Engineering Economics

Lecture 1

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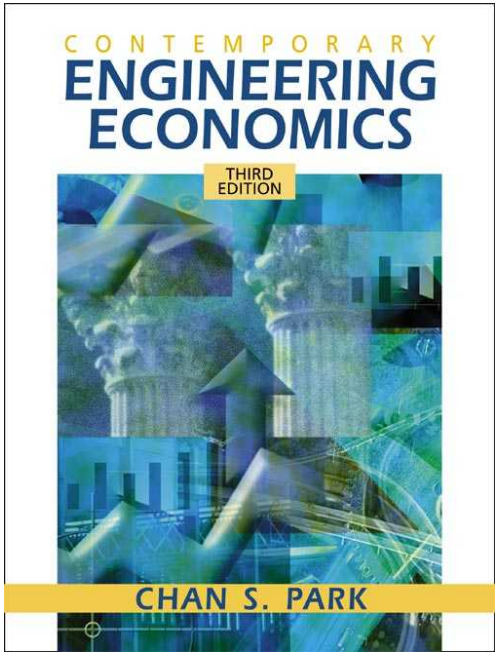
What Is Economics?

Chapter 1
Engineering Economic Decisions

- Rational Decision-Making Process
- Economic Decisions
- Predicting Future
- Role of Engineers in Business
- Large-scale engineering projects
- Types of strategic engineering economic decisions

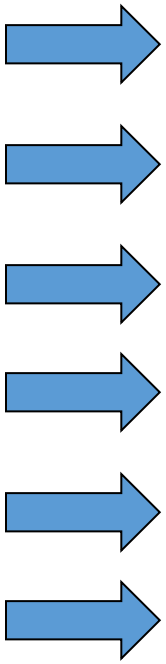


Rational Decision-Making Process

1. Recognize a decision problem
2. Define the goals or objectives
3. Collect all the relevant information
4. Identify a set of feasible decision alternatives
5. Select the decision criterion to use
6. Select the best alternative

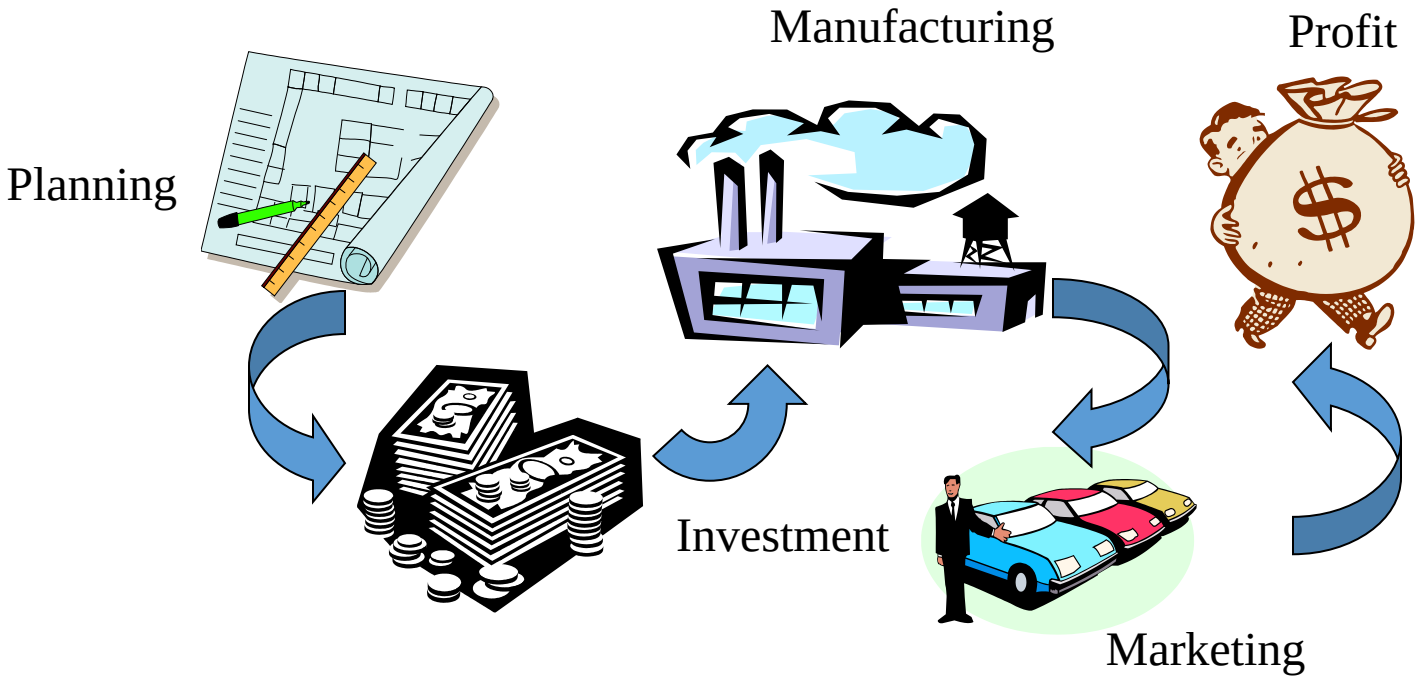
Which Car to Lease?

1. Recognize a decision problem
2. Define the goals or objectives
3. Collect all the relevant information
4. Identify a set of feasible decision alternatives
5. Select the decision criterion to use
6. Select the best alternative



- Need a car
- Want mechanical security
- Gather technical as well as financial data
- Choose between Rolls Royce and Honda
- Want minimum total cash outlay
- Select Honda

Engineering Economic Decisions

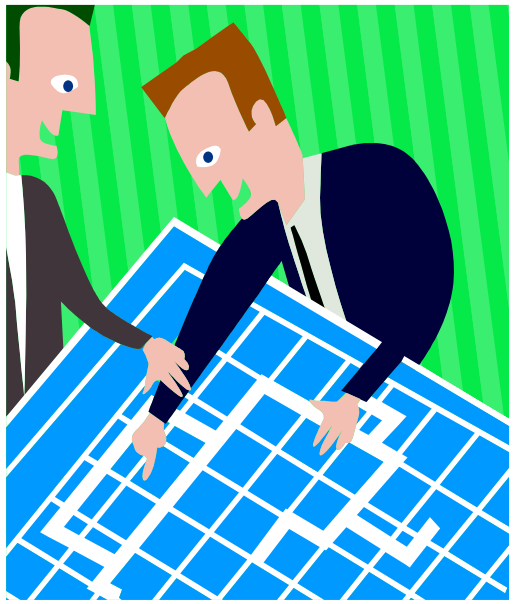


Predicting the Future

- Required investment
- Forecasting product demand
- Estimating selling price
- Estimating manufacturing cost
- Estimating product life

Role of Engineers in Business

- Participate in a variety of decision-making processes, ranging from manufacturing, through marketing, to financing decisions
- Plan for the acquisition of equipment
- Design products from the concept to shipping



A Large-Scale Engineering Project

- Requires a large sum of investment
- Takes a long time to see the financial outcomes
- Difficult to predict the revenue and cost streams

Types of Strategic Engineering Economic Decisions

- Equipment and Process Selection
- Equipment Replacement
- New Product and Product Expansion
- Cost Reduction
- Service Improvement
- Public Works
- Cost Effectiveness

Equipment & Process Selection

- How do you choose between Plastic SMC and Steel sheet stock for the auto body panel?
- The choice of material will dictate the manufacturing process for the body panel as well as manufacturing costs.

Which Material to Choose?

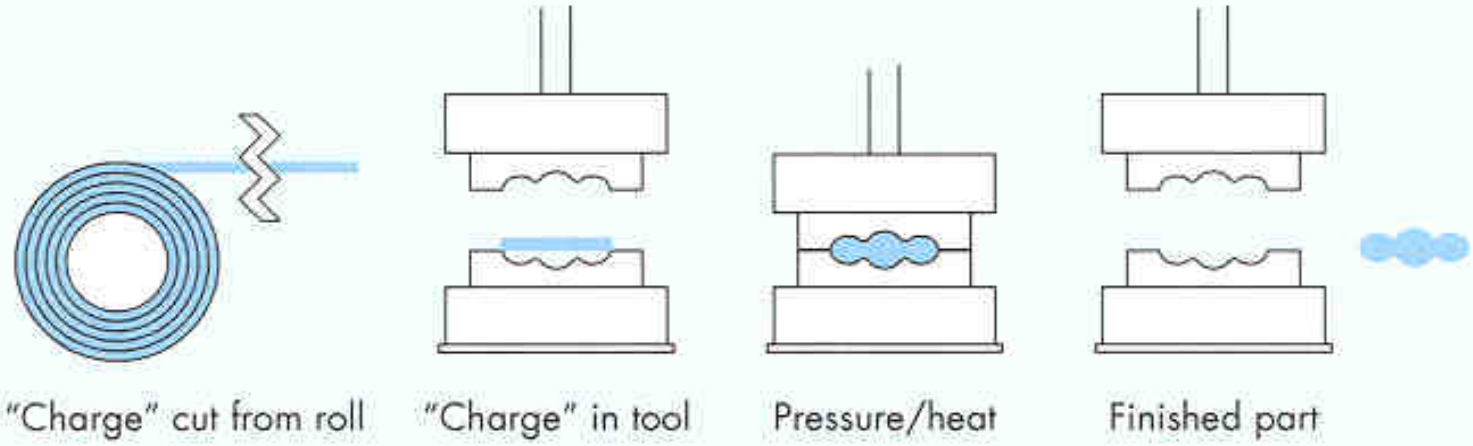
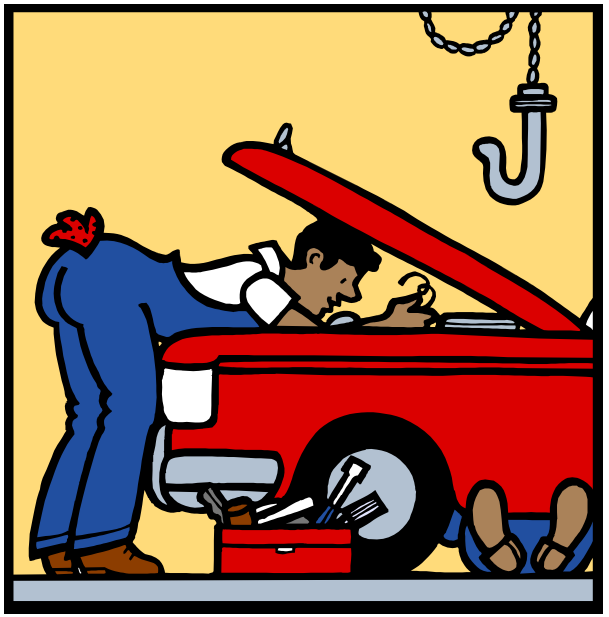


Figure 1.2 Sheet molding compound process (Courtesy of Dow Plastics, a business group of the Dow Chemical Company)

Description	Plastic SMC	Steel Sheet Stock
Material cost ($/kg)	$1.65	$0.77
Machinery investment	$2.1 million	$24.2 million
Tooling investment	$0.683 million	$4 million
Cycle time (minute/part)	2.0	0.1

Equipment Replacement

- Is now the time to replace the old machine?
- If not, when is the right time to replace the old equipment?



New Product and Product Expansion

- Shall we build or acquire a new facility to meet the increased demand?
- Is it worth spending money to market a new product?

Cost Reduction

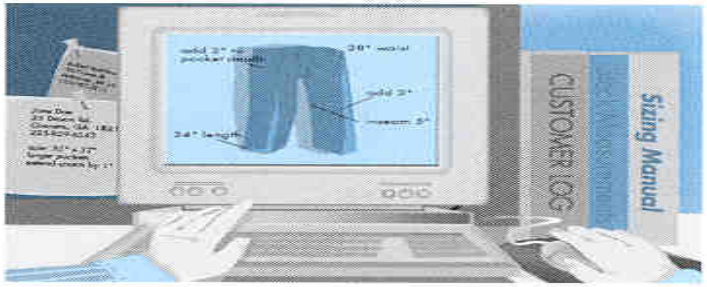
- Should a company buy equipment to perform an operation now done manually?
- Should spend money now in order to save more money later?

Service Improvement

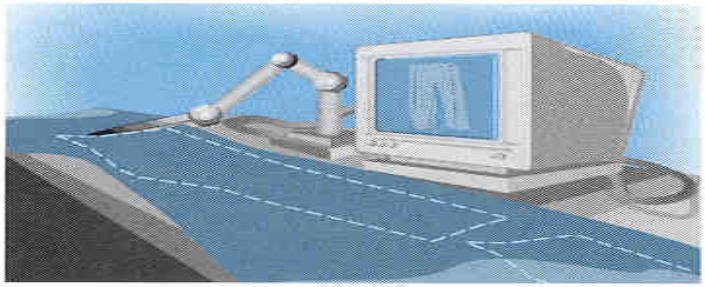
From Data to Denim

A new computerized system being installed at some Original Levi's Stores allows women to order customized blue jeans. Levi Strauss declined to have its factory photographed, so here is an artist's conception of how the process works.

A sales clerk measures the customer using instructions from a computer as an aid.



The clerk enters the measurements and adjusts the data based on the customer's reaction to samples.



The final measurements are relayed to a computerized fabric cutting machine at the factory.

Bar codes are attached to the clothing to track it as it is assembled, washed, and prepared for shipment.

Figure 1.5 Making customized blue jeans for women

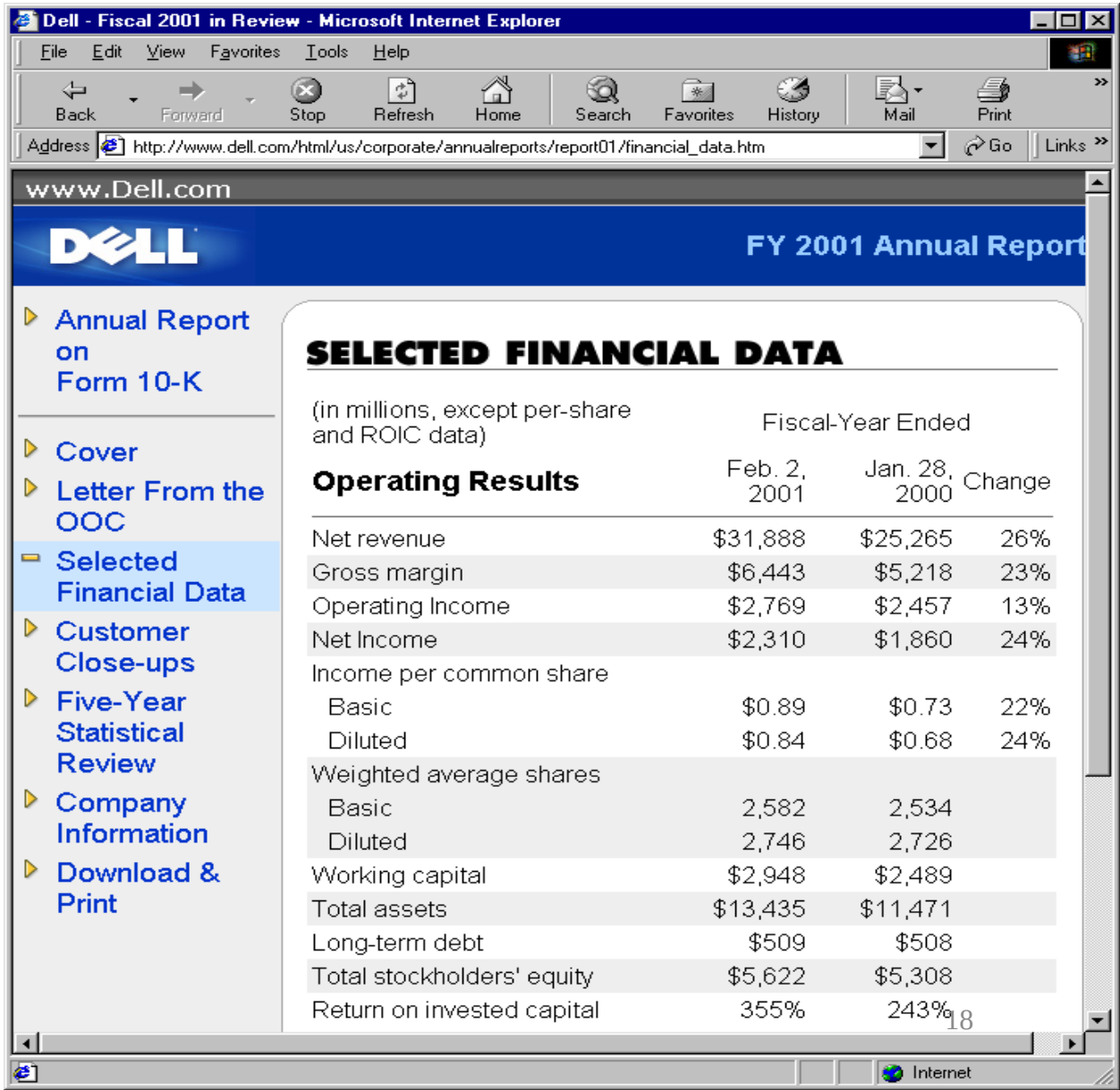
- How many more jeans would Levi need to sell to justify the cost of additional robotic tailors?

Summary

- The term engineering economic decision refers to all investment decisions relating to engineering projects.
- The five main types of engineering economic decisions are (1) equipment and process selection, (2) equipment replacement, (3) new product and product expansion, (4) cost reduction, and (5) service improvement.
- The factors of time and uncertainty are the defining aspects of any investment project.

Chapter 2
Understanding Financial Statements

- Accounting: The Basis of Decision-Making
- Net Worth: How well am I doing?
- Financial Status for Businesses
- Using Ratios to Make Business Decisions



Accounting – The Language of Business

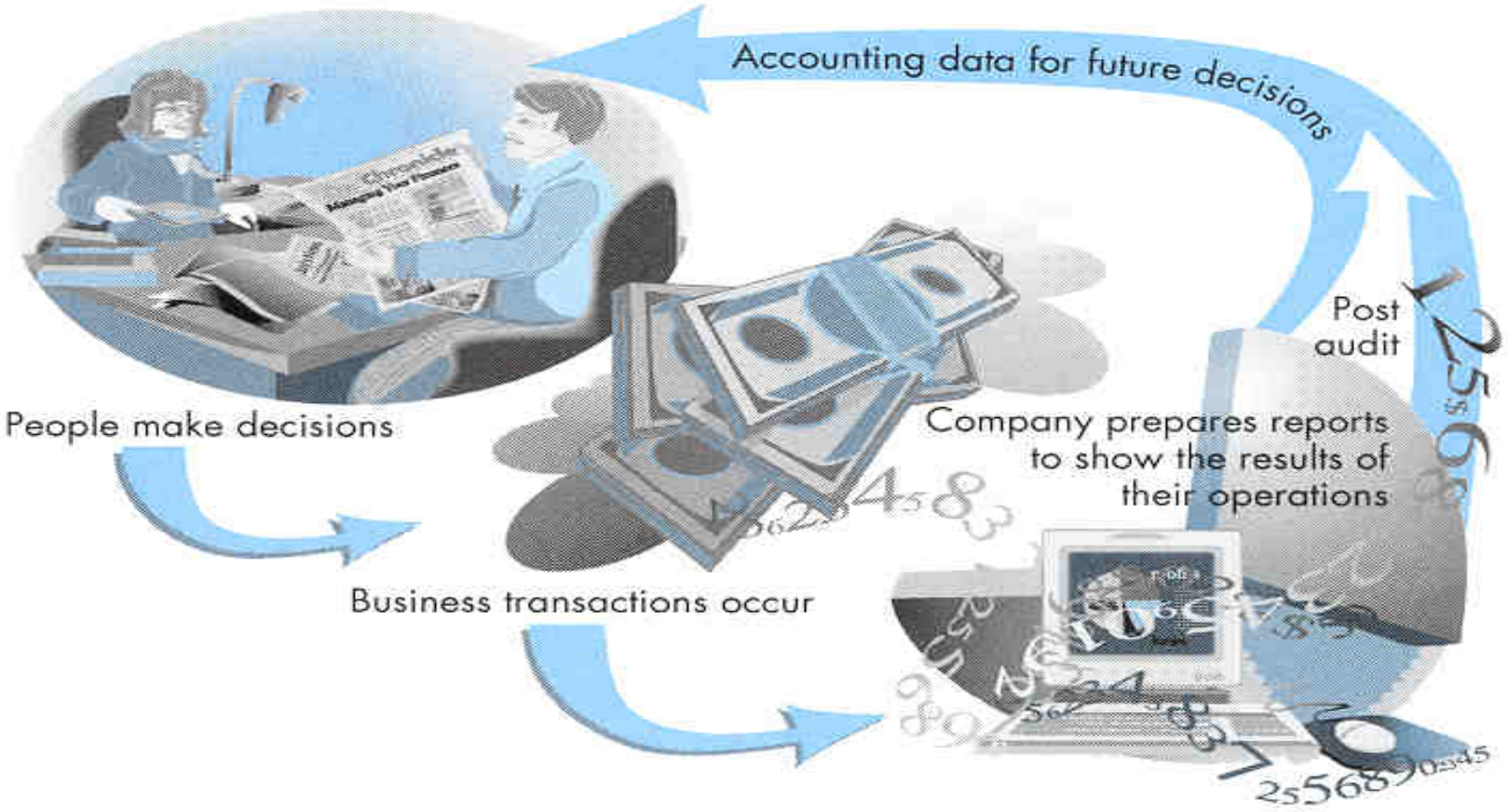


Figure 2.1 The accounting system, which illustrates the flow of information

Financial Status for Business

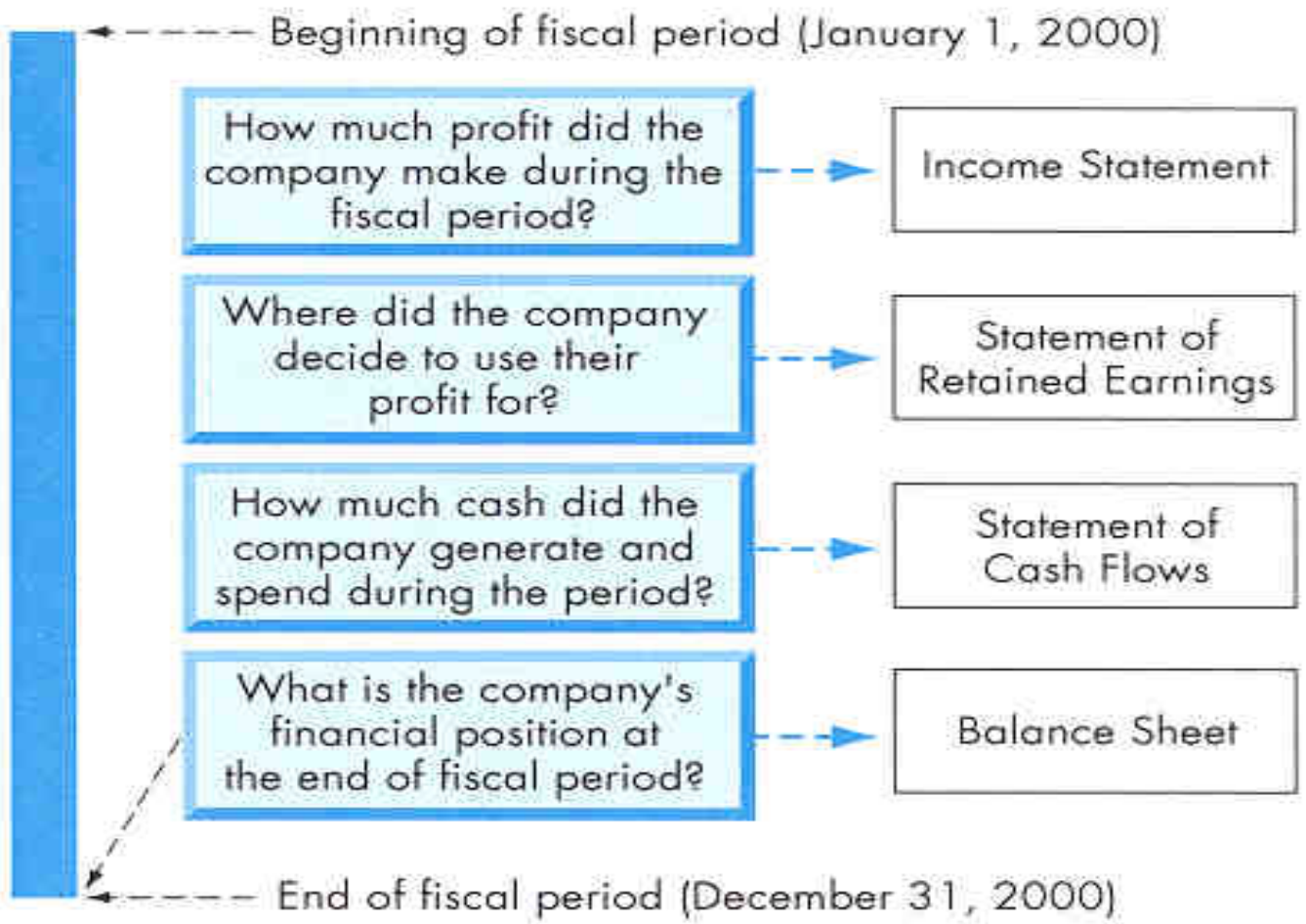


Figure 2.2 Information reported on the financial statements

Why Do Engineers Need to Understand the Financial Statements?

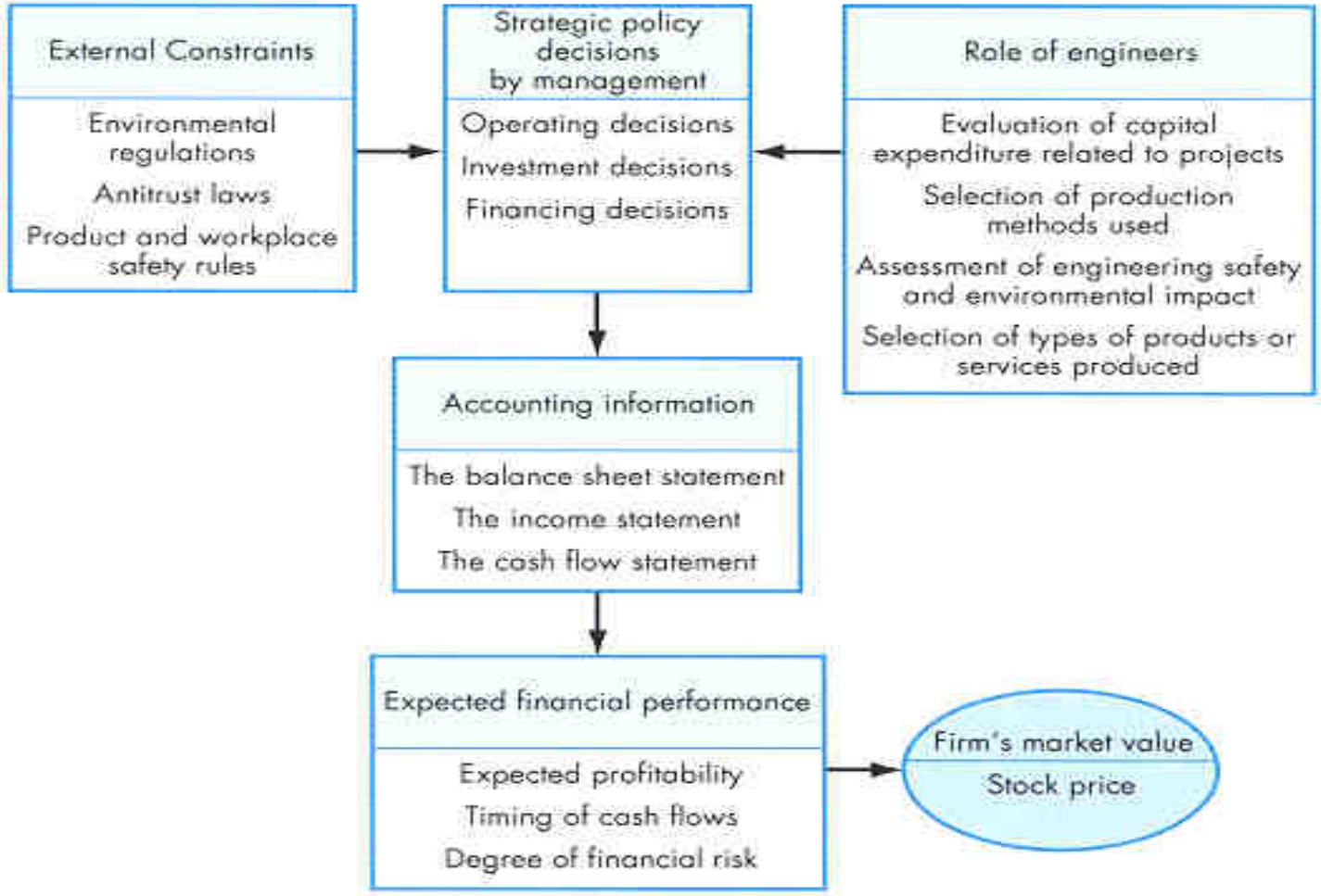
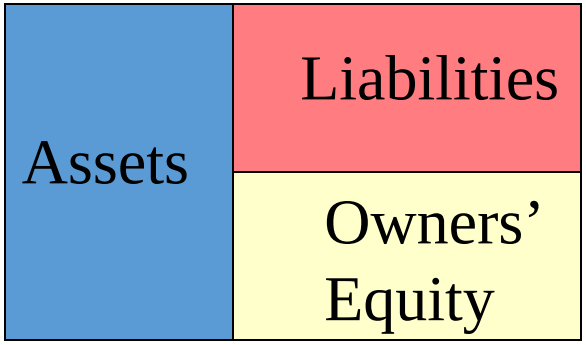


Figure 2.3 Summary of major factors affecting stock price

Accounting Equation



Assets = Liabilities + Owners' Equity

The Balance Sheet – Dell Computer Co.

	28-Jan-00	29-Jan-99	Change	Percent
Current assets:				
Cash	$3,809	$1,726	$2,803	121%
Short-term investments	323	923	(600)	-65%
Account receivables, net	2,608	2,094	514	25%
Inventories	391	273	118	43%
Other	550	791	(241)	-30%
Total current assets	7,681	5,807	1,874	32%
Property, plant, and equipment, net	765	523	242	46%
Long-term investments	1,048	532	516	97%
Equity securities and other investments	1,673	---	1,673	
Goodwill and others	304	15	289	1927%
Total assets	$11,471	$6,877	$4,594	67%
LIABILITIES AND STOCKHOLDERS' EQUITY				
Current liabilities:				
Accounts payable	$3,538	$2,397	$1,141	48%
Accrued and other	1,654	1,298	356	27%
Total current liabilities	5,192	3,695	1,497	41%
Long-term debt	508	512	(4)	-1%
Other	463	349	114	33%
Total liabilities	6,163	4,556	1,607	35%
Stockholders' equity:				
Preferred stock	---	---		
Common stock and capital in excess of $0.01 per value	3,583	1,781	1,802	101%
Retained earnings	1,260	606	654	108%
Other	465	(66)	531	
Total stockholders' equity	5,308	2,321	2,987	129%
Total liabilities and stockholders' equity	$11,471	$6,877	$4,594	67%

Income Statement – Dell Computer Co.

(in millions, except per share amount)	Fiscal Year Ended	
	28-Jan-00	29-Jan-99
Net revenue	$25,265	$18,243
Cost of revenue	20,047	14,137
Gross margin	5,218	4,106
Operating expenses:		
Selling, general and administrative	2,387	1,788
Research, development, and engineering	568	272
Total operating expenses	2,955	2,060
Operating income	2,263	2,046
Other income	188	38
Income before income taxes	2,451	2,084
Provision for income taxes	785	624
Net income	$1,666	$1,460
Earnings per common share:		
Basic	$0.66	$0.58
Diluted	$0.61	$0.53
Weighted average shares outstanding:		
Basic	2,536	2,531
Diluted	2,728	2,772
Retained Earnings:		
Balances at beginning of period	606	607
Net income	1,666	1,460
Repurchase of common stocks	(1,012)	(1,461)
Balances at end of period	$1,260	$606

Cash Flow Statement – Dell Computer Co.

(in millions)	Fiscal Year Ended 28-Jan-00	29-Jan-99
Cash flows from operating activities:		
Net income	$1,666	$1,460
Depreciation and amortization	156	103
Changes in working capital	2,104	873
Net cash provided by operating activities	3,926	2,436
Cash flows from investing activities:		
Marketable securities:		
Purchase	(3,101)	(1,938)
Sales	2,319	1,304
Capital expenditures	397	(296)
Net cash used in investing activities	(1,183)	(930)
Cash flows from financing activities:		
Purchase of common stock	(1,061)	(1,518)
Issuance of common stock under employee plans	289	212
Proceeds from issuance of long-term debt	20	494
Cash received from sale of equity options and other	63	
Repayment of borrowings	(6)	
Net cash used in financing activities	(695)	(812)
Effect of exchange rate changes on cash	35	(10)
Net increase in cash	$2,083	$684
Cash at beginning of period	1,726	1,042
Cash at end of period	$3,809	$1,726

Cash Flow Statement

Tells how much cash a company's business generates or uses and contains clues to how healthy earnings are

Cash used to buy or received from selling stock, assets, and businesses, plus capital expenditures.

Cash from or paid to outsiders—such as banks or stockholders

Lists cash at the beginning and end of the period covered by the filing, plus the change in cash.

	Fiscal Year Ended	
(in millions)	**28-Jan-00**	**29-Jan-99**
Cash flows from operating activities:		
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Cash at beginning of period	1,726	1,042
Cash at end of period	$3,809	$1,726

Key Summary of Dell's Financial Statements

Balance Sheet--January 28, 2000	
Assets	
Cash	$3,809
Other current assets	3,872
Total current assets	7,681
All other assets	3,790
Total assets	**11,471**
Liabilities and Stockholders' Equity	
Current liabilities	5,192
Other liabilities	971
Total liabilities	6,163
Stockholders' equity:	
Common stock	3,583
Retained earnings	1,260
Other equity	(465)
Total stockholders' equity	5,308
Total liabilities and stockholders' equity	**$11,471**

Key Summary Continued

Income Statement--Fiscal Year 2000	
Net revenue	25,265
Expenses (including income taxes)	23,599
Net income	**$1,666**
Statement of Retained Earnings--Fiscal Year 2000	
Beginning retained earnings	606
Net income	1,666
Purchase and retirement of 56 million shares	(1,012)
Ending retained earnings	**$1,260**
Statement of Cash Flows--Fiscal Year 2000	
Net cash flow from operating activities	$3,926
Net cash flow from investing activities	(1,183)
Net cash flow from financing activities	(695)
Effect of exchange rate change on cash	(35)
Beginning cash	1,726
Ending cash	**$3,804**

Using Financial Ratios

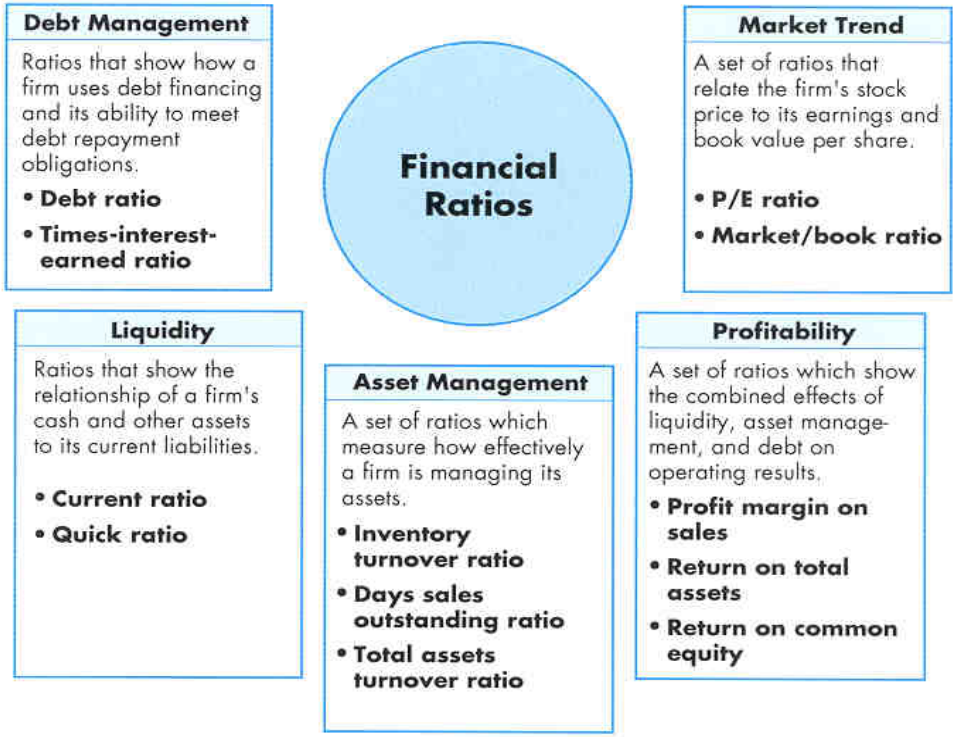

Figure 2.4 Types of ratios used in evaluating a firm's financial health

Debt Management Analysis

Ratios that show how a firm uses debt financing and its ability to meet debt repayment obligations

- Debt ratio
- Times-interest-earned ratio

Debt Ratio

- What It Measures: The extent to which a form uses debt financing
- How You Compute: The ratio of total debt to total assets

$$\text{Debt ratio} = \frac{\text{Total debt}}{\text{Total assets}} = \frac{\$6{,}163}{\$11{,}471} = 53.73\%$$

Time-Interest-Earned Ratio

- What It Measures: The ability of the firm to meet its annual interest payments
- How You Compute: The ratio of earnings before interest and taxes (EBIT) to interest charges

$$\text{Time-interest-earned ratio} = \frac{\text{EBIT}}{\text{Interest expense}}$$

$$= \frac{(\$2{,}451 + \$34)}{\$34}$$

$$= 73 \text{ times}$$

Liquidity Analysis

Ratios that show the relationship of a firm's cash and other assets to its current liabilities

- Current ratio
- Quick ratio

Current Ratio

- What It Measures: The extent to which the claims of short-term creditors are covered by assets
- How You Compute: The ratio computed by dividing current assets by current liabilities

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$= \frac{\$7{,}681}{\$5{,}192}$$

$$= 1.48 \text{ times}$$

Quick (Acid Test) Ratio

- What It Measures: The firm's ability to pay off short-term obligations without relying on the sale of inventories.
- How You Compute: This ratio is computed by deducting inventories from current assets and dividing the remainder by current liabilities.

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}}$$

$$= \frac{\$7{,}681 - \$391}{\$5{,}192}$$

$$= 1.40 \text{ times}$$

End of Lecture 1