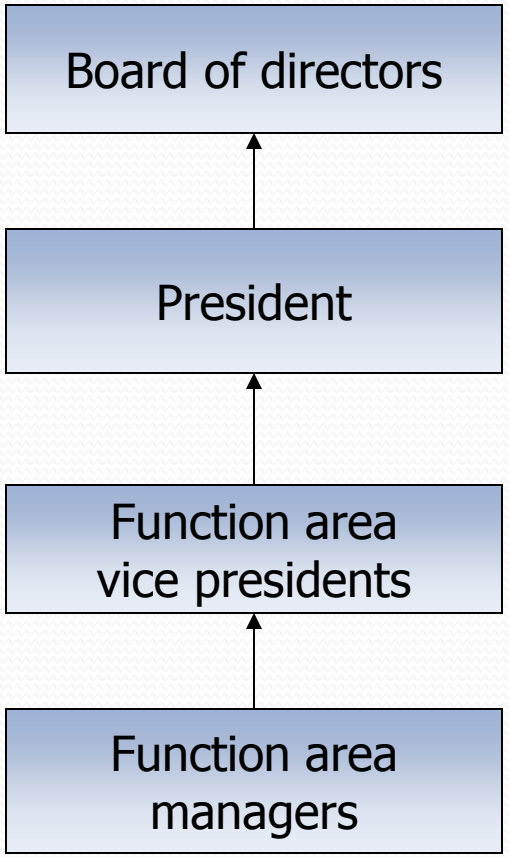

Expected sales in three major dept: Orange, Red and Yellow
Projected Sales
Meeting leader
Control station
Participant stations

Wide Area Decision Network

- Characteristics
  - Location of group members is distant
  - Decision frequency is high
  - Virtual workgroups
    - Groups of workers located around the world working on common problems via a GDSS

Executive Support System

- Characteristics
  - A specialized DSS that includes all the hardware, software, data, procedures, and people used to assist senior-level executives within the organization



Characteristics of ESSs

- Tailored to individual executives
- Easy to use
- Drill down capabilities
- Support the need for external data
- Help with situations with high degree of uncertainty
- Futures orientation (predictions, forecasting)
- Linked with value-added business processes

Capabilities of an ESS

- Support for
  - defining overall vision
  - strategic planning
  - strategic organizing and staffing
  - strategic control
  - crisis management

Basic Structure of All Optimisation Models

- Excel Models

Different Forms and Applications of Optimization Models

- Excel models

Developing a Financial Optimisation Model

- Excel Models

Performing Sensitivity Analysis of an Optimisation Model

- Excel Models

Interpreting the Solution of an Optimisation Model to a Non-technical Manager

- Excel Model

Lessons Learned and Lessons to be Learned

Q1: Different Ways to Describe Costs

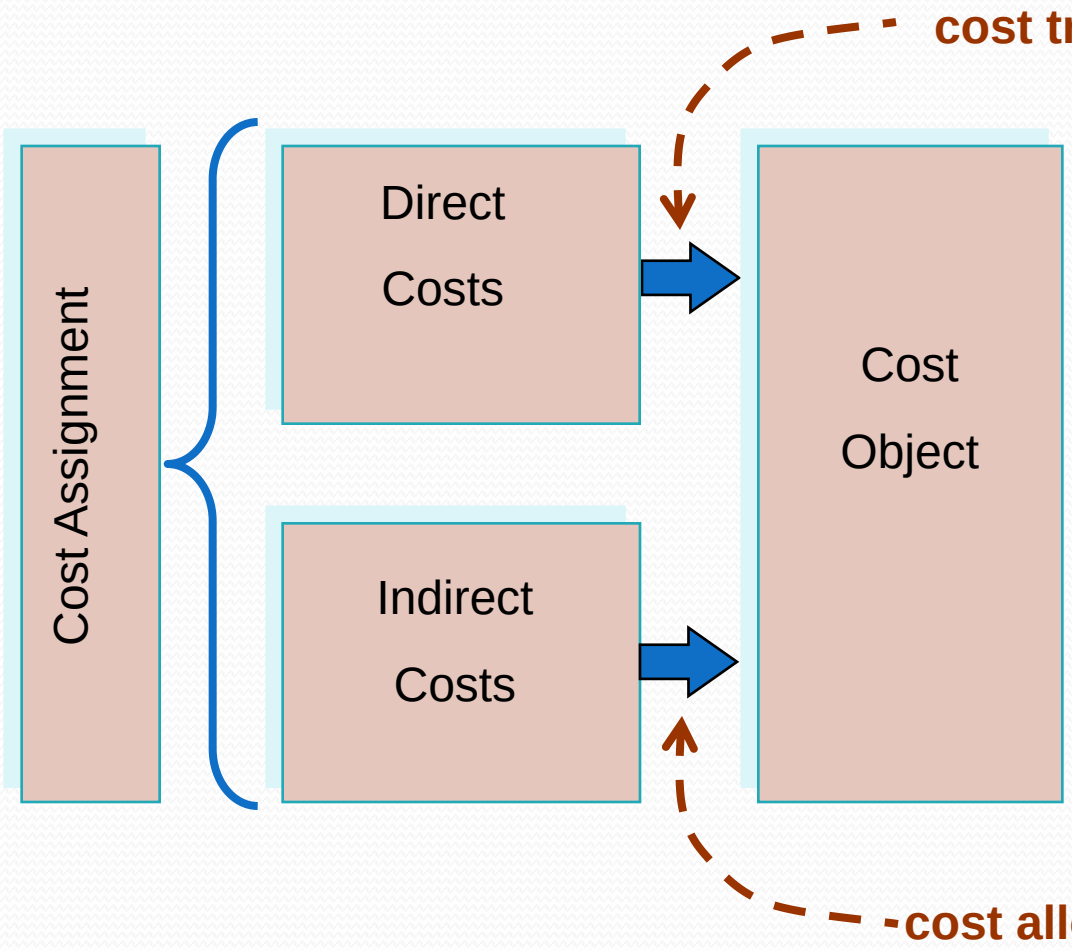
- Costs can be defined by how they relate to a cost object, which is defined as any thing or activity for which we measure costs.

- Costs can also be categorized as to how they are used in decision making.

- Costs can also be distinguished by the way they change as activity or volume levels change.

Q1: Assigning Costs to a Cost Object

Determining the costs that should attach to a cost object is called cost assignment.



Direct costs are easily traced to the cost object.

Indirect costs are not easily traced to the cost object, and must be allocated.

Q1: Direct and Indirect Costs

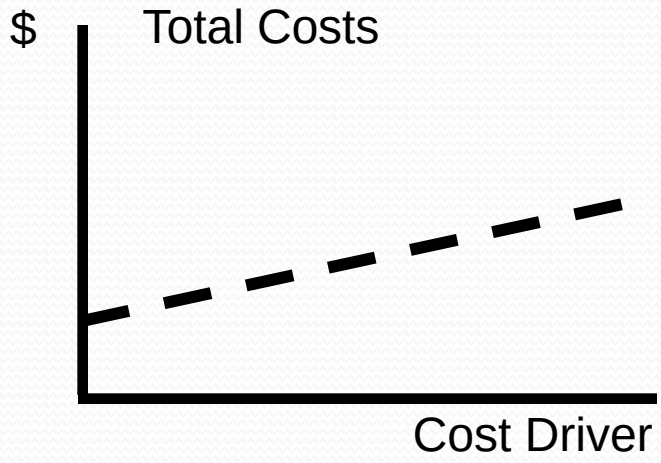
- In manufacturing:
  - all materials costs that are easily traced to the product are called direct material costs
  - all labor costs that are easily traced to the product are called direct labor costs
  - all other production costs are called overhead costs
- Whether or not a cost is a direct cost depends upon:
  - the definition of the cost object
  - the precision of the bookkeeping system that tracks costs
  - the technology available to capture cost information
  - whether the benefits of tracking the cost as direct exceed the resources expended to track the cost
  - the nature of the operations that produce the product or service

Q1: Linear Cost Behavior Terminology

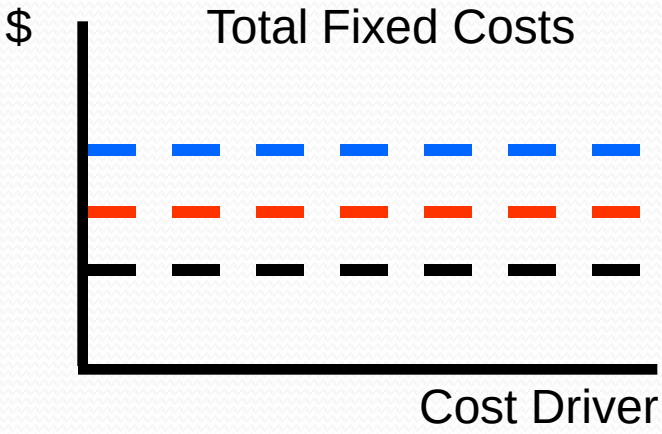
- Total fixed costs are costs that do not change (in total) as activity levels change.

- Total variable costs are costs that increase (in total) in proportion to the increase in activity levels.
- Total costs equal total fixed costs plus total variable costs.
- The relevant range is the span of activity levels for which the cost behavior patterns hold.
- A cost driver is a measure of activity or volume level; increases in a cost driver cause total costs to increase.

Q1: Behavior of Total (Linear) Costs



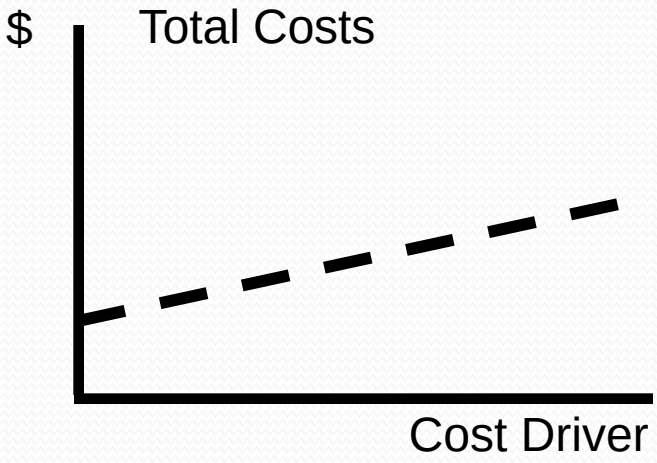
If costs are linear, then total costs graphically look like this.



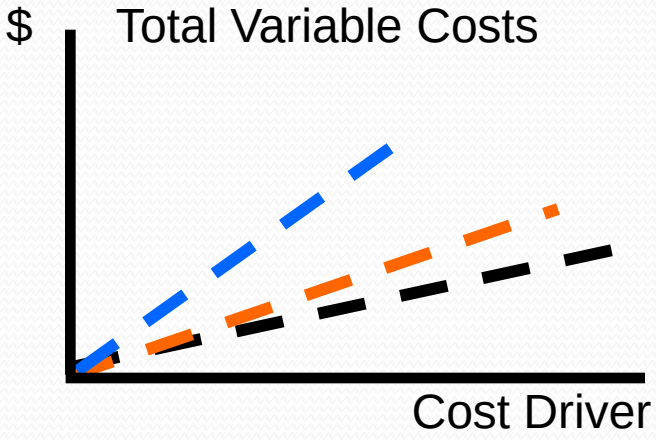
Total fixed costs do not change as the cost driver increases.

Higher total fixed costs are higher above the x axis.

Q1: Behavior of Total (Linear) Costs



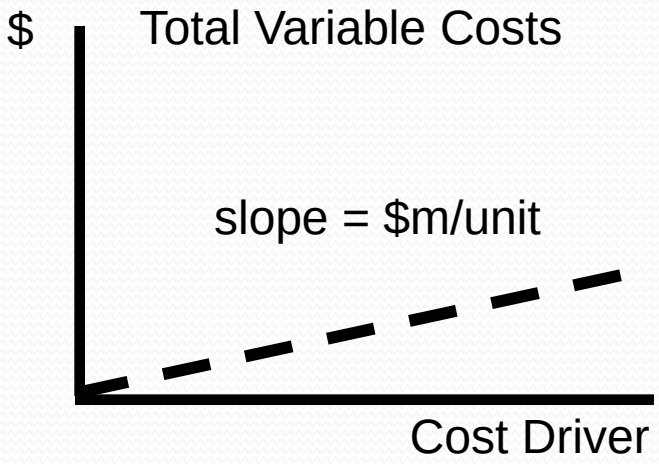
If costs are linear, then total costs graphically look like this.



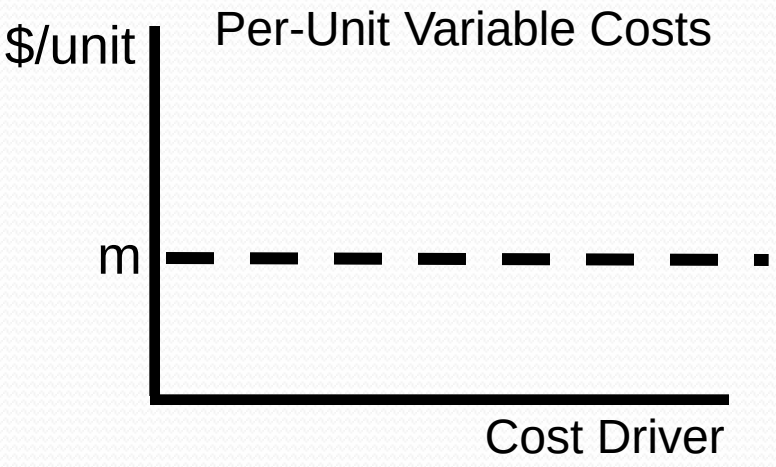
Total variable costs increase as the cost driver increases.

A steeper slope represents higher variable costs per unit of the cost driver.

Q1: Total Versus Per-unit (Average) Cost Behavior

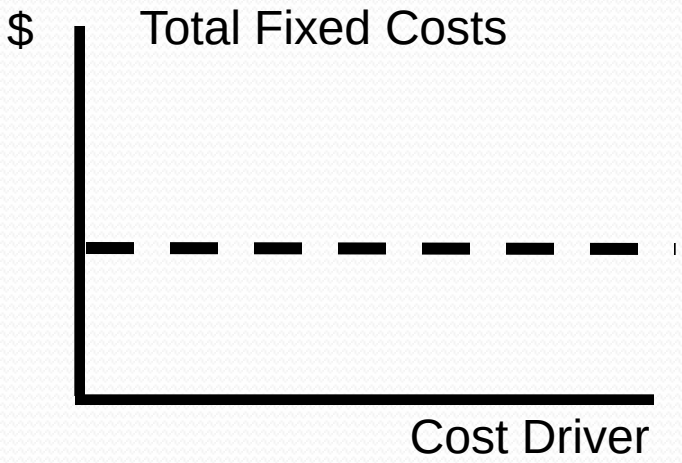


If total variable costs look like this . . .

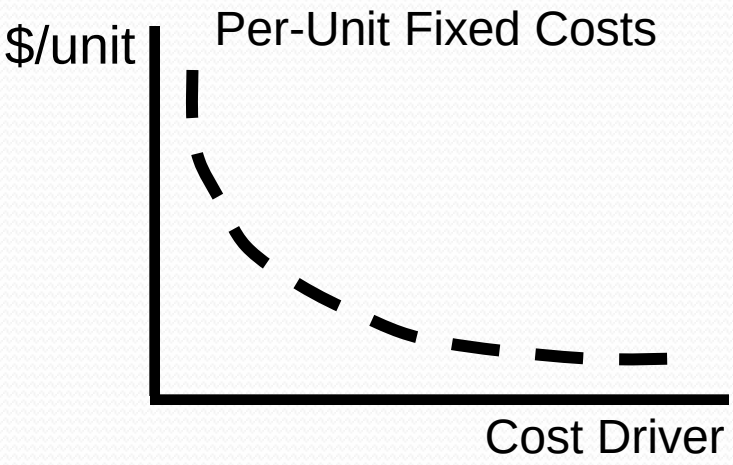


. . . then variable costs per unit look like this.

Q1: Total Versus Per-Unit (Average) Cost Behavior



If total fixed costs look like this . . .



. . . then fixed costs per unit look like this.

Q1: Total Versus Per-Unit (Average) Cost Behavior

Lari's Leather produces customized motorcycle jackets. The leather for one jacket costs $50, and Lari rents a shop for $450/month. Compute the total costs per month and the average cost per jacket if she made only one jacket per month. What if she made 10 jackets per month?

Average variable costs are constant

Total variable costs go up

1 Jacket

	Total Costs/ Month	Average Cost/ Jacket
Leather	$50	$50
Rent	$450	$450
Total	$500	$500

10 Jackets

	Total Costs/ Month	Average Cost/ Jacket
Leather	$500	$50
Rent	$450	$45
Total	$950	$95

Total fixed costs are constant

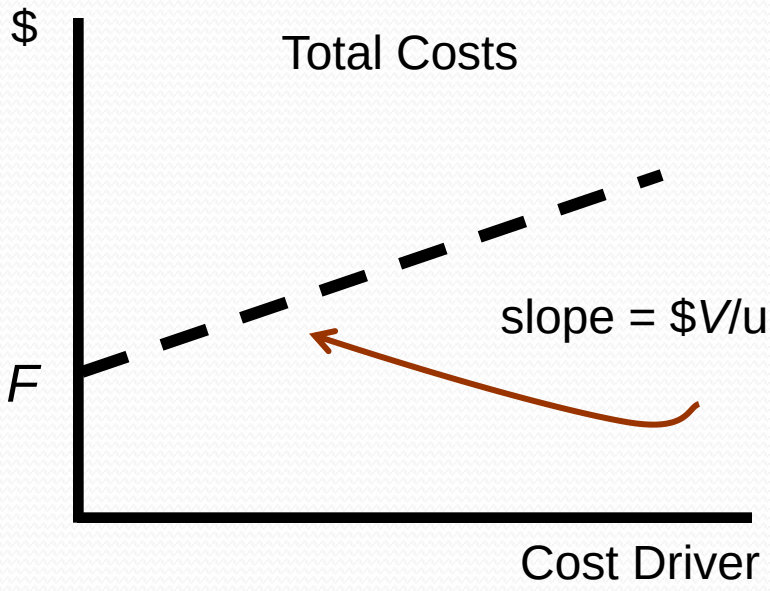
Average fixed costs go down

Q1: The Cost Function

When costs are linear, the cost function is:

$TC = F + V \times Q$, where

F = total fixed cost, V = variable cost per unit of the cost driver, and Q = the quantity of the cost driver.



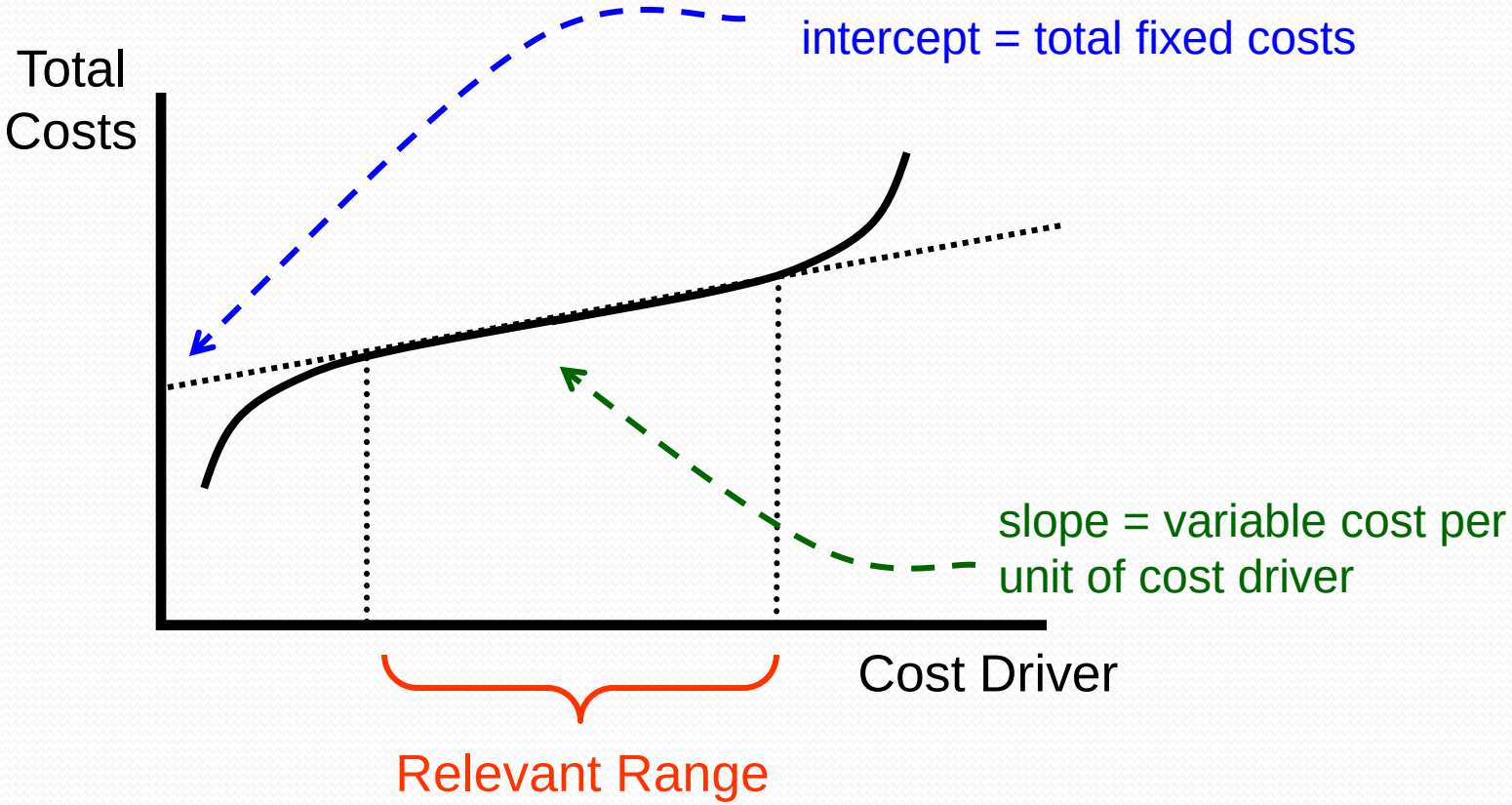
The intercept is the total fixed cost.

The slope is the variable cost per unit of the cost driver.

A cost that includes a fixed cost element and a variable cost element is known as a mixed cost.

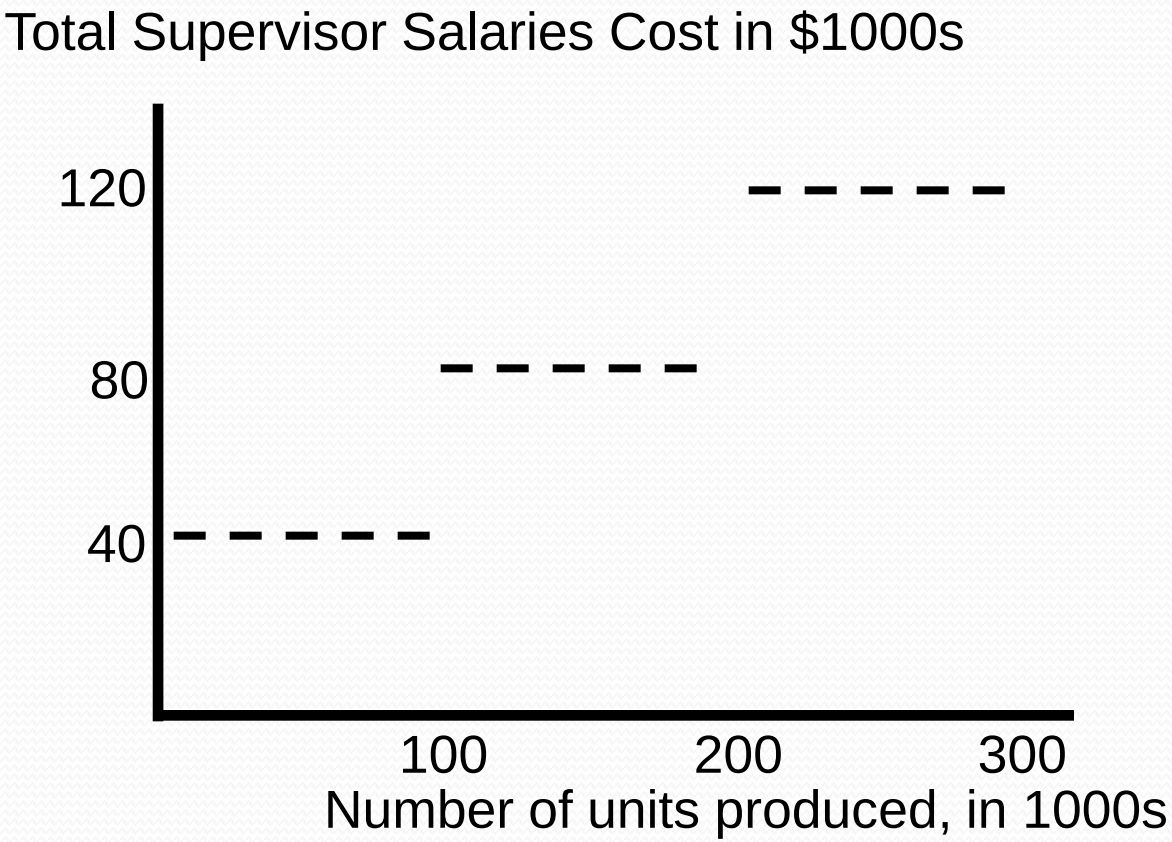
Q1: Nonlinear Cost Behavior

Sometimes nonlinear costs exhibit linear cost behavior over a range of the cost driver. This is the relevant range of activity.



Q1: Stepwise Linear Cost Behavior

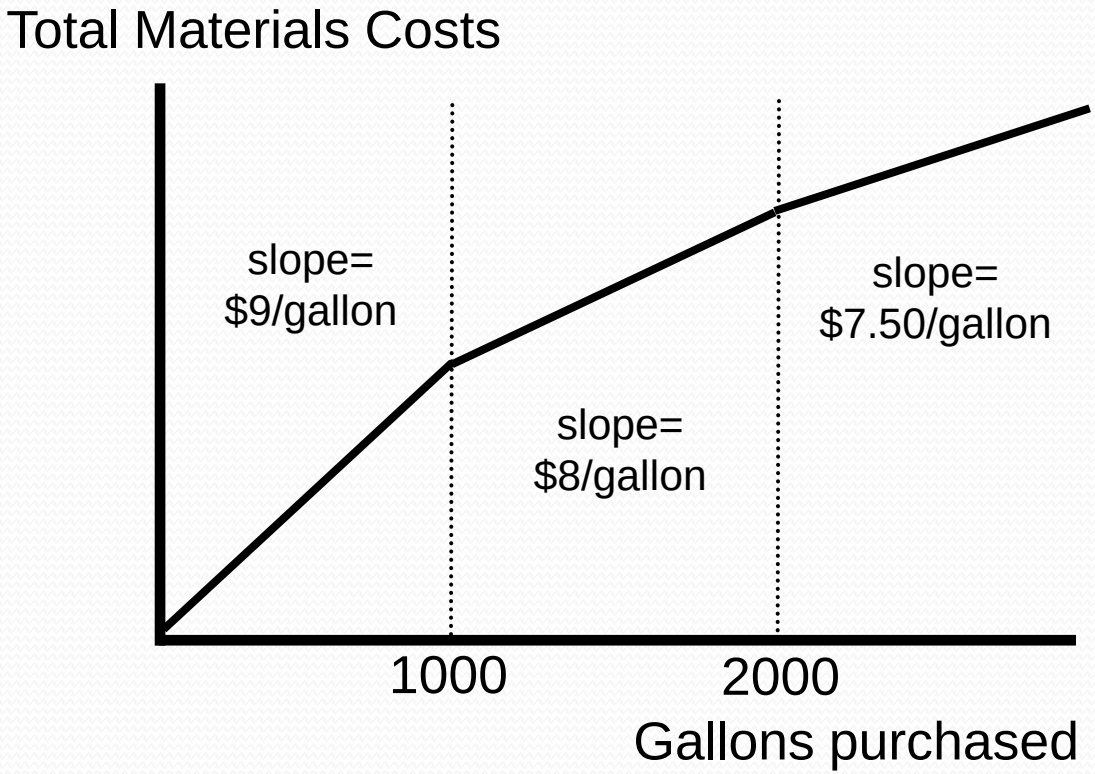
Some costs are fixed at one level for one range of activity and fixed at another level for another range of activity. These are known as stepwise linear costs.



Example: A production supervisor makes $40,000 per year and the factory can produce 100,000 units annually for each 8-hour shift it operates.

Q1: Piecewise Linear Cost Behavior

Some variable costs per unit are constant at one level for one range of activity and constant at another level for another range of activity. These are known as piecewise linear costs.



Example: A supplier sells us raw materials at $9/gallon for the first 1000 gallons, $8/gallon for the second 1000 gallons, and at $7.50/gallon for all gallons purchased over 2000 gallons.

Q1: Cost Terms for Decision Making

- We have learned the distinction between relevant and irrelevant cash flows.

- Opportunity costs are the benefits of an alternative one gives up when that alternative is not chosen.
  - Opportunity costs are difficult to measure because they are associated with something that did not occur.
  - Opportunity costs are always relevant in decision making.

- Sunk costs are costs that were incurred in the past.
  - Sunk costs are never relevant for decision making.

Q1: Cost Terms for Decision Making

- Discretionary costs are periodic costs incurred for activities that management may or may not determine are worthwhile.
  - These costs may be variable or fixed costs.
  - Discretionary costs are relevant for decision making only if they vary across the alternatives under consideration.

- Marginal cost is the incremental cost of producing the next unit.
  - When costs are linear and the level of activity is within the relevant range, marginal cost is the same as variable cost per unit.
  - Marginal costs are often relevant in decision making.

Q2: What Process is Used to Estimate Future Costs?

Past costs are often used to estimate future, non-discretionary, costs. In these instances, one must also consider:

- whether the past costs are relevant to the decision at hand
- whether the future cost behavior is likely to mimic the past cost behavior
- whether the past fixed and variable cost estimates are likely to hold in the future

Q3: Engineered Estimates of Cost Functions

- Use accountants, engineers, employees, and/or consultants to analyze the resources used in the activities required to complete a product, service, or process.

- For example, a company making inflatable rubber kayaks would estimate some of the following:
  - the amount and cost of the rubber required
  - the amount and cost of labor required in the cutting department
  - the amount and cost of labor required in the assembly department
  - overhead costs and the best cost allocation base to use
  - the selling costs, including commissions and advertising
  - the distribution costs

Q3: Account Analysis Method of Estimating a Cost Function

- Review past costs in the general ledger and past activity levels to determine each cost's past behavior.

- For example, a company producing clay wine goblets might review its records and find:
  - the cost of clay is piecewise linear with respect to the number of pounds of clay purchased
  - skilled production labor is variable with respect to the number of goblets produced
  - unskilled production labor is mixed, and the variable portion varies with respect to the number of times the kiln is operated
  - production supervisors' salary costs are stepwise linear
  - distribution costs are mixed, with the variable portion dependent upon the number of retailers ordering goblets

Q3: Example - Account Analysis Method of Estimating a Cost Function

- The table on the right contains the expenditures for Scott Manufacturing during the last year.
- 100,000 units were produced and sold
- $500,000 of sales revenue was recorded

Required:

1. Determine the cost function using units produced as the driver
2. Repeat using sales dollars as the driver

Expense	Amount	Variable	Fixed
Direct Materials	$500,000		
Direct Labor	300,000		
Rent	25,000		
Insurance	15,000		
Commissions	200,000		
Property Tax	20,000		
Telephone	10,000		
Depreciation	85,000		
Power & Light	30,000		
Admin Salaries	100,000		
Total	1,285,000		

Q3: Example - Account Analysis Method of Estimating a Cost Function

- Steps in estimating a cost function using account analysis
  - Separate fixed and variable costs
  - Total the fixed costs
  - Total the variable costs
  - Calculate a variable cost per driver
  - Write out the cost function

Q3: Solution - Account Analysis Method of Estimating a Cost Function

Expense	Amount	Variable	Fixed
Direct Materials	$500,000	500,000	
Direct Labor	300,000	300,000	
Rent	25,000		25,0
Insurance	15,000		15,0
Commissions	200,000	200,000	
Property Tax	20,000		20,0
Telephone	10,000		10,0
Depreciation	85,000		85,0
Power & Light	30,000		30,000
Admin Salaries	100,000		100,000
Total	1,285,000	1,000,000	285,000

Cost Function on Units:

TC = FC + VC/Unit * Qty
TC = $285,000 + ($10/unit) * Qty

Cost Function on Dollars:

TC = FC + VC/Sales $ * Sales $
TC = $285,000 + ($0.20) * Sales $

Q3: Two-Point Method of Estimating a Cost Function

- Use the information contained in two past observations of cost and activity to separate mixed and variable costs.
- It is much easier and less costly to use than the account analysis or engineered estimate of cost methods, but:
  - it estimates only mixed cost functions,
  - it is not very accurate, and
  - it can grossly misrepresent costs if the data points come from different relevant ranges of activity

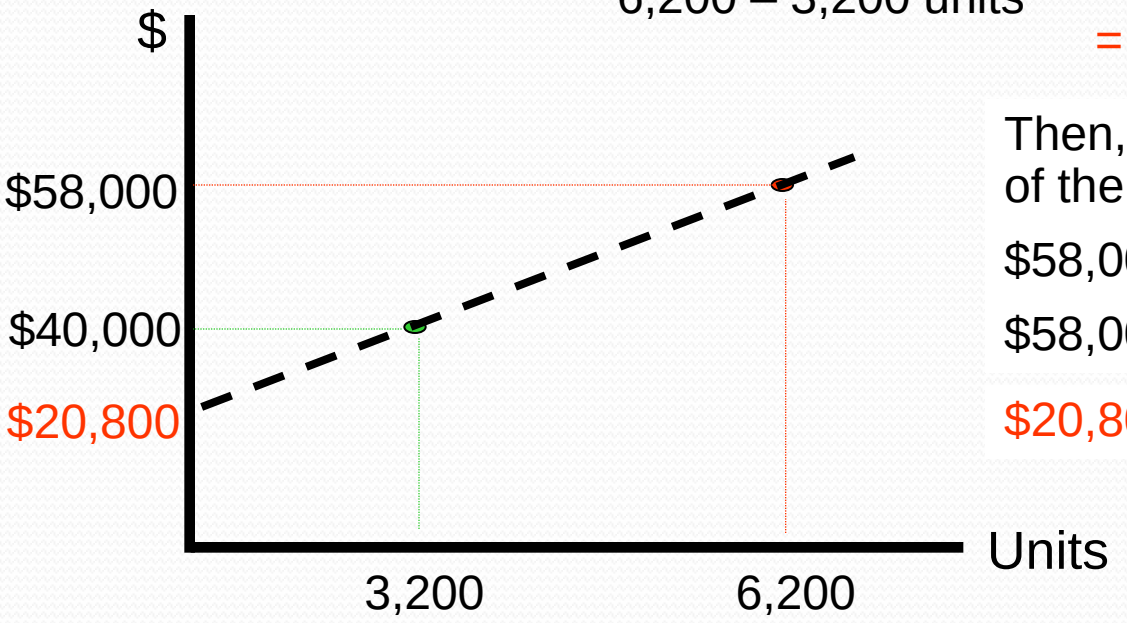
Q3: Example - Two-Point Method of Estimating a Cost Function

In July the Gibson Co. incurred total overhead costs of $58,000 and made 6,200 units. In December it produced 3,200 units and total overhead costs were $40,000. What are the total fixed factory costs per month and average variable factory costs?

We first need to determine *V*, using the equation for the slope of a line.

rise/run = $\frac{\$58,000 - \$40,000}{6,200 - 3,200 \text{ units}}$ = $18,000/3,000 units

= $6/unit



Then, using TC = *F* + *V* x *Q*, and one of the data points, determine F.

$58,000 = *F* + $6/unit x 6,200 units

$58,000 = *F* + $37,200

$20,800 = *F*

Q3: High-Low Method of Estimating a Cost Function

- The high-low method is a two-point method
  - the two data points used to estimate costs are observations with the highest and the lowest activity levels

- The extreme points for activity levels may not be representative of costs in the relevant range
  - this method may underestimate total fixed costs and overestimate variable costs per unit,
  - or vice versa.

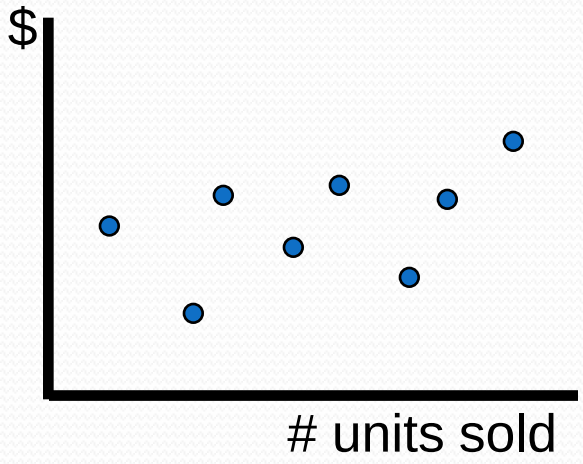
Q4: How Does a Scatterplot Assist with Categorizing a Cost?

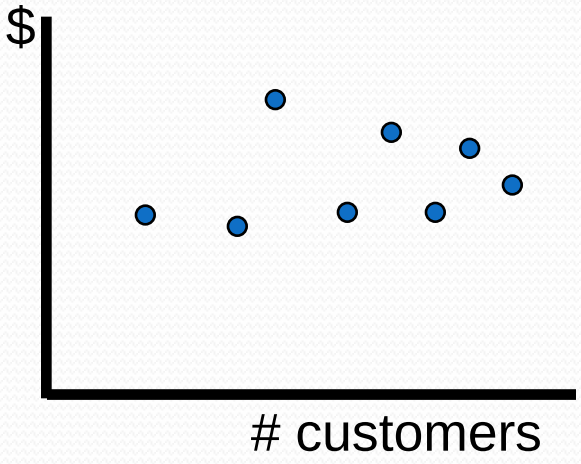
- A scatterplot shows cost observations plotted against levels of a possible cost driver.

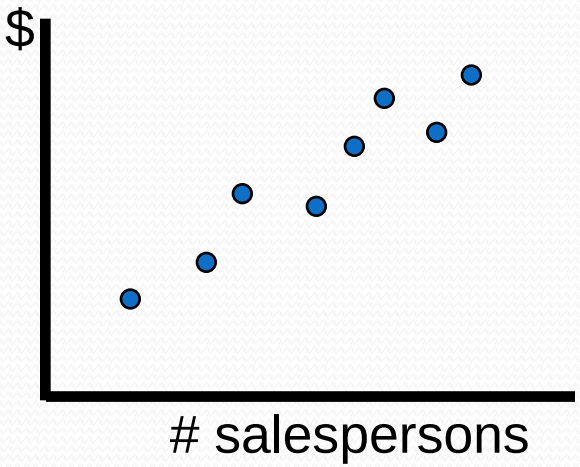
- A scatterplot can assist in determining:
  - which cost driver might be the best for analyzing total costs, and
  - the cost behavior of the cost against the potential cost driver.

Q4: Which Cost Driver Has the Best Cause & Effect Relationship with Total Cost?

8 observations of total selling expenses plotted against 3 potential cost drivers

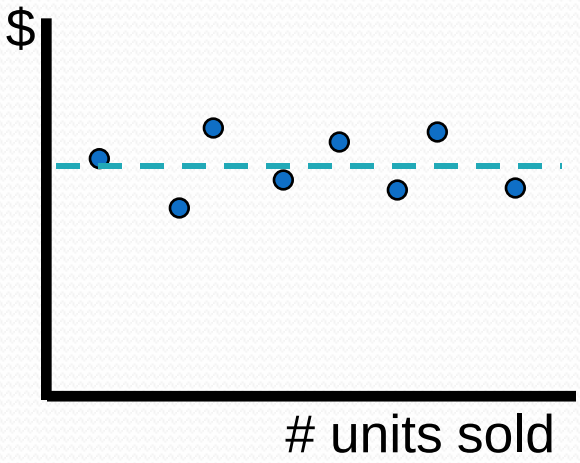






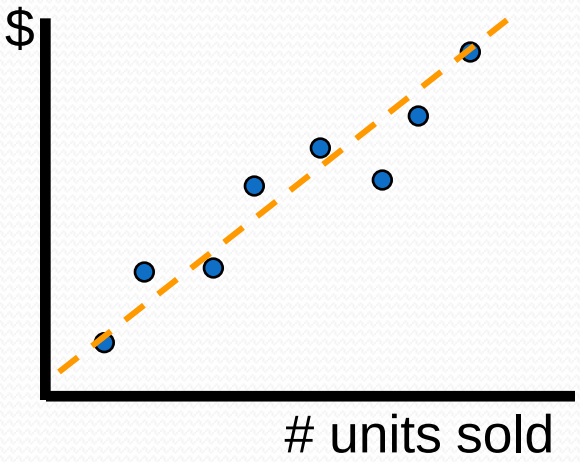
The number of salespersons appears to be the best cost driver of the 3.

Q4: What is the Underlying Cost Behavior?

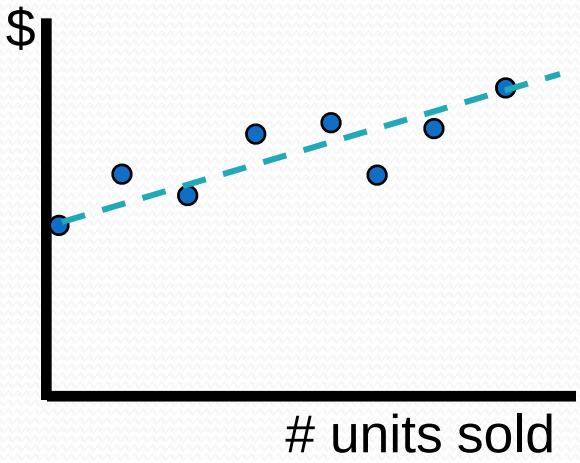


This cost is probably linear and fixed.

This cost is probably linear and variable.

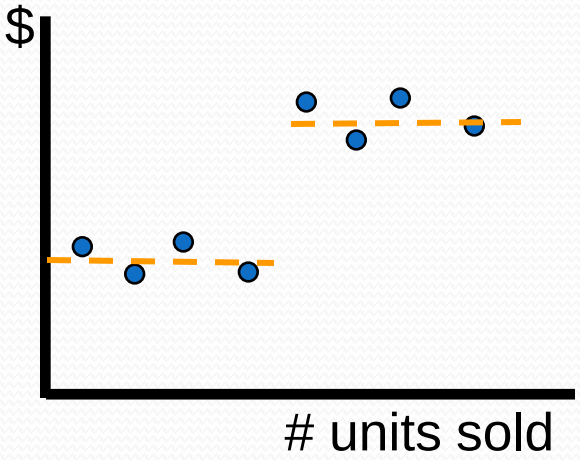


Q4: What is the Underlying Cost Behavior?

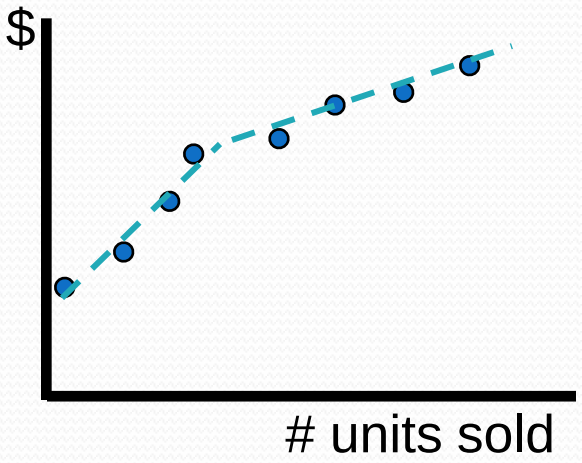


This cost is probably linear and mixed.

This is likely a stepwise linear cost.

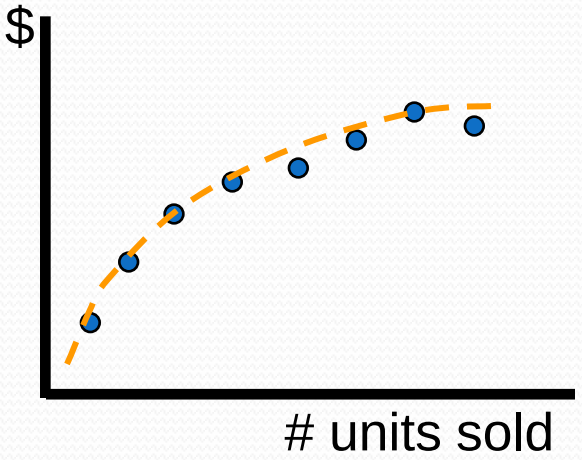


Q4: What is the Underlying Cost Behavior?



This cost may be piecewise linear.

This cost appears to have a nonlinear relationship with units sold.



Q5: How is Regression Analysis Used to Estimate a Mixed Cost Function?

- Regression analysis estimates the parameters for a linear relationship between a dependent variable and one or more independent (explanatory) variables.

- When there is only one independent variable, it is called simple regression.

- When there is more than one independent variable, it is called multiple regression.

$$Y = \alpha + \beta X + \square$$

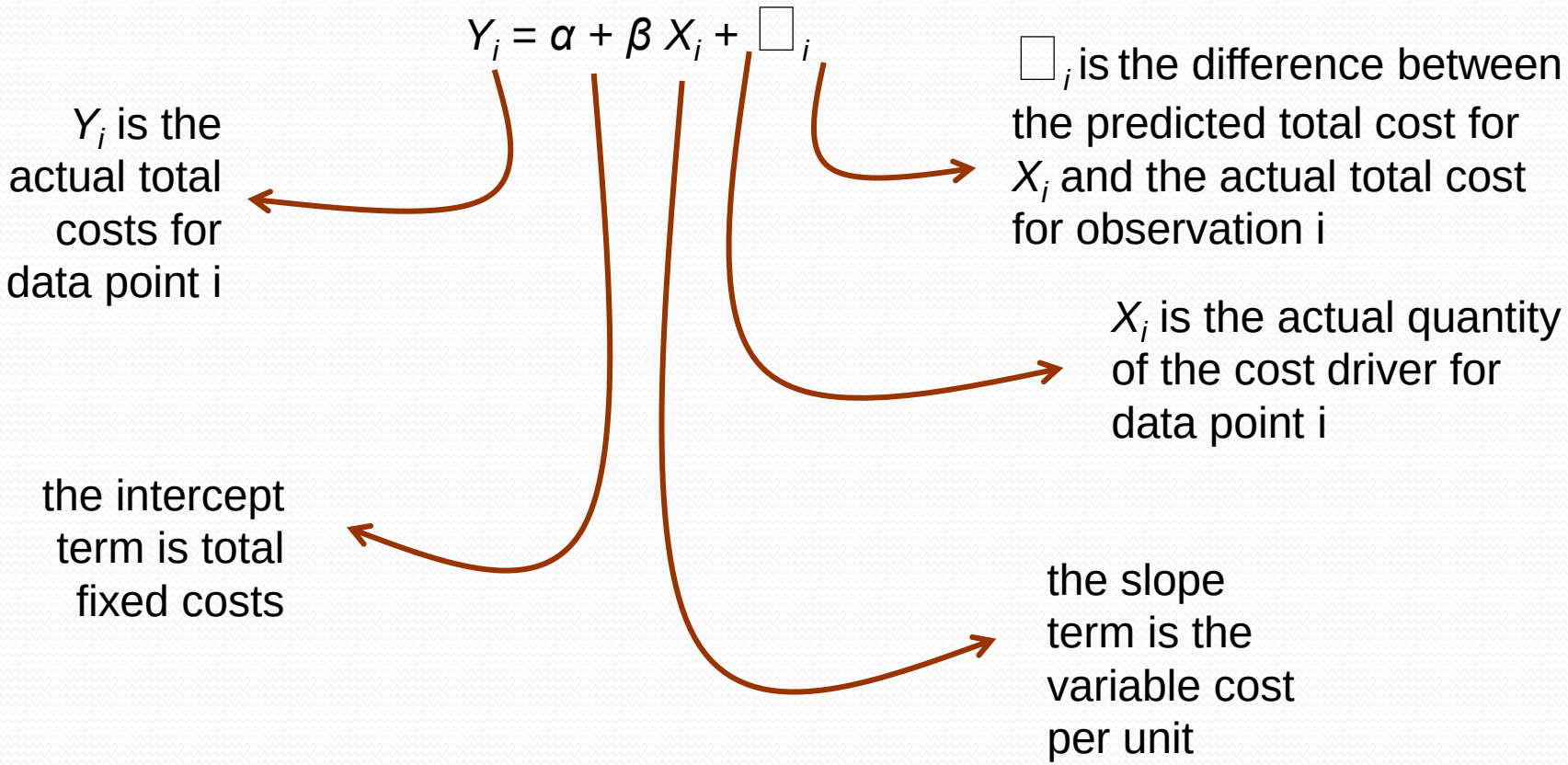
dependent variable

independent variable

α and β are the parameters; $\square$ is the error term (or residual)

Q5: How is Regression Analysis Used to Estimate a Mixed Cost Function?

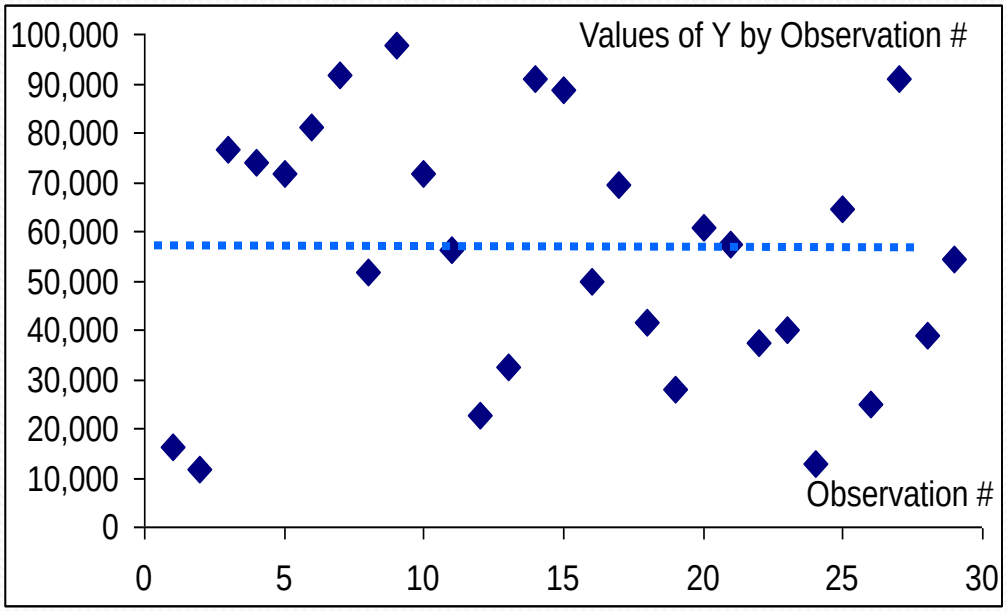
We can use regression to separate the fixed and variable components of a mixed cost.



Q5: Regression Output Terminology: Adjusted *R*-Square

- Goodness of fit
  - How well does the line from the regression output fit the actual data points?
  - The adjusted *R*-square statistic shows the percentage of variation in the Y variable that is explained by the regression equation.
  - The next slide has an illustration of how a regression equation can explain the variation in a Y variable.

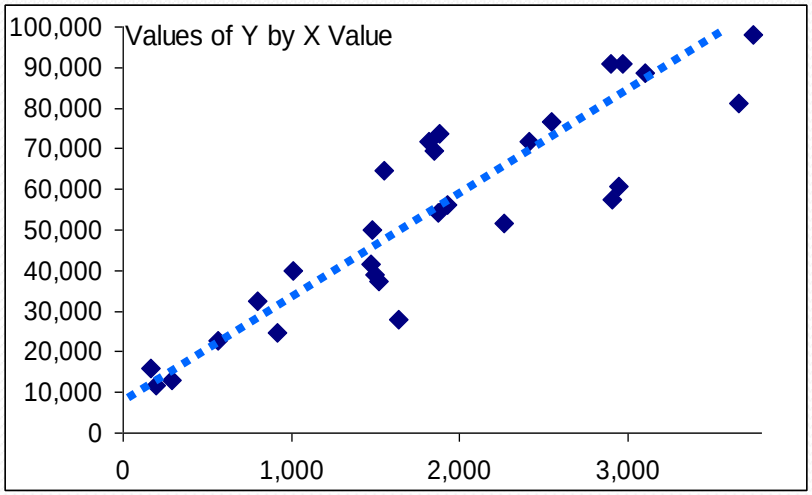
Q5: Regression Output Terminology: Adjusted *R*-Square



- We have 29 observations of a Y variable, and the average of the Y variables is 56,700.
- If we plot them in order of the observation number, there is no discernable pattern.
- We have no explanation as to why the observations vary about the average of 56,700.

Q5: Regression Output Terminology: Adjusted *R*-Square

If each Y value had an associated X value, then we could reorder the Y observations along the X axis according to the value of the associated X.



Now we can measure how the Y observations vary from the "line of best fit" instead of from the average of the Y observations. Adjusted *R*-Square measures the portion of Y's variation about its mean that is explained by Y's relationship to X.

Q5: Regression Output Terminology: *p*-value and *t*-statistic.

- Statistical **significance** of regression coefficients
  - When running a regression we are concerned about whether the "true" (unknown) coefficients are non-zero.
  - Did we get a non-zero intercept (or slope coefficient) in the regression output only because of the particular data set we used?

Q5: Regression Output Terminology: *p*-value and *t*-statistic.

- The *t*-statistic and the *p*-value both measure our confidence that the true coefficient is non-zero.
  - In general, if the t-statistic for the intercept (slope) term > 2, we can be about 95% confident (at least) that the true intercept (slope) term is not zero.
  - The p-value is more precise
    - it tells us the probability that the true coefficient being estimated is zero
    - if the p-value is less than 5%, we are more than 95% confident that the true coefficient is non-zero.

Q5: Interpreting Regression Output

Suppose we had 16 observations of total costs and activity levels (measured in machine hours) for each total cost. If we regressed the total costs against the machine hours, we would get . . .

Regression Statistics	
Multiple R	0.885
R Square	0.783
Adjusted R Square	0.768
Standard Error	135.3
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2937	64.59	45.47	1.31E-16
Machine Hours	5.215	0.734	7.109	5.26E-06

The coefficients give you the parameters of the estimated cost function.

Predicted total costs = $2,937 + ($5.215/mach hr) x (# of mach hrs)

Total fixed costs are estimated at $2,937.

Variable costs per machine hour are estimated at $5.215.

Q5: Interpreting Regression Output

Regression Statistics	
Multiple R	0.885
R Square	0.783
Adjusted R Square	0.768
Standard Error	135.3
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2937	64.59	45.47	1.31E-16
Machine Hours	5.215	0.734	7.109	5.26E-06

The regression line explains 76.8% of the variation in the total cost observations.

(5.26E-06 means 5.26 x 10^{-6}, or 0.00000526)

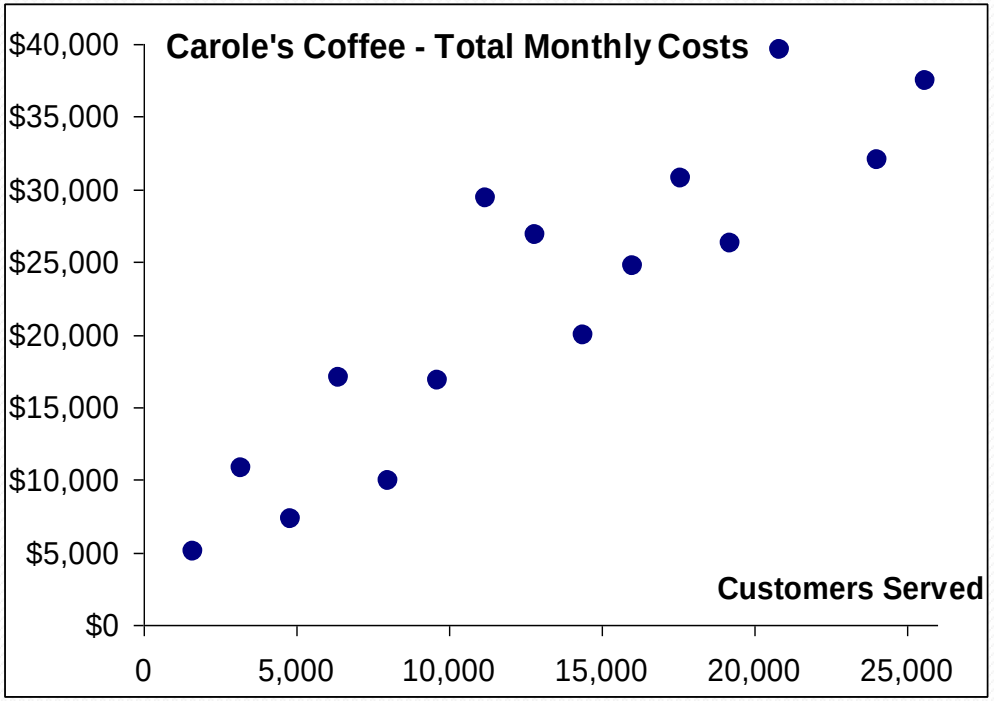
The high *t*-statistics . . .

. . . and the low p-values on both of the regression parameters tell us that the intercept and the slope coefficient are “statistically significant”.

Q5: Regression Interpretation Example

Carole's Coffee asked you to help determine its cost function for its chain of coffee shops. Carole gave you 16 observations of total monthly costs and the number of customers served in the month. The data is presented below, and the a portion of the output from the regression you ran is presented on the next slide. Help Carole interpret this output.

Costs	Customers
$5,100	1,600
$10,800	3,200
$7,300	4,800
$17,050	6,400
$9,900	8,000
$16,800	9,600
$29,400	11,200
$26,900	12,800
$20,000	14,400
$24,700	16,000
$30,800	17,600
$26,300	19,200
$39,600	20,800
$42,000	22,400
$32,000	24,000
$37,500	25,600



Q5: Regression Interpretation Example

Regression Statistics	
Multiple R	0.91
R Square	0.8281
Adjusted R Square	0.8158
Standard Error	4985.6
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	4634	2614	1.7723	0.0980879
Customers	1.388	0.169	8.2131	1.007E-06

What is Carole's estimated cost function? In a store that serves 10,000 customers, what would you predict for the store's total monthly costs?

Predicted total costs = $4,634 + ($1.388/customer) x (# of customers)

Predicted total costs at 10,000 customers = $4,634 + ($1.388/customer) x 10,000 customers

= $18,514

Q5: Regression Interpretation Example

Regression Statistics	
Multiple R	0.91
R Square	0.8281
Adjusted R Square	0.8158
Standard Error	4985.6
Observations	16

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	4634	2614	1.7723	0.0980879
Customers	1.388	0.169	8.2131	1.007E-06

What is the explanatory power of this model? Are the coefficients statistically significant or not? What does this mean about the cost function?

The model explains 81.58% of the variation in total costs, which is pretty good.

The slope coefficient is significantly different from zero. This means we can be pretty sure that the true cost function includes nonzero variable costs per customer.

The intercept is not significantly different from zero. There's a 9.8% probability that the true fixed costs are zero*.

*(Some would say the intercept is significant as long as the p-value is less than 10%, rather than 5%.)

Q6: Considerations When Using Estimates of Future Costs

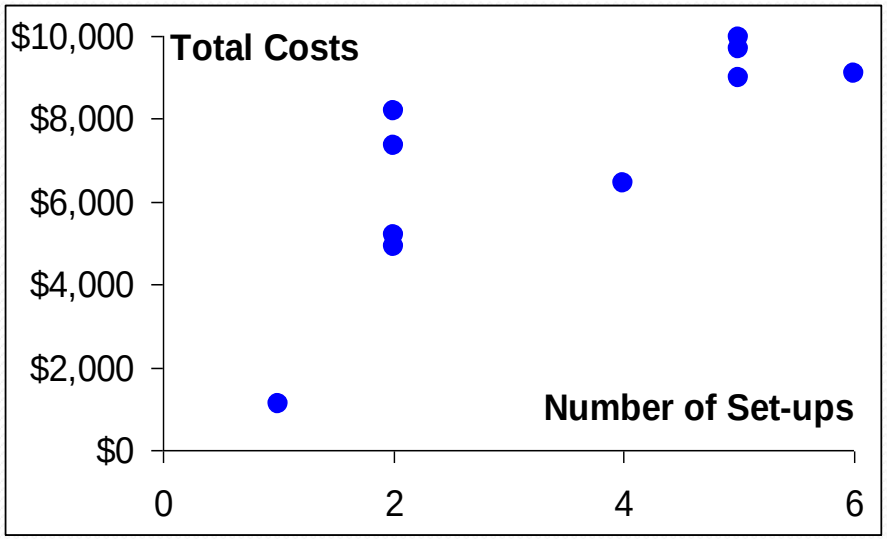
- The future is always unknown, so there are uncertainties when estimating future costs.
  - The estimated cost function may have mis-specified the cost behavior.
  - The cost function may be using an incorrect cost driver.
  - Future cost behavior may not mimic past cost behavior.
  - Future costs may be different from past costs.

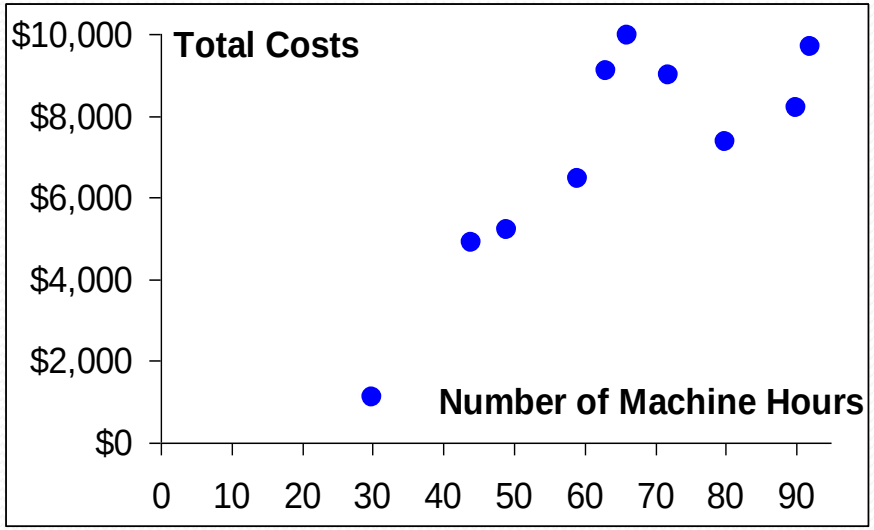
Q6: Considerations When Using Estimates of Future Costs

- The data used to estimate past costs may not be of high-quality.
  - The accounting system may aggregate costs in a way that mis-specifies cost behavior.
  - Information from outside the accounting system may not be accurate.
- The true cost function may not be in agreement with the cost function assumptions.
  - For example, if variable costs per unit of the cost driver are not constant over any reasonable range of activity, the linearity of total cost assumption is violated.

Multiple Regression Example

We have 10 observations of total project cost, the number of machine hours used by the projects, and the number of machine set-ups the projects used.





Multiple Regression Example

Regress total costs on the number of set-ups to get the following output and estimated cost function:

Regression Statistics	
Multiple R	0.788
R Square	0.621
Adjusted R Square	0.574
Standard Error	1804
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	2925.6	1284	2.278	0.0523
# of Set-ups	1225.4	338	3.62	0.0068

Predicted project costs = $2,926 + ($1,225/set-up) x (# set-ups)

The explanatory power is 57.4%. The # of set-ups is significant, but the intercept is not significant if we use a 5% limit for the p-value.

Multiple Regression Example

Regress total costs on the number of machine hours to get the following output and estimated cost function:

Regression Statistics	
Multiple R	0.814
R Square	0.663
Adjusted R Square	0.621
Standard Error	1701
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	-173.8	1909	-0.09	0.9297
# Mach Hrs	112.65	28.4	3.968	0.0041

Predicted project costs = - $173 + ($113/mach hr) x (# mach hrs)

The explanatory power is 62.1%. The intercept shows up negative, which is impossible as total fixed costs can not be negative. However, the *p*-value on the intercept tells us that there is a 93% probability that the true intercept is zero. The # of machine hours is significant.

Multiple Regression Example

Regress total costs on the # of set ups *and* the # of machine hours to get the following:

Regression Statistics	
Multiple R	0.959
R Square	0.919
Adjusted R Square	0.896
Standard Error	891.8
Observations	10

	Coefficients	*Std Error*	*t Stat*	*P-value*
Intercept	-1132	1021	-1.11	0.3044
# of Set-ups	857.4	182.4	4.7	0.0022
# of Mach Hrs	82.31	16.23	5.072	0.0014

Predicted project costs = - $1,132 + ($857/set-up) x (# set-ups) + ($82/mach hr) x (# mach hrs)

The explanatory power is now 89.6%. The *p*-values on both slope coefficients show that both are significant. Since the intercept is not significant, project costs can be estimated based on the project's usage of set-ups and machine hours.

What is a Learning Curve?

A learning curve is

- the rate at which labor hours per unit decrease as the volume of activity increases
- the relationship between cumulative average hours per unit and the cumulative number of units produced.

A learning curve can be represented mathematically as:

$Y = \alpha X^r$, where

Y = cumulative average labor hours,

α = time required for the first unit,

X = cumulative number of units produced,

r = an index for learning = ln(% learning)/ln(2), and

ln is the natural logarithmic function.

Learning Curve Example

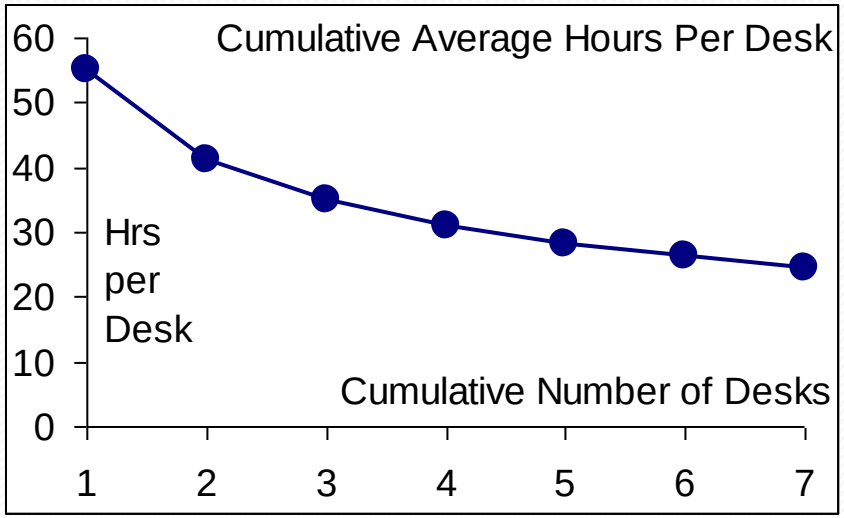
Deanna's Designer Desks just designed a new solid wood desk for executives. The first desk took her workforce 55 labor hours to make, but she estimates that each desk will require 75% of the time of the prior desk (i.e. "% learning" = 75%). Compute the cumulative average time to make 7 desks, and draw a learning curve.

First compute *r*: $r = \ln(75\%)/\ln(2) = -0.2877/0.693 = -0.4152$

Then compute the cumulative average time for 7 desks:

$Y = 55 \times 7^{(-0.4152)} = 25.42$ hrs

In order to draw a learning curve, you must compute the value of *Y* for all *X* values from 1 to 7. . . .



Sustainability Accounting

17: Sustainability Accounting

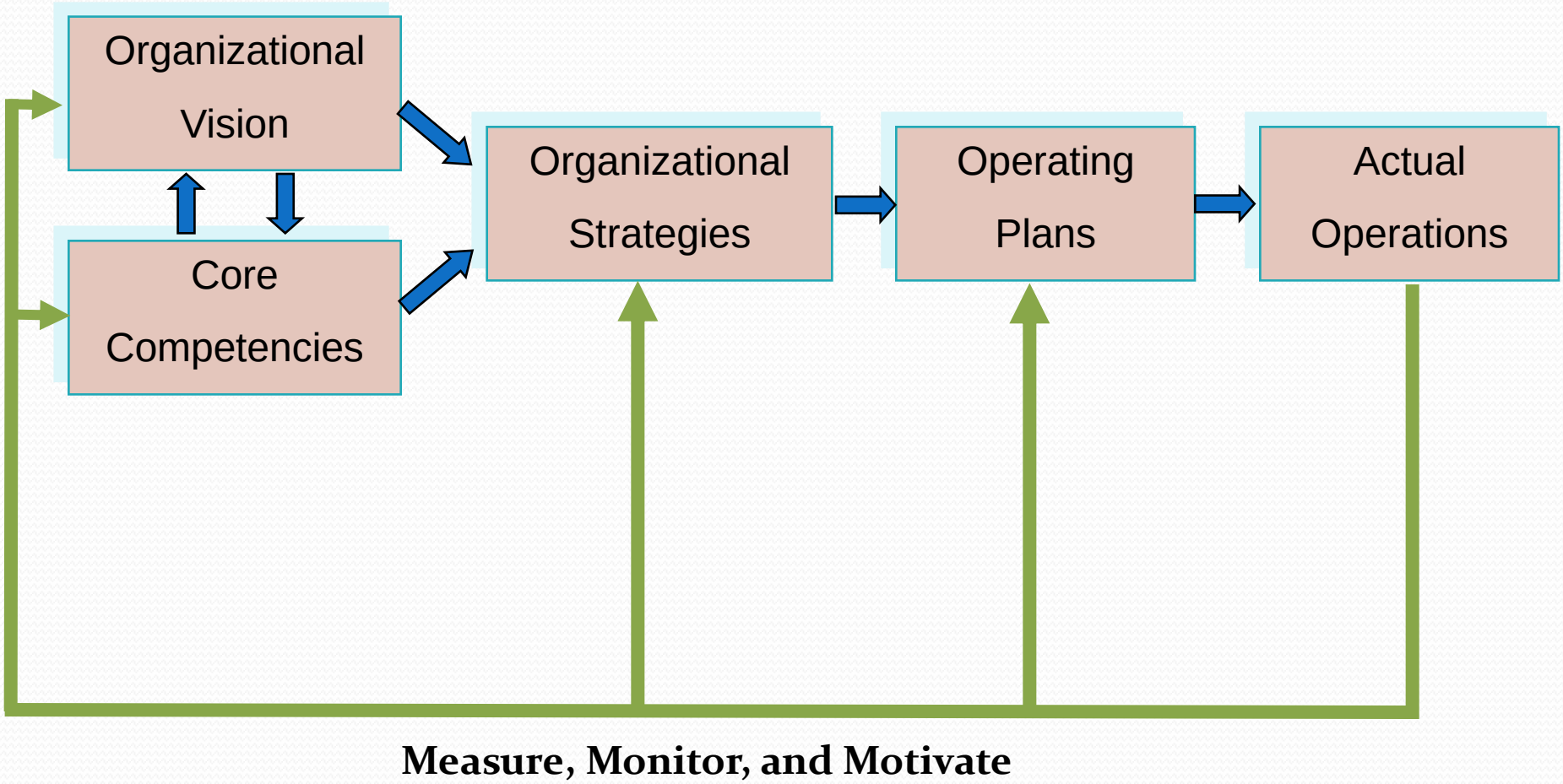
Learning objectives

- Q1: What are sustainability and sustainable management?
- Q2: What are sustainability accounting, sustainability management accounting, and sustainability reporting?
- Q3: What are the motivations and frameworks for external sustainability reporting?
- Q4: What management accounting tools are useful for sustainability management and reporting?

Q1:Sustainability and Sustainable Management

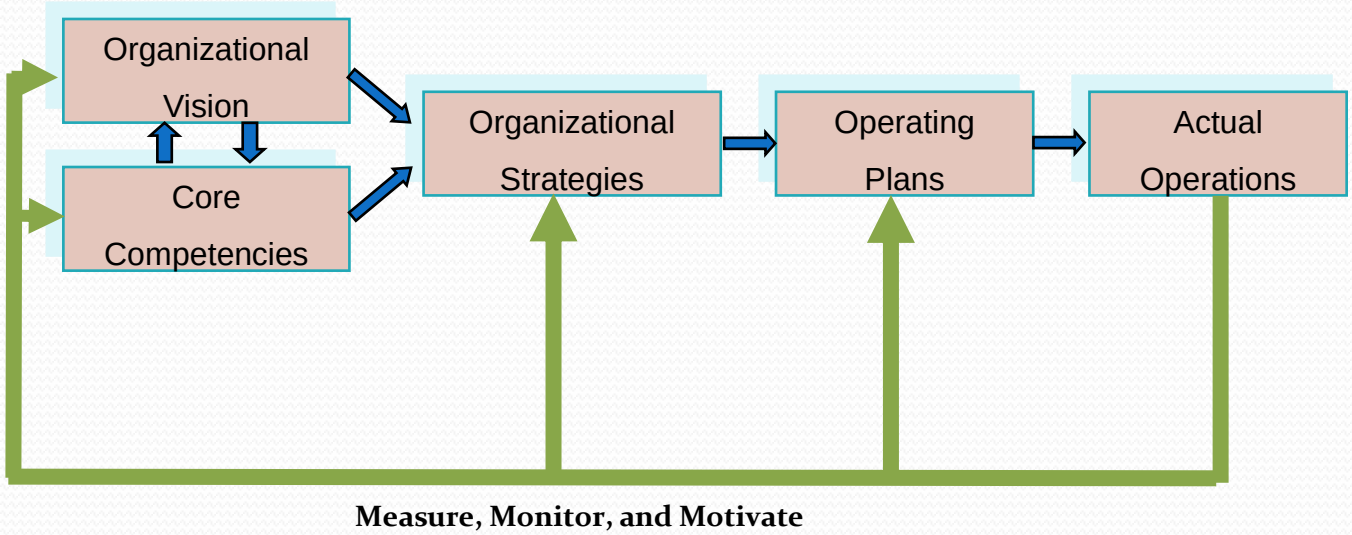
- Sustainability is defined as “activities and approaches that maintain or increase added value without creating long-term threats to economic environment or social systems.”
- Sustainable management is “the ability to direct an organization in ways that restore and enhance all forms of capital to generate shareholder value and contribute to the well-being of current and future generations.”

Q1: Overview of Strategic Management Process



Q1: Overview of Strategic Management Process

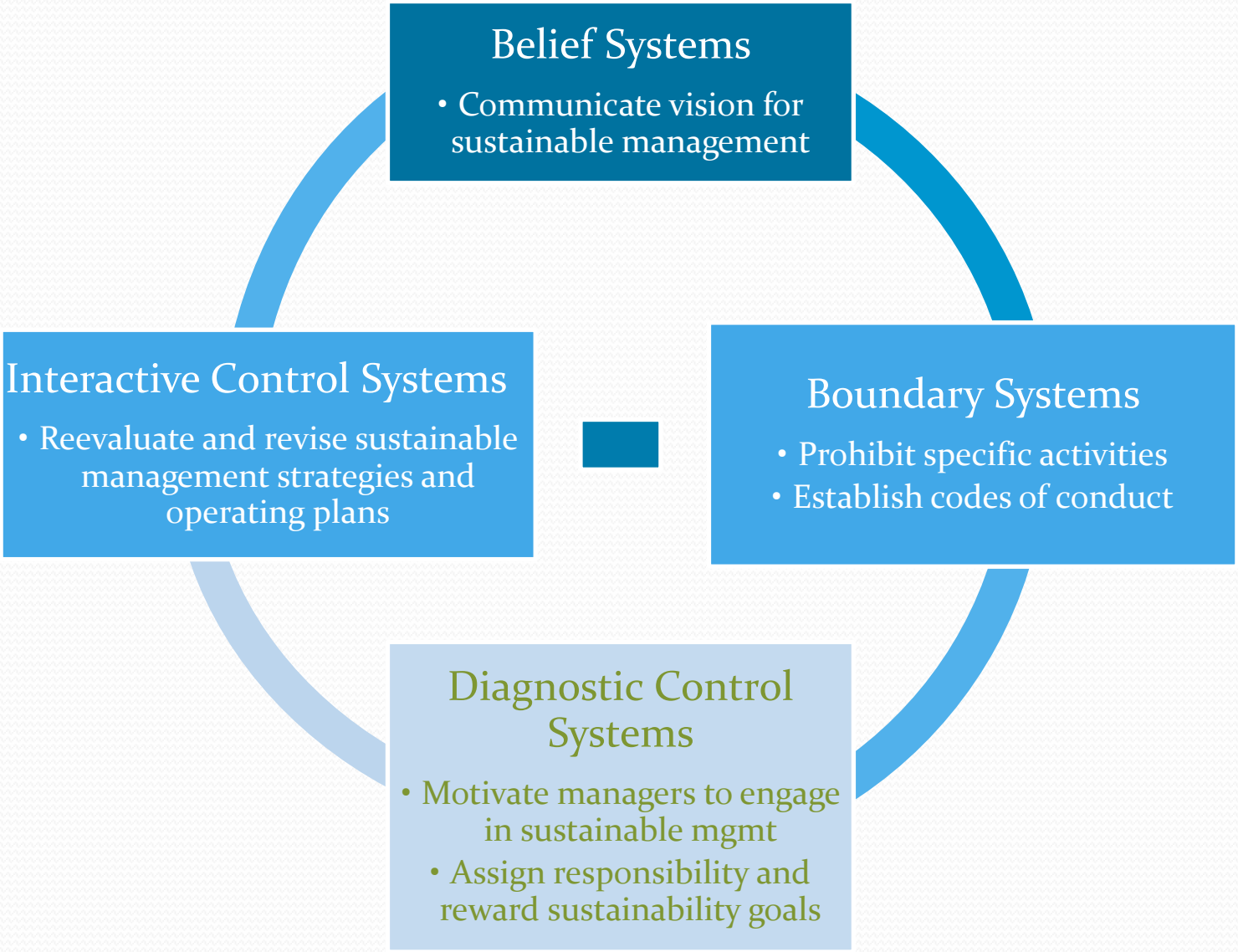
Sustainable Management involves addressing sustainability issues in each aspect of the strategic management process.



Triple bottom line:

Economic, Environmental, and Social

Q1: Sustainability and Levers of Control



- Sustainability accounting is the systematic recording, reporting, and analysis of quantitative and qualitative information about sustainable management practices and performance.
- Sustainability management accounting involves activities to assist in the sustainable management process including:
  - designing business processes
  - budgeting and forecasting
  - implementing and monitoring internal controls

Q2: Sustainability Reporting

Internal Reporting	External Reporting
• Provides information for sustainability management decisions to support the strategic management process ◦ Some issued regularly (monthly worker injuries or volumes of waste) ◦ Others issued for one time use	• Distributed outside the company to various stakeholder groups • Reports may be required ◦ Compliance reports for laws such as minimum wage or pollution levels • May be voluntary and unregulated

Q2: Sustainability Reporting

EXTERNAL Sustainability Reporting

- What standards to follow, if any?
- Combine with financial statements?
- Any assurance service?

INTERNAL Sustainability Reporting

What information is needed for:

- Decision making?
- Monitoring operations and performance evaluation?
- Monitoring of strategic plans?

Gathering and Measuring INFORMATION

- **Priorities/materiality:** What is important to report? Who needs information? When?
- **Information systems:** What new systems are needed to collect data and report information? Are sustainability systems stand-alone or integrated? What quality of information is needed?
- **Measuring financial costs and benefits:** Are sustainability costs and benefits separated from non-sustainability items? How to address externalities? When should costs be recognized? How valid and reliable are measurements? What new measurement methods should be developed?
- **Measuring nonfinancial data:** What nonfinancial data are needed? What types of collection methods or models are needed?

Q3: External Reporting Motivations

Ethical considerations	Economic considerations	Reputation or brand
Innovation and learning	Employee motivation	Risk Management or risk reduction
Strengthened supplier relationships	Access to capital or increased shareholder value	Improved government relationship

- Greenwashing is when companies appear to spend significant resources on publicity about being environmentally friendly without making substantive changes in their environmental impact.
- Watch for:
  - Misleading words, visuals, and graphics
  - Vague and unproven green claims
  - Overstated or exaggerated environmental claims
  - Omitted or masked information to divert attention from environmentally damaging aspects

Q3: Frameworks and Guidelines

- Global Reporting Initiative (GRI)
  - Framework for disclosure on economic, environmental, and social performance
  - 77% of FIRMS in KPMG 2008 study uses GRI reporting guidelines
- ISO 26000 – Guidance for Social Responsibility
  - Will be released in 2010
  - Provides principles for sustainability reporting, guidance for several major reporting areas, and recommendations for implementation

Q4: Sustainability

- When fully integrated into an organization, sustainable management affects everything the organization does.

- Examples include:
  - Qualitative and quantitative information used in decision making must also include environmental and social considerations
  - Must recognize and measure the social and environmental costs in the accounting system
  - More stakeholder groups need to be considered
  - Sustainability is incorporated into all control systems

Q4: Relevant Costs for Decision

- Sustainability costs are often overlooked by traditional management accounting systems
- Timing of environmental and social responsibility costs often lag the related decision
- Five levels of sustainability costs
  - Conventional Costs
  - Hidden Costs
  - Contingent Costs
  - Image and Relationship Costs
  - Externalities

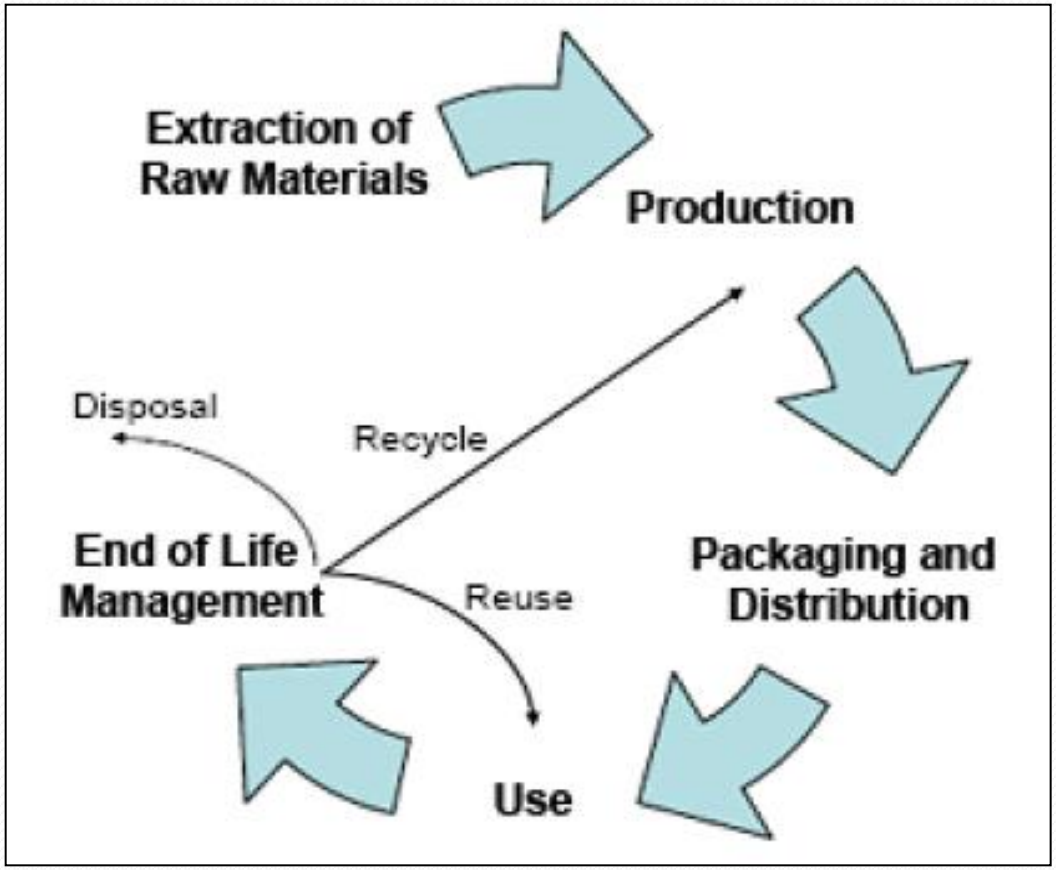
- Material Flow Accounting (input output analysis) is the process of analyzing the movement of all physical materials through an organization's operations
- Inputs include:
  - Direct and indirect manufacturing materials
  - All forms of energy
- Outputs include:
  - Products
  - Waste
  - Emissions

Q4: Material Flow Cost

- Material Flow Cost Accounting is the process of analyzing and tracking the physical units and costs of materials and energies through a manufacturing process
- Similar to process costing (Chpt 6)
  - Costs are assigned separately to waste and emissions (similar to abnormal spoilage)
  - Practice avoids burying the costs of waste
- All wasted materials are treated as negative product

Q4: Sustainability Life Cycle

- Life cycle costing involves summing the costs of these activities throughout both internal and external value chains



Q4: Sustainability and Capital Budgeting

- Incremental Operating Cash flows are often impacted by sustainable management initiatives
- These cash flows must be included in capital budgeting decisions
  - Waste and Emission Treatment
  - Prevention and Environmental Management
  - Non-Product Output
    - Material Purchase
    - Processing Costs
  - Environmental Revenues
  - Image Benefits and Costs

Q4: Sustainability Balanced Scorecard

- Assuming sustainable management is integrated into the strategic management process, then sustainability should be implemented into the balanced scorecard
- Three possible ways to integrate sustainability:
  - Integrate into the traditional four perspectives
  - Add a sustainability perspective to the scorecard
  - Create a separate sustainability balanced scorecard

Future of Sustainability Reporting

- Integration with Annual Reports
- Stakeholder Dialogue
- Linked to Strategy, with Targets/Goals
- Process and Product Innovation
- Less Focus on Business Case
- Larger Audience
- Global Standards with Assurance

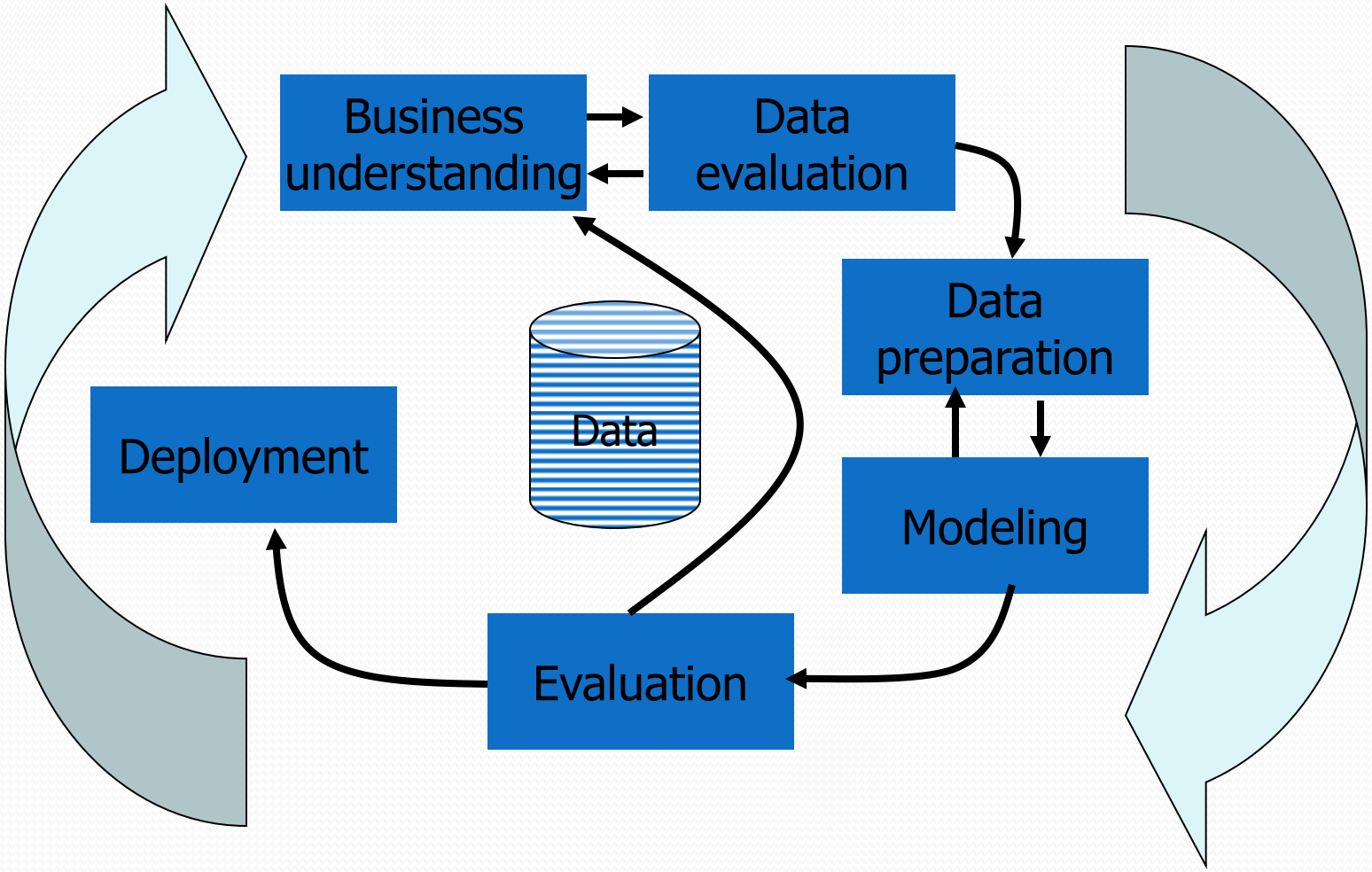
Case Study



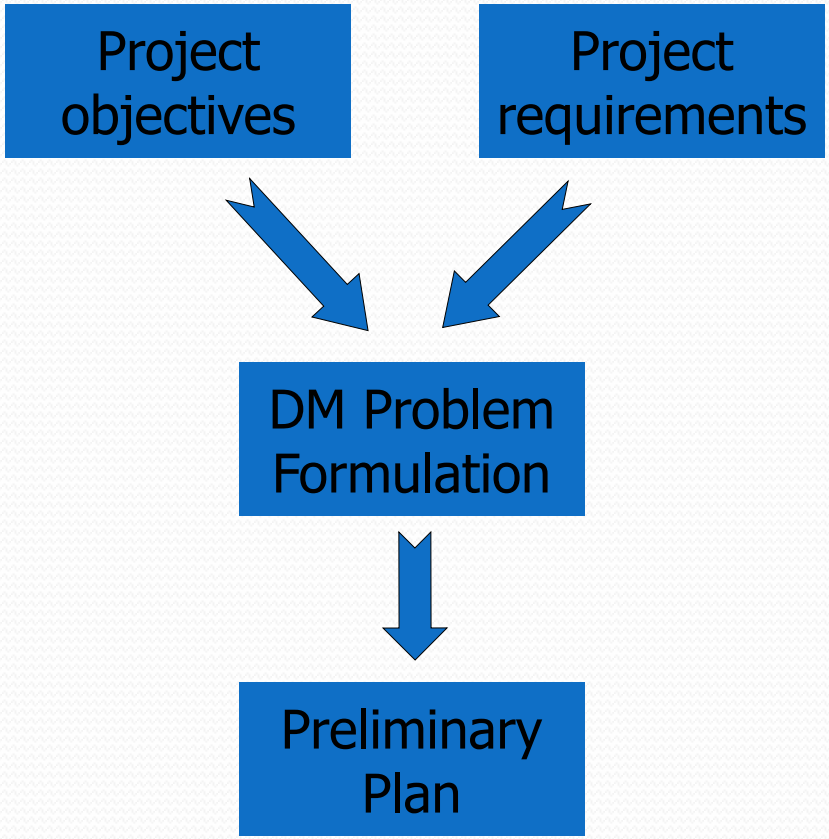
The CRISP Data Mining Process

Interpreting Data Case Study

The Data Mining Process



Business Understanding



Case Study

- Data mining project done for a large insurance company
- Consider the use of data mining to improve understanding of customer databases
- Led by the data warehousing team, which wanted to also improve their expertise

Business Objectives

- Understand what coverage packages are of interest to a customer group
  - Targeting of new customers
  - Cross-selling opportunities to existing customers
- Understand why a customer group terminates coverage
  - Know in advance what groups are likely to terminate
  - Understand what factors influence termination

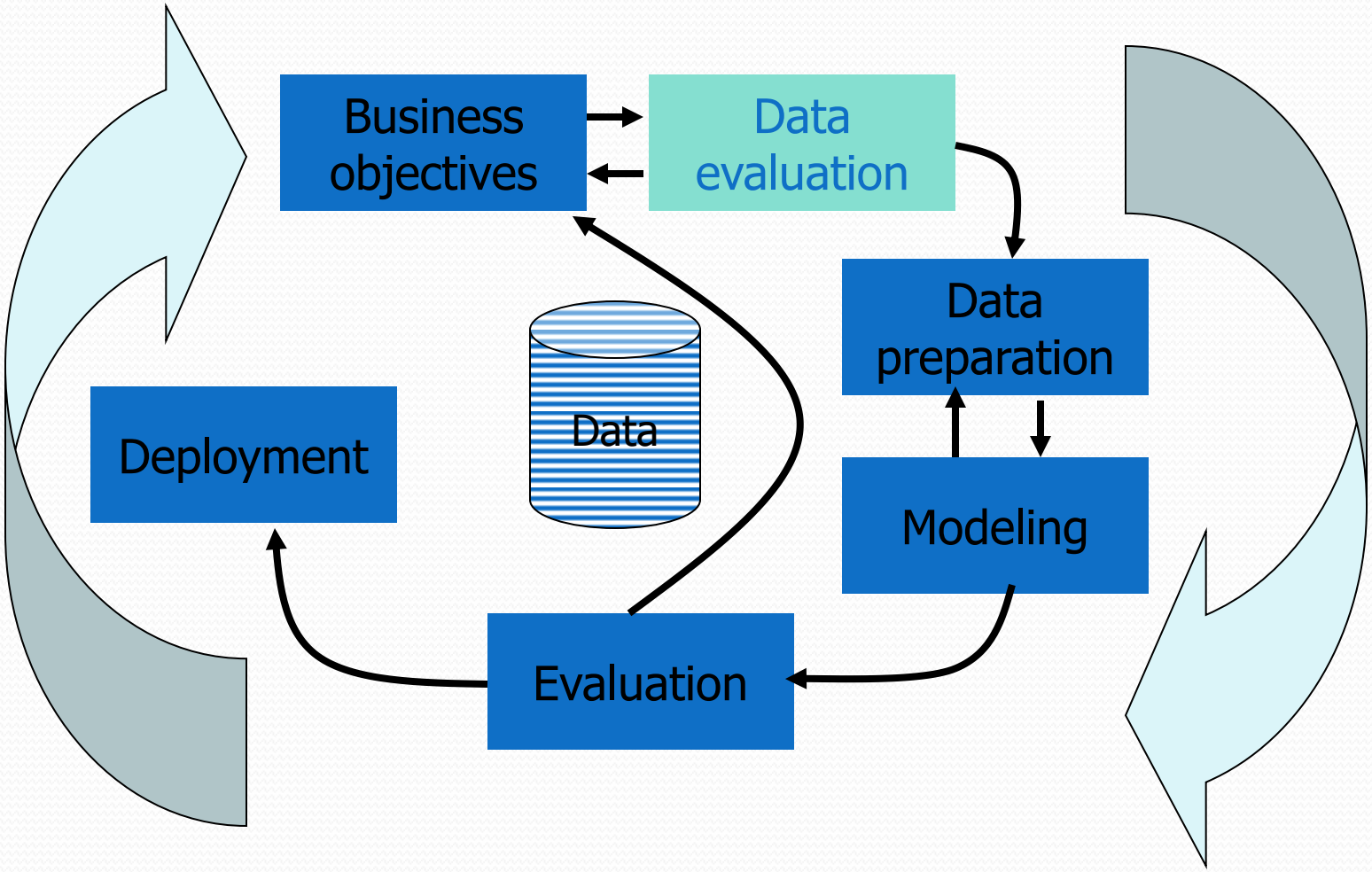
What are the Goals?

- The business goals
  - Improve customer retention
  - Increase cross-selling
- Success criteria
  - Customer turnover rate
  - Amount of cross-selling

Data Mining Problems

- Classify new and existing customers as either interested or not interested in a particular coverage
- Classify existing customers as either likely or unlikely to terminate coverage

The Data Mining Process



Data Evaluation

- Initial data collections
- Data quality
- Initial insights
- Interesting subsets

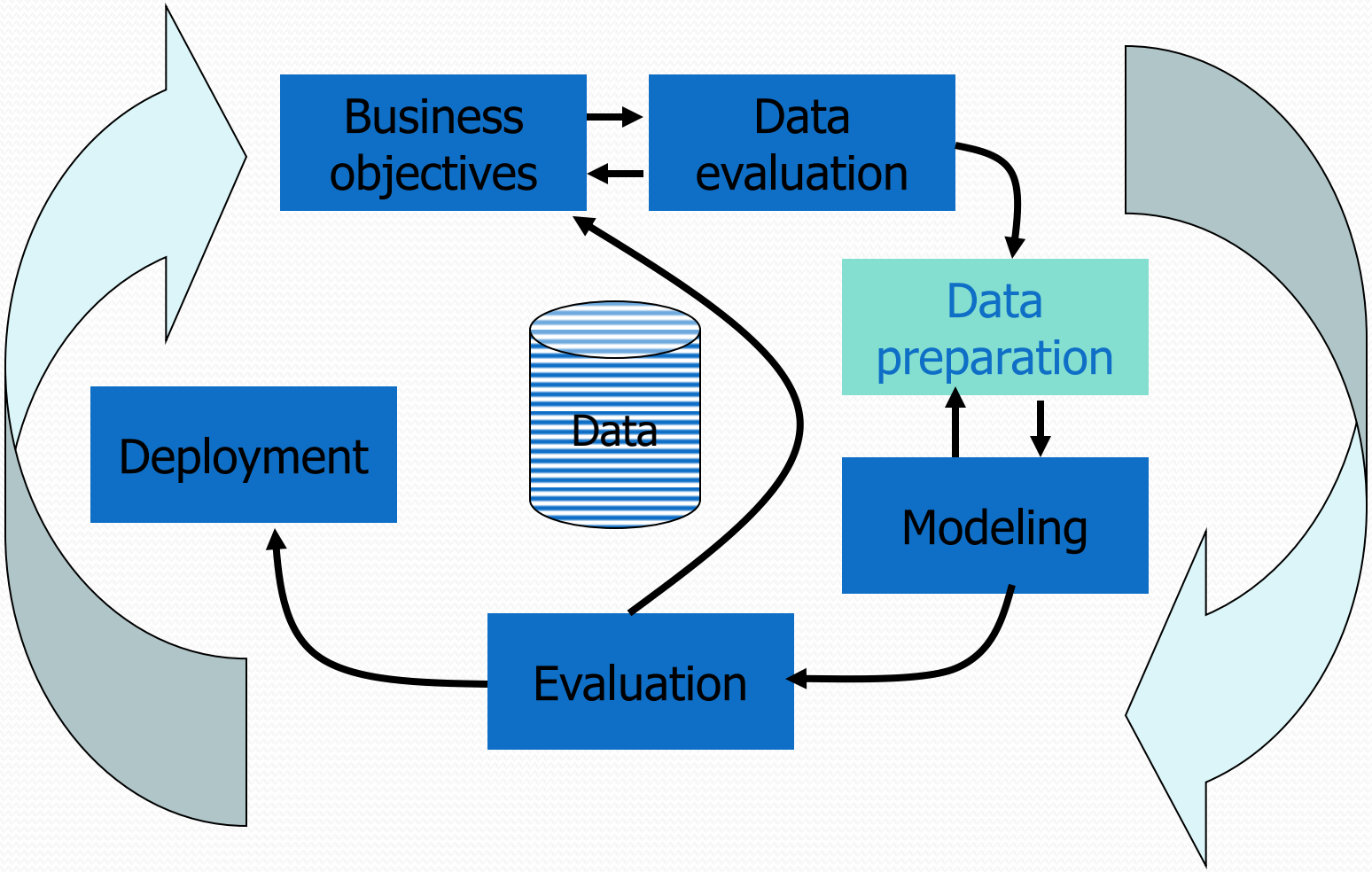


Data warehousing team

Case Study: Data Evaluation

- Data was extracted from select customer databases by company personnel
- Coverage programs with few customers selected for pilot project
- Five separate files extracted for five coverage programs

The Data Mining Process



Data Preparation



Technical tasks:

✓Data selection
✓Attribute selection
✓Data cleaning

Case Study: Data Preparation

- Some initial formatting of data in MS Excel
  - Cleaning of data file
  - Combine headers/instances
  - Add a new attribute: interest (yes/no)
  - Must create the no interest cases
- End up with a CSV formatted file

Weka Data Mining Software

- Data in CSV format loaded into Weka:
  - Data preprocessing
  - Attribute selection
  - Modeling
    - Classification
    - Clustering
    - Association rule mining
  - Visualization

Data Preprocessing in Weka

- Initial data inspection
  - Missing values
  - Useless attributes
  - Numeric attributes as nominal
- Some helpful Weka filters
  - *RemoveUseless*
  - *ReplaceMissingValues*

Data Preprocessing in Weka

- Data reduction:
  - Instance dimension
    - *RemovePercentage*, and *Resample* filters
  - Attribute dimension
    - Remove redundant attributes
    - Remove irrelevant attributes
    - Identify most important attributes

Attribute Selection Methods

- Three main methods used:
  - InfoGain
  - ChiSquared
  - Relief
- Combined results from complimentary methods
- Final pruning of attribute list to twenty attributes

Selected Attributes

- Location
  - Tax State
  - Contract State
  - State Code
  - Zip Code

Selected Attributes

- Size
  - Case Size Range
- Industry
  - Industry Classification
  - Industry Classification Name
  - SIC Code

Selected Attributes

- Timing
  - New Sale Flag
  - Decision Maker Effective Month
  - Decision Maker Effective Year
  - Next Renewal Month
  - Next Renewal Year

Selected Attributes

- Internal
  - Agency Number
  - Office Name
  - Pricing Category Code
  - Product Line Name
  - Small Group Flag

Relevance of Attribute Selection

- Improved modeling
  - Faster model induction
  - Higher accuracy
  - Easier to interpret models
- Structural knowledge gained from the selection of attributes

Most Important Attributes

- What attributes effect the purchasing decision of a customer group?
- E.g., the five most important factor that determine if a customer group purchases a particular insurance coverage
  - Agency Number
  - Small Group Flag
  - Zip Code
  - Decision Maker Effective Year
  - Next Renewal Month

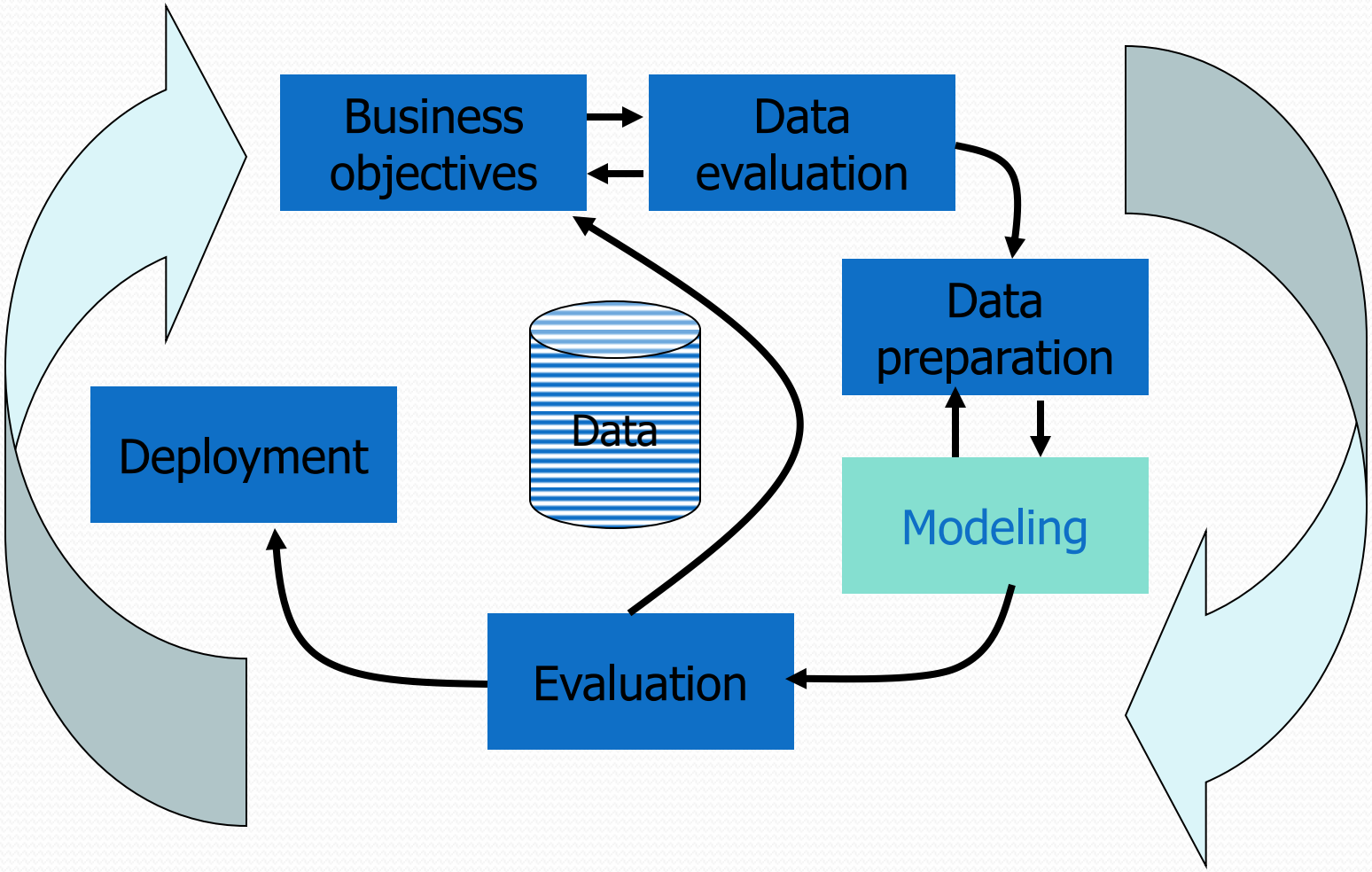
Customer Segmentation

- Unique groups of customers
  - Similar characteristics
  - Similar behavior in terms of interest in coverage
- For example, separate predictive models for customer segments for a particular type of insurance

Customer Segments Used for Modeling

- Results
  - Three segments for one database
  - Two segments for two databases
  - One segment for two databases
- Continue modeling for each segment independently

The Data Mining Process



Modeling

- Select modeling technique(s)
- Calibrate modeling techniques
- Make adjustments to data

Modeling

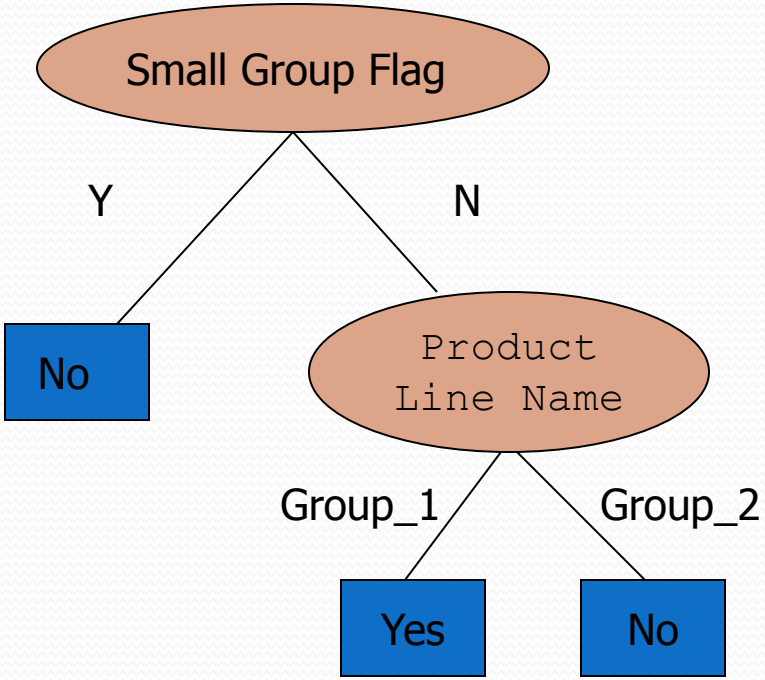
- Mathematical models for predicting if a customer is interested in a coverage
- Understand why a customer is interested
- For example:

  If a customer's state is *Indiana* **and** the office is *Indianapolis_Office1* **then** the customer is interested in *Coverage_3*

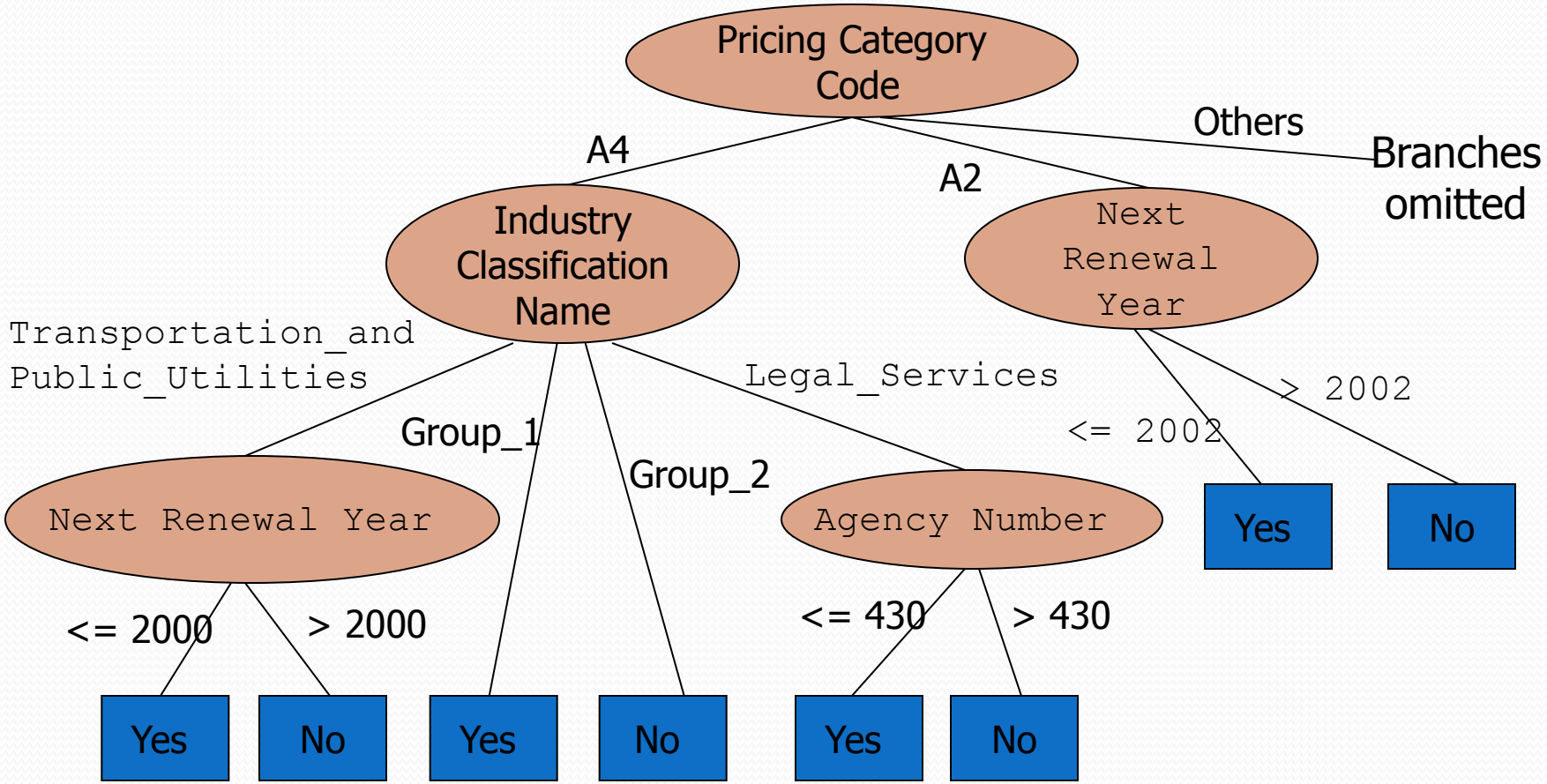
Modeling Techniques

- Three modeling techniques tried for predicting customer interest:
  - Decision trees
  - Artificial neural networks (ANN)
  - Support vector machines (SVM)
- Decision trees have the advantage of transparency
- ANN and SVM did not have significantly better prediction accuracy

Insurance Coverage Interest (Type 6)



Insurance Coverage Interest (Type 7)



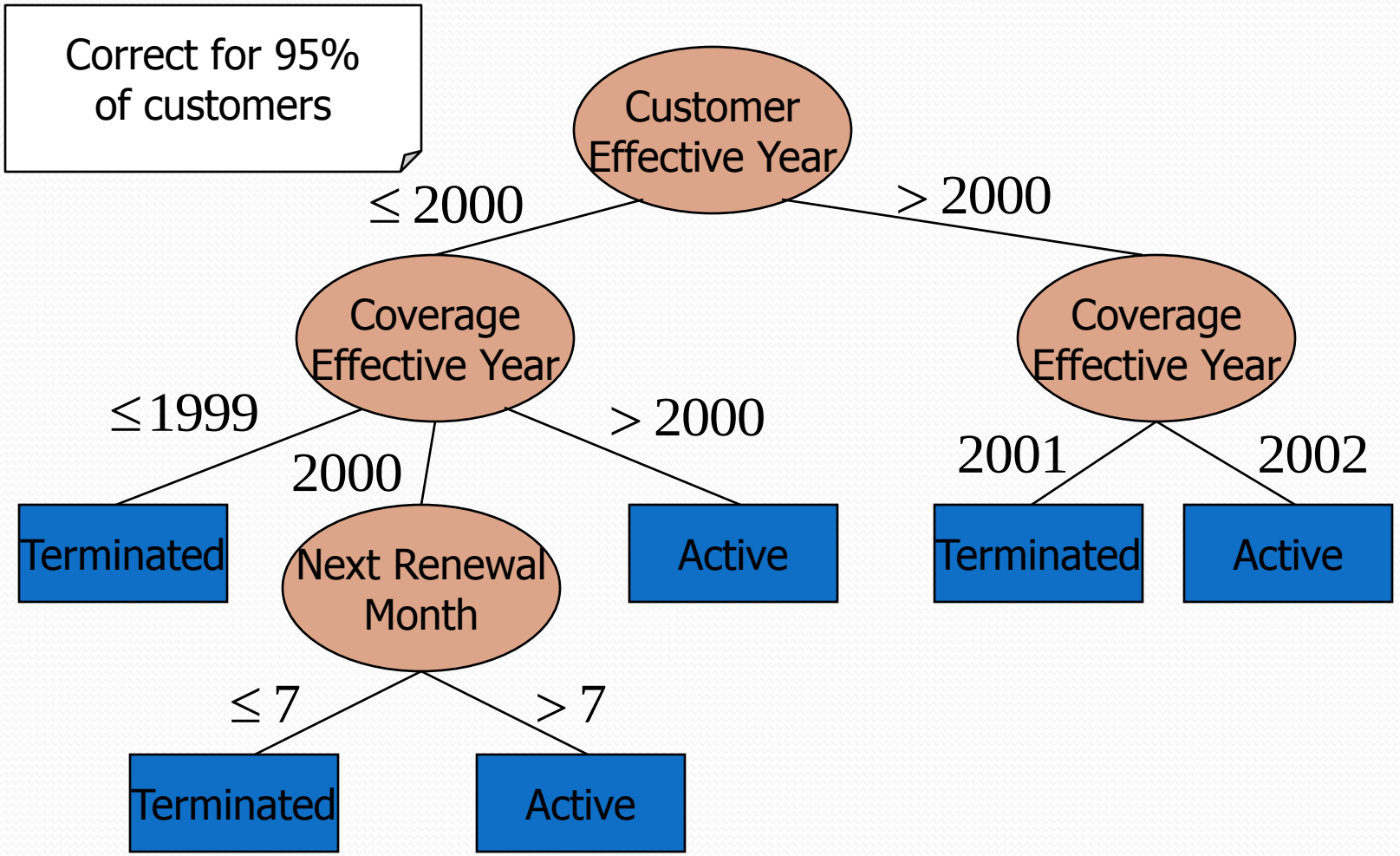
Accuracy of Predicting Customer Interest

Coverage	Accuracy
Type 1	84.0%
Type 2	97.2%
Type 3	98.3%
Type 4	99.5%
Type 5	88.4%
Type 6	100%
Type 7	76.3%
Type 8	85.0%
Type 9	94.8%

Modeling

- Mathematical models for predicting if a customer will terminate coverage
- Why do customers terminate a specific type of coverage?
- What are the important factors in a customers decision to terminate coverage?

Who Terminates Type 3 Coverage?



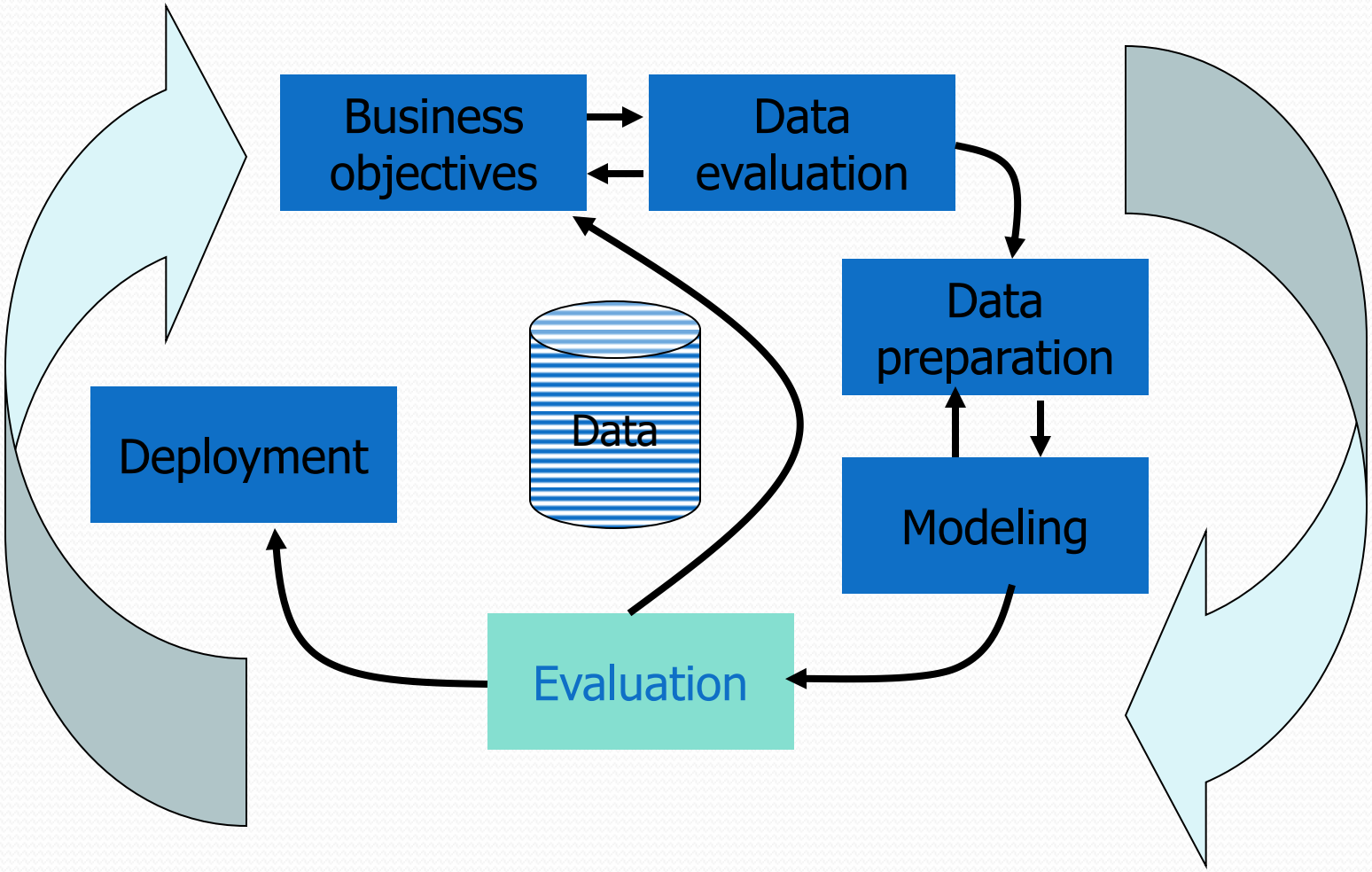
Who Terminates Type 1 Coverage?

- Decision tree based on:
  - Distribution number
  - Underwriting department number
  - Price category
  - Rate type
  - Rate Plan Year
- Predicts 96.3% of terminations correctly

Accuracy of Predicting Termination

Model	Accuracy
Type 1	96.3%
Type 2	96.5%
Type 3	95.3%
Type 4	88.9%
Type 5	88.3%

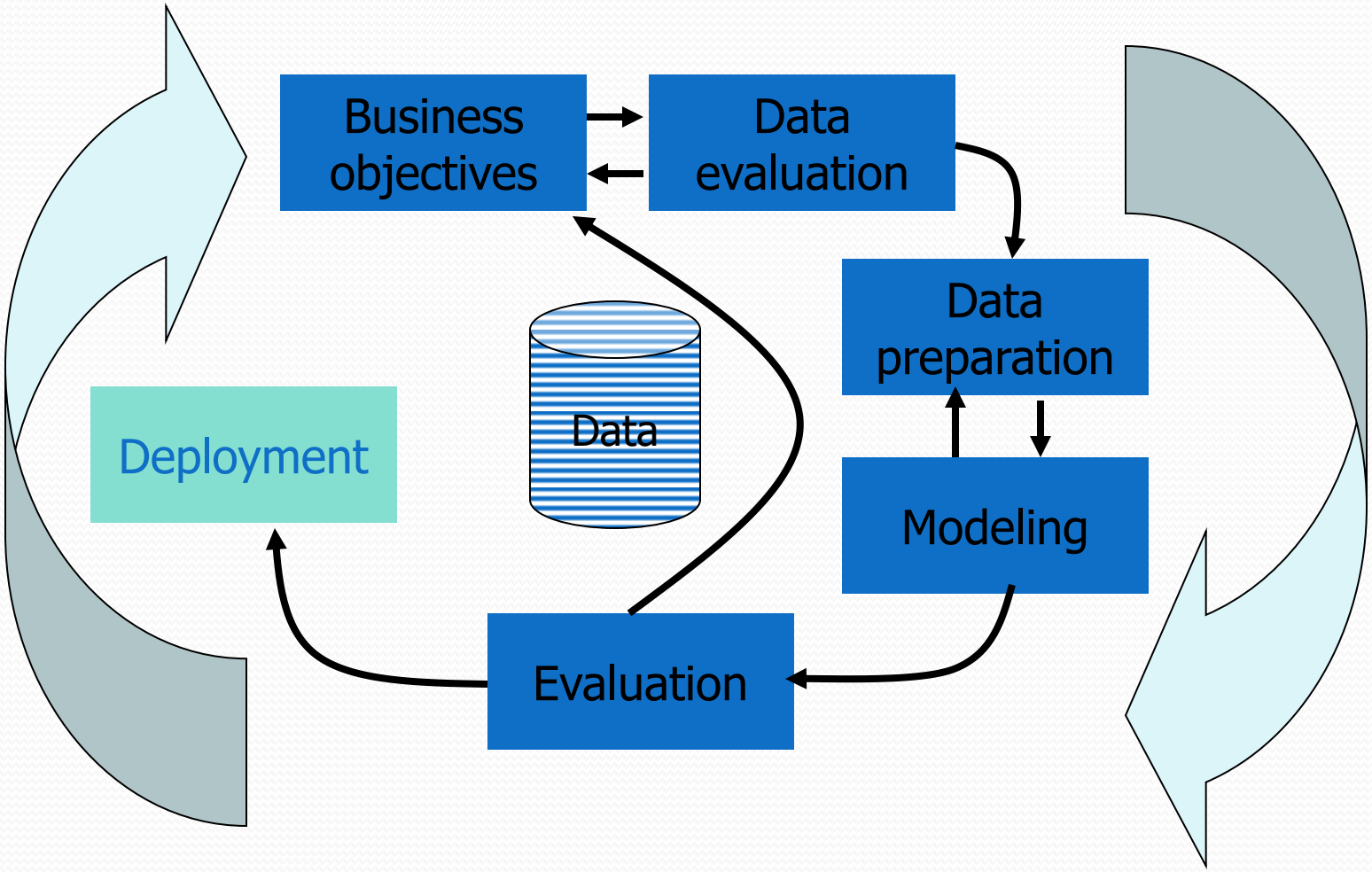
The Data Mining Process



Evaluation

- Data analysis results in a good model
- Are business objectives being achieved?
- Is there an important business issue that has not been considered?
- Should the results be used?

The Data Mining Process



Deployment

- Incorporate the results in the organization's decision making process
  - Report
  - Decision support system
  - Personalization of web pages
  - Repeatable data mining process

Exercise

What are the main points of the correlation between Strategic Development Plan and Budget ?

What are the advantages/ disadvantages of SDP Linkage with Budget.

Main points of correlation between Strategic Budget Plan and Annual Budget

1. SBP and Budget should be prepared using the same budget classification
   - Preferably this should have dimensions for economic items, administration structure, programme structure, function and funding
2. Annual budget must link directly to the first year of the SBP
3. SBP should be around a *rolling* three year plan..
   - Work each year should focus on forecasts for year 3 and minor changes for years 1 and 2, NOT a complete rewrite of the plan

Main points of correlation between Strategic Budget Plan and Annual Budget

4. SBP should be a 'living plan', not just something that is prepared in April-May
   - Agreed annual budget should be immediately reflected in the SBP
5. SBP must show future changes in recurrent costs that result from capital investment now
6. Estimates in the SBP should be backed up by good costing records.
7. SBP should distinguish ongoing committed plans, existing plans not yet started, and new plans.

Advantages of effective linkage between program plans, SBP and annual budget

1. Making three-year SBP estimates reduces the need to set over-optimistic annual budgets.
2. Annual budgets are easier to set, because planning has already taken place for the program and SBP.
3. The annual budget is linked to strategic plans, not made on an 'incremental basis'.
4. Hence sectors and ministries can plan to progressively improve their operations and achieve longer term objectives.
5. Corporate heads can plan to allocate resources to sectors targeted in strategic plans.

Difficulties of linking program plans, SBP and annual budget

1. The master copies of three-year plans are often held at department heads, and are often significantly rewritten from year to year, which should be unnecessary.
2. CEO should hold master copy of ***agreed*** three-year plans. Submissions from departments should focus on ***changes*** to this plan
3. Ongoing plans can be ignored if arbitrary budget cuts are made.

Final Review & Questions



Thank You

