

CHAPTER 3
PROFITABILITY ANALYSIS AND PLANNING

| Variable costs | Fixed costs |
|---|--|
| Raw materials to finished goods | |
| Direct materials | Fixed manufacturing overhead |
| Direct labor | |
| Variable manufacturing overhead | |
| Variable selling and administrative costs | Fixed selling and administrative costs |

※ **Contribution income statement**

- **Sales – Variable costs = Contribution margin** then less fixed costs = Profit
 - ✓ Internal decision making and Sensitivity analysis
 - ✓ Contribution margin contributes fixed costs and profit
- **Unit contribution margin = CM/Units sale**; Each units of sale contributes to FC and profit (units vs. profit)
- **Contribution margin ratio = CM/Sales**; Each dollars of sale contributes to FC and profit (dollar vs. profit)
- **Break-even unit sales volume = Fixed costs/Unit contribution margin** (Unit sales Cover FC only, no profit)
- **Dollar Break-even point = Fixed costs/Contribution margin ratio** (Dollar sales Cover FC only, no profit)
- **Margin of safety=anticipated sales-(break-even sales)**

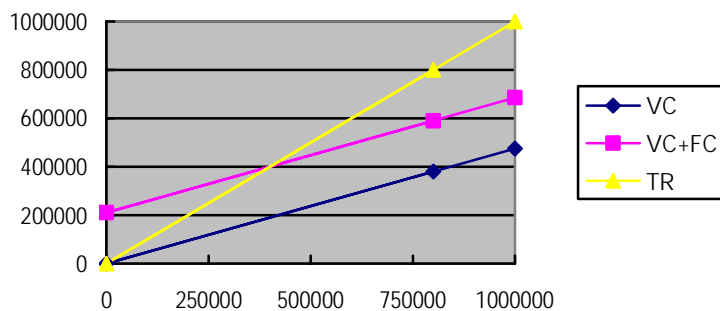
※ **Functional income statement**

- **Sale – manufacturing cost of goods sold = Gross margin** , then less all selling and administrative costs = Profit

【Exercise 3-3】 Contribution Margin concepts

| | | | |
|---------------|---------|----------|-------------|
| Sales | | | 800,000 |
| Costs | Fixed | Variable | |
| Goods sold | | 300,000 | |
| Labor | 160,000 | 60,000 | |
| Supplies | 2,000 | 5,000 | |
| Utilities | 12,000 | 3,000 | |
| Rent | 24,000 | | |
| Advertising | 6,000 | 2,000 | |
| Miscellaneous | 6,000 | 10,000 | |
| Total Costs | 210,000 | 380,000 | (590,000) |
| Net income | | | 210,000 |

- a. Annual Break-even dollar sales volume=固定成本／邊際貢獻率 $210,000 / ((800,000 - 380,000) / 800,000) = \$400,000$
- b. Annual margin of safety in dollars=800,000-400,000=400,000
- c. **CVP graph**



Fixed cost=210,000

Sales 800,000 with VC=380,000

- d. Annual Break-even dollar sales volume= $262,500 / (1 - (380,000 / 800,000)) = 500,000$

【Exercise 3-22】 Cost-Volume-Profit analysis of alternative products

| | Mountaineer | Touring |
|---------------------|-------------|---------|
| Selling price/unit | 88.00 | 80.00 |
| Variable costs/unit | 52.80 | 52.80 |

Income tax rate=40%

- a. contribution margin ration of Touring= $(p-v)/p=(80-52.8)/80=0.34$
- b. before-tax profit= $24,000/(1-0.4)=40,000$ $(316,800+40,000)/(80-52.8)=13117.6 \rightarrow$ 13118 pairs
- c. $(88-52.8)X-369,600=(80-52.8)X-316,800$ $X=6,600$ pairs profit=\$-137,280
- d. contribution margin ratio $M=(88-52.8)/88=0.4$ $T=(80-52.8)/80=0.34$
 $0.4X-369,600=0.34X-316,800$ $X=880,000$ profit=\$-17,600
- e. Profit(M)= $(88-52.8)*12,000-369,600=$ $52,800$; Profit(T)= $(80-52.8)*12,000-316,800=9,600$ 所以採用 Mountaineering type
- f. $BEP(M)=369,600/(88-52.8)=316,800/(80-b)=BEP(T)$ $b=49.83$ Change $V(T)=52.8-49.83=\$2.97$
- g. $BEP(T)=(316,800*1.1)/(80-52.8*0.9)=10729.064 \rightarrow 10729$ pairs

CHAPTER 4
CONTRIBUTION ANALYSIS FOR DECISION MAKING

Make or Buy

Relevant or Irrelevant costs

Allocate limited resources

【Exercise 4-11】 Make or Buy

Annual volume=10,000 unit facility-level fixed factory overhead = \$50,000 over 10,000units

| | |
|------------------|--------------|
| Direct materials | 8.00 |
| Direct labor | 1.50 |
| Factory overhead | 7.00 |
| Total | 16.50 |

| | Cost to Make | Cost to Buy | Difference |
|-------------------|------------------------------|-----------------|--------------|
| Purchase | | 4*10,000=40,000 | |
| Make costs | | | |
| Direct materials | 2*10,000=20,000 | | |
| Direct labor | 1.5*0.5*10,000=7,500 | | |
| Variable overhead | (7*10,000-50,000)*0.5=10,000 | | |
| Totals | 37,500 | 40,000 | 2,500 |

- Fresh air should make the electric motor, Save \$2,500
- Cost to make=37,500+8,000=45,500 Should buy to save \$5,500
- 閒置，策略聯盟等關係

【Exercise 4-15】 Limited resources

| | X | Y | Z |
|------------------------------|-----|-----|-----|
| Unit selling price | 160 | 100 | 200 |
| Unit variable costs | 100 | 50 | 180 |
| Unit contribution margin | 60 | 50 | 20 |
| Labor hours per unit | 4 | 2 | 4 |
| Contribution margin per hour | 15 | 25 | 5 |

- weekly contribution from each product
 - Highest unit selling price=Z
 - Highest unit contribution margin=X
 - Highest contribution per labor hour=Y

| | Unit selling price | Unit CM | Unit CM/hr |
|--------------------------------|--------------------|---------|------------|
| Best | Z | X | Y |
| Limitation of labor hours/week | 200 | 200 | 200 |
| Labor hours per unit | 4 | 4 | 2 |
| 可生產單位數(週) | 50 | 50 | 100 |
| Unit contribution margin | 20 | 60 | 50 |
| Total contribution margin | 1,000 | 3,000 | 5,000 |

- Maximizes the contribution per unit of constraining factor : Y = \$25 CM/hr

c. Opportunity cost

- labor hour to produce 10 units of X (4 hr/unit)*10unit =40
- labor hour per unit of Y = 2
- required reduction in Y =40/2=20
- unit contribution margin of Y =50
- Opportunity cost =20*50=1,000
- Net disadvantage of producing X =60*10-1,000=-400

CHAPTER 5
VALUE CHAIN ANALYSIS AND ACTIVITY-BASED MANAGEMENT

【Exercise 5-15】 Two-stage ABC for manufacturing

The first stage: costs are assigned to activities

| Activity cost pool | Activity Cost | Activity cost driver | Cost/unit activity 分攤率 |
|--------------------|---------------|----------------------|------------------------|
| Machine setup | 600,000 | 12,000 (hours) | 50 |
| Material handling | 120,000 | 2,000 (tons) | 60 |
| Machine operation | 500,000 | 10,000 (hours) | 50 |

The second stage: cost objectives based on activities

| | J26 Cams | Z43 Shafts |
|----------------------|----------|------------|
| Units produced | 500 | 300 |
| Machine hours | 3 | 5 |
| Direct labor hours | 200 | 400 |
| Direct labor cost | 5,000 | 10,000 |
| Direct material cost | 25,000 | 18,000 |
| Tons of material | 12.5 | 9.0 |
| Setup hours | 3 | 7 |

Required: Determine the batch and unit costs of both objectives using ABC

| | J26 Cams | Z43 Shafts |
|--------------------------|--------------------------|--------------------------|
| Manufacturing Overhead | | |
| <i>Machine setup</i> | $50 \times 3 = 150$ | $50 \times 7 = 350$ |
| <i>Material handling</i> | $60 \times 12.5 = 750$ | $60 \times 9 = 540$ |
| <i>Machine Operation</i> | $50 \times 3 = 150$ | $50 \times 5 = 250$ |
| Total | 1,050 | 1,140 |
| Direct material | 25,000 | 18,000 |
| Direct labor | 5,000 | 10,000 |
| Batch cost | 31,050 | 29,140 |
| Unit produced | 500 | 300 |
| Unit cost | =31,050/500=62.10 | =29,140/300=97.13 |

【Exercise 5-20】 Two-stage ABC for manufacturing with ABC variances

※ The first stage: costs are assigned to activities

| Activity | Budgeted activity cost | Activity cost driver At practical capacity | Cost/unit activity |
|--------------------------------|------------------------|--|--------------------|
| Purchasing & Material handling | 675,000 | 900,000(kg) | 0.75 |
| Setup | 700,000 | 1,400(setups) | 500.0 |
| Machine operations | 960,000 | 12,000(hours) | 80.0 |
| First unit inspection | 50,000 | 800(batches) | 62.5 |
| Packing | 250,000 | 312,500(units) | 0.8 |

※ The second stage: cost objectives based on activities

| | A | B | Specialty | Total |
|-----------------------|---------|---------|-----------|-----------|
| Units | 150,000 | 100,000 | 50,000 | 300,000 |
| Batches | 100 | 80 | 600 | 780 |
| Setups | 300 | 160 | 900 | 1,360 |
| Machine operations | 6,000 | 3,000 | 2,000 | 11,000 |
| Kg of raw materials | 400,000 | 300,000 | 200,000 | 900,000 |
| Direct material costs | 900,000 | 600,000 | 800,000 | 2,300,000 |
| Unit/Batch | 1,500 | 1,250 | 83 | |

a. Unit cost of each product

| Activity | A | B | Specialty | Total |
|-----------------------|---------------------------------|---------------------------------|---------------------------------|---------|
| Direct material | 900,000 | 600,000 | 800,000 | |
| Purchasing & handling | $0.75 \times 400,000 = 300,000$ | $0.75 \times 300,000 = 225,000$ | $0.75 \times 200,000 = 150,000$ | 675,000 |
| Setups | $500 \times 300 = 150,000$ | $500 \times 160 = 80,000$ | $500 \times 900 = 450,000$ | 680,000 |

| | | | | |
|-----------------------|---------------------|--------------------|-------------------|-----------|
| Machine operations | 80*6,000=480,000 | 80*3,000=240,000 | 80*2,000=160,000 | 880,000 |
| First unit inspection | 62.5*100=6,250 | 62.5*80=5,000 | 62.5*600=37,500 | 48,750 |
| Packing | 0.8*150,000=120,000 | 0.8*100,000=80,000 | 0.8*50,000=40,000 | 240,000 |
| Total | 1,956,250 | 1,230,000 | 1,637,500 | 2,523,750 |
| Unit cost | /150,000=13.042 | /100,000=12.300 | /50,000=32.750 | |

b. 83 units/batch in specialty 主要是因為每批特殊產品的數量太少，而造成特殊產品之單位成本高於標準產品成本的原因。

c. Idle capacity variance 閒置產能差異

| Activity | Budgeted activity cost | Activity cost driver at practical capacity 2004 |
|------------------------|------------------------|---|
| Purchasing & handling | 675,000 | 675,000 |
| Setups | 700,000 | 680,000 |
| Machine operations | 960,000 | 880,000 |
| First unit inspection | 50,000 | 48,750 |
| Packing | 250,000 | 240,000 |
| Total | 2,635,000 | 2,523,750 |
| Idle capacity variance | 111,250 | |

d. Activity costs on practical capacity rather than on actual activity 實質產能是可供使用的最大產能，它允許正常的修理及維護活動發生（理論產能則不允許）。為了避免成本分配時波動性過大（因為產能利用所造成的），作業成本應該依設備的實質產能加以計算。按實質產能來進行的成本分派，比起按實際作業或平均作業來進行成本分派，會有較低的成本分配給每個成本標的。按實質產能來分派的成本是較佳的（亦較有競爭力）。為了使一個組織可以成為一個世界級的競爭者，管理階層應該盡力去使實際產能利用與實質產能相等，因為其他競爭者也正這麼做，而且很少顧客會願意負擔閒置產能的成本。

※補充：

為決定製造費用的最適分攤率，必須先決定分攤固定製造費用作業水準，而其可能的選擇有四：理論（理想）產能（Theoretical (Ideal) capacity）、實質產能（Practical capacity）、正常產能（Normal capacity）、當期預計產能（Currently expected capacity）。

理論（理想）產能（Theoretical (Ideal) capacity）：係指人與機器均能持續不斷地工作，且在最佳效率情況下所能達到的作業水準。由於生產過程中必然會有不可避免之停工狀況，採此水準將使預計分攤率過低，而產生大額的少分攤製費，使產品成本低估，而影響訂價等決策，故實務上甚少採用。

正常產能（Normal capacity）：係指為供應產品之需求所應達成之作業水準。

當期預計產能（Currently expected capacity）：係指於年度開始時，依當時情況合理估計之該年度預計作業水準。

正常產能應為計算固定製造費用分攤率時，最適用的作業水準。因為其考慮長期平均需求之作業水準，以作為分攤固定製費的依據。當能避免各種循環波動對固定製費分攤之影響。

CHAPTER 8
INVENTORY VALUATION APPROACHES AND
JUST-IN-TIME INVENTORY MANAGEMENT

Part I: The impact of inventory valuation on financial statements

| Absorption costing 歸納成本法 Functional format | 成本項目 | Variable costing 變動成本法 Contribution format |
|--|--|--|
| Product costs | Direct materials | Product costs |
| | Direct labor | |
| | Variable manufacturing overhead | |
| | Fixed manufacturing overhead | |
| Period costs | Variable selling and administrative expenses | Period costs |
| | Fixed selling and administrative expenses | |

- 產品成本(Product costs)
 - 與產品購買或製造有關，應歸屬至存貨之成本，未出售前為存貨，出售時再轉為銷貨成本。
- 期間成本(Period costs)
 - 與產品購買或製造無關，而應與期間配合列為當期費用之成本。

| | Absorption costing 歸納成本法 | Variable costing 變動成本法 |
|------------------------|-----------------------------|---------------------------|
| Format 損益表格式 | Functional format | Contribution format |
| Manufacturing and sell | Both | Sell |
| Usage 用途 | External | Internal |
| 評估績效 | 易被操作 | 較正確 |

【Exercise 8-4】 Absorption and Variable costing comparison: Production equals Sales

Catsup manufactures and sells 15,000 cases each quarter. 3rd quarter of 2004

| | |
|---|--------|
| Total fixed manufacturing overhead | 30,000 |
| Fixed selling and administrative expenses | 10,000 |
| Sales price per case | 25 |
| Direct materials per case | 12 |
| Direct labor per case | 4 |
| Variable manufacturing overhead per case | 3 |

Required:

a. Cost per case under both AC and VC

| | Absorption costing 歸納成本法 Functional format | Variable costing 變動成本法 Contribution format |
|---------------------------------|--|--|
| Direct materials | 12 | 12 |
| Direct labor | 4 | 4 |
| Variable manufacturing overhead | 3 | 3 |
| Fixed manufacturing overhead | $30,000/15,000=2$ | |
| Total | \$21 | \$19 |

b. Net income under both AC and VC

Absorption costing 歸納成本法 Functional format

| | |
|-----------------------------|---------------------------|
| Sales | $25 * 15,000 = 375,000$ |
| -Cost of good sold | $21 * 15,000 = (315,000)$ |
| Gross profit | 60,000 |
| -Selling and administrative | (10,000) |
| Net income | \$50,000 |

Variable costing 變動成本法 Contribution format

| | |
|----------------|-------------------------|
| Sales | $25 * 15,000 = 375,000$ |
| Variable costs | |

| | | |
|----------------------------|---------------------|----------|
| Cost of good sold | 19*15,000=(285,000) | |
| Contribution margin | | 90,000 |
| Fixed costs | | |
| Manufacturing overhead | 30,000 | |
| Selling and administrative | 10,000 | (40,000) |
| Net income | | \$50,000 |

- c. Reconcile net income. Sale= There is no difference in income because sales and production are the same. When this situation is maintained, the two methods yield the same net income. 因為生產量剛好等於銷售量，所以在這兩種方法之下所計算的淨利並無任何差異。

CHAPTER 10

STRATEGIC MANAGEMENT OF CAPITAL EXPENDITURES

- ※ Long-range planning for Capital budgeting → capital budgeting committee
- ※ **Three phases of project's predicted cash flows: Initial investment, Operation, Disinvestments** (salvage value)
- 1) Consider the time value of money
 - a. **Net Present Value**=NPV(Discout rate, Value1... ValueN)-Initial investment by Excel method
 - b. **Internal Rate of Return**(Time-adjusted rate of return)=IRR(Initial investment. Value1.. ValueN, Discount rate)
 - ※ When Net present value=0 means minimum discount rate without losing money
 - ※ NPV consider investment size and different discount rate investment (vs. IRR)
 - ※ Minimum annual net cash inflow=(Initial investment-PV(residual))/Discount rate factor
 - 12% discount rate=3.605 factor for five years. 每年最少淨收入
 - Time-adjusted Break-even point
- 2) Not consider the time value of money
 - a. **Payback period**=Initial investment/Annual operating cash inflows
- ※ Mutually exclusive investment: acceptance of one automatically causes the rejection of the other(s)
 - **Present value index**=Present value of subsequent cash flows/Initial investment
- ※ **Depreciation Tax Shield** 折舊稅盾=Depreciation * Tax rate
 - 10,000 五年使用無殘值, Tax rate=30%, DTS=(10,000/5)*0.3=600

【Exercise 10-5】 NPV, IRR

| | | | | | | | | | |
|--------------------|----------|-------|--------|-------|---------|-------|--------|-------|---------|
| Initial Investment | (42,580) | | | | | | | | |
| Operation | | 12% | | 24% | | 22% | | 30% | |
| Year 1 | 18,000 | 0.893 | 16,074 | 0.806 | 14,508 | 0.820 | 14,760 | 0.769 | 13,842 |
| Year 2 | 25,000 | 0.797 | 19,925 | 0.650 | 16,250 | 0.672 | 16,800 | 0.592 | 14,800 |
| Year 3 | 20,000 | 0.712 | 14,240 | 0.524 | 10,480 | 0.551 | 11,020 | 0.455 | 9,100 |
| Salvage | 0 | | | | | | | | |
| NPV | | | 7,659 | | (1,342) | | 0 | | (4,838) |

- a. Discount rate of 12%, NPV=7,659
- b. $(24-12)/x-12=(7659-(-1342))/7659 \rightarrow x=22.21\%$

【Exercise 10-16】 Payback period, NPV and PVI

| | |
|--|---------|
| Operating costs of manual system | 400,000 |
| Operating costs of CAD/CAM | 200,000 |
| Before-tax cash savings | 200,000 |
| Income taxed shield without tax @ 30% | 60,000 |
| Depreciation tax shield=480,000/6=80,000 80,000*0.3=24,000 | 24,000 |
| Relevant annual after-tax cash flows | 164,000 |

1. Payback period=Initial investment/Annual operating cost savings= 480,000/164,000=2.93 years
2. Net present value

| | |
|--------------------------------------|-----------------------|
| Present value of after-tax cash flow | 164,000*3.326=545,464 |
| Initial Investment | 480,000 |
| Net Present Value | 65,464 |

3. Present value of cash flow/Initial investment=Present value index So, 545,464/480,000=1.14

CHAPTER 13

PROFITABILITY ANALYSIS OF STRATEGIC BUSINESS SEGMENTS

【Exercise 13-12】 ROI, Residual Income, and EVA: Basic Computations

| | Trucking | Seafood | Construction |
|--|--------------------------|--------------------------|--------------------------|
| Sales | 600,000 | 750,000 | 900,000 |
| Operating assets | 300,000 | 250,000 | 350,000 |
| Net operating income | 51,000 | 56,000 | 59,000 |
| Current liabilities | 20,000 | 10,000 | 30,000 |
| ROI (return on investment) | 51,000/300,000 | 56,000/250,000 | 59,000/350,000 |
| =Net operating income/Operating assets | =0.170 | =0.224 | =0.169 |
| =Invest turnover*Return-on-sales | =2*0.085 | =3*0.075 | =2.57*0.066 |
| <i>Investment turnover</i> | 600,000/300,000 =2 | 750,000/250,000 =3 | 900,000/350,000 =2.57 |
| <i>Return-on-sales ratio(Margin)</i> | 51,000/600,000 =0.085 | 56,000/750,000 =0.075 | 59,000/900,000 =0.066 |
| RI(Residual income) | 51,000 | 56,000 | 59,000 |
| =Net Operating income | -(300,000*0.12) | -(250,000*0.12) | -(350,000*0.12) |
| -(Operating assets*Desired rate of return) | =15,000 | =26,000 | =17,000 |
| EVA(Economic Value Added) | (51,000*0.7) | (56,000*0.7) | (59,000*0.7) |
| =(Income after tax) | -(300,000-20,000)*0.1 | -(250,000-10,000)*0.1 | -(350,000-30,000)*0.1 |
| - (Cost of capital employed) | =7,700 | =15,200 | =9,300 |

WACC(weighted average cost of capital)=10%; Desired rate of return on investment=12%; 30% tax rate

*Cost of capital employed = (Operating assets – Current liabilities)*WACC

*EVA 與 RI 有三點不同：After-tax income, Net assets and WACC (instead of desired rate of return)

*CEO 喜好用 RI 而不用 ROI 來評估公司投資，EVA 更有經濟效益評估；但是在 RI 和 EVA 都是比較主觀，而且
在不同大小的投資方案之間不易比較，所以投資大眾仍然喜好 ROI