Capital Investment decision – Estimating Cash Flows -Capital Budgeting 2 Chapter 10

- Important Terms and relevant cash flows
- Common Types of Cash Flows
- Relevant Cash Flows and the Stand-Alone Principle
- Project Cash Flows: A First Look
- Pro Forma Financial Statements and Project Cash Flows.
- Different approaches to calculate OCF
- Change in Net Working Capital
- After-tax cash flow from the sale of an asset
- Evaluating projects

Key steps in the Capital Budgeting Process

- Key steps in the capital budgeting process:
    1) Generating investment project proposals
    2) Estimating cash flows
    3) Evaluating projects (NPV, Payback Period, IRR, PI)
    4) Reviewing projects performance after it has been implemented.

Important Terms
Cost of Capital or required rate of return

- The firm's cost of capital is the cost of the funds supplied to it by investors.

- It is also referred to as <u>Required Rate of Return</u>, since it is the minimum required rate of return by the firm's investors.

- For this lecture we will assume that the cost of capital is a known value.

Relevant Cash Flows and the Stand-Alone Principle

A relevant cash flow for a project is a change in the firm's overall future cash flow that comes about as a direct consequence of the decision to take that project.

Incremental cash flows are the difference between a firm's future cash flows with a project and those without the project.

- Any cash flow that exists regardless of whether or not a project is undertaken is <u>not relevant</u>.

Stand-alone principle is the assumption that evaluation of a project may be based on the project's incremental cash flows.

- Once we have determined incremental cash flows from undertaking a project, we can view that project as a kind of "minifirm" with its own future revenues and costs, its own assets, and its own cash flows.

- Then, we will primarily be interested in comparing the cash flows from this minifirm to the cost of acquiring it.

Project Classification

One way to classify projects that go through the capital budgeting process:

- Expansion of Existing products or new products or markets
- Cost reduction (cost cutting)
- Replacement of existing projects: Maintenance of business
- Safety and environmental projects required by law

Common Types of Cash Flows when considering Incremental Cash Flows

- Sunk costs – costs that have accrued in the past (No)
- Opportunity costs – costs of lost options (Yes)
- Side effects (yes)
- Change in New Working Capital (Yes)
- Financing costs (No)

Sunk Costs – Not relevant

- A sunk cost is an outlay that has already been made and cannot be removed or recovered and therefore should not be considered in an investment decision.

Opportunity costs - Relevant

- cost is the most valuable alternative that is given up if a particular investment is undertaken

- Opportunity costs of resources are the cash flows those resources could generate if they are not used in the project under consideration.

- They are lost revenues if the project is undertaken.

Side effects – Relevant

It is not unusual for a project to have a side, or spillover, effect, both good and bad.

Recall that incremental cash flows for a project include all resulting changes in the firm's future cash flows.

Side effects are all indirect effects of a project on existing operations/cash flow. It should be included in the cash flow calculation.

- Can be negative or positive effects
  - Positive side effects (***Synergy***) – benefits to other projects
  - Negative side effects (***Erosion*** or Cannibalism) – costs (or lost revenues) to other projects. occurs when the cash flows of a new project come at the expense of a firm's existing projects.

Change in New Working Capital

- Projects normally require the firm to invest in net working capital in addition to long-term assets.

- Project will generally need some amount of cash on hand to pay any expenses that arise, as well as initial investment in inventories and accounts receivable.

- Investment in project net working capital closely resembles a loan.

Finance Costs

In analysing a proposed investment, we will not include interest paid or any other financing costs (For Example, dividends or principal repaid) because we are interested in the cash flow generated by the assets of the project.

Interest expense already included in the discount rate used to discount cash flows (weighted average cost of capital)
So, if we deduct interest expense when calculating relevant operating cash flows, we would be double counting it.

Other Issues:

- We are interested only in measuring cash flow at the time when it actually occurs, not when revenues and costs accrue in an accounting sense.

- We are always interested in after tax cash flow because taxes are definitely a cash outflow

Project Cash Flows

1. Capital spending
2. Changes in net working capital
3. Operating cash flow.
4. Cash flow from sale of an asset

Pro Forma Financial Statements and Project Cash Flows

Pro forma financial statements *project* future years' operations.

Suppose we think we can sell 50,000 cans of shark attractant per year at a price of $4 per can. It costs us about $2.50 per can to make the attractant, and a new product such as this one typically has only a three-year life. We require a 20% return on new products.

- Fixed costs for the project, including such things as rent on the production facility, will run $17,430 per year.

- We will need to invest a total of $90,000 in manufacturing equipment; assume this $90,000 will be 100% depreciated over the three-year life of the project.

- Expected value for the asset, in three years, is $30,000.

- Project will require an initial $20,000 investment in net working capital, and the tax rate is 21%.

Project Operating Cash Flow: Shark Attractant Project

Projected Income Statement

Sales (50,000 units at $4/Unit)	$ 200,000
Less: Variable costs (50,000 units at $2.5/unit	125,000
Less: Fixed costs	17,430
Less: Depreciation (90,000÷3)	30,000
EBIT	$ 27,570
Less: Taxes (21%)	5,790
Net income	$ 21,780

OCF = Sales - Costs + Depreciation – Taxes (Top-Down Approach) = Sales – Costs (excluding dep)- Taxes

EBIT (since this is net of dep., we will add dep back)	$ 27,570
Depreciation	+ 30,000
Taxes	– 5,790
Operating cash flow	$ 51,780

OCF= NI + Depreciation (Bottom-Up Approach)

Net Income	$21,780
+ Depreciation	30,000
Operating cash flow	$51,780

The **Bottom-Up Approach**

$$OCF = Net\ income + Depreciation$$

The **Top-Down Approach**

EBDIT= Sales - Costs

$$OCF = Sales - Costs - Taxes$$

The **Tax Shield Approach**

Dep tax shield

$$OCF = (Sales - Costs) \times (1 - T_C) + Depreciation \times T_C$$

OCF = (Sales – Costs) x (1 – Tax rate) (Tax shield Approach)

= (200,000-125,000-17,430) x (1-.21) + 30,000 x .21)

= (58,000 x .79) + 30,000 x .21

= 45,480.3 + 6,300

= $51,780

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After-tax cash flow from the sale of an asset

Annual depreciation (straight line 3 years) = 90,000 / 3 = $30,000

Asset book value in 3 years = Asset cost – accumulated depreciation

Accumulated depreciation = 90,000 – (30,000 x 3)

$$= 90,000 - 90,000$$
$$= 0$$

We must pay taxes on the difference between sale price of $30,000 and book value of $0.

Tax on the gain from sale of the asset = (Sale price – Book value) x Tax rate

$$= (30,000 - 0) \times .21$$
$$= \$6,300$$

After-tax cash flow from the sale of the asset = Sale price – Tax on gain

$$= 30,000 - 6,300$$
$$= \$23,700$$

Cash flows summary

Projected Total Cash Flows:

	Year 0	Year 1	Year 2	Year 3
Operating cash flow		$ 51,780	$ 51,780	$51,780
Changes in NWC	−$ 20,000			+20,000
Capital spending	− 90,000			23,700
Total project cash flow	-110,000	$ 51,780	$ 51,780	$95,480

We will now calculate:
- NPV
- IRR
- Payback Period
- PI

Projected Total Cash Flow and Value
Should this project be accepted?

- The **NPV** at the 20% required return is:

$$\text{NPV} = -\$110{,}000 + \frac{51{,}780}{1.2} + \frac{51{,}780}{1.2^2} + \frac{95{,}480}{1.2^3}$$

$$= \$24{,}362.96$$

Based on these projections, the project creates over $10,000 in value and should be accepted (NPV>0)

- Return on this investment obviously exceeds 20% because the NPV is positive at 20%.

After trial and error, the **IRR** works out to be about **32.27%.**

- **Payback** on this project is about **2.07 years.**

		Remaining
0	110,000.00	
1	51,700.00	58,300.00
2	51,700.00	6,600.00
3	95,480.00	0.07

- You can also calculate **PI** by rearranging the formula and using :
  PI = (NPV / I/O) + 1 = (24,362.96 / 110,000) + 1 = 1.22

NPV

CF0	-110,000
CF1	51,780
F1	2
CF2	51,780+20,000+23700
F2	1

NPV	
I	20
NPV	
CPT	24,362.96

IRR

CF0   -110,000   IRR

CF1   51,780   CPT   32.27

F1   2

CF2   51,780+20,000+23,700

F2   1

Summary: Three approaches to calculate OCF (Operating Cash Flow)

The **Bottom-Up Approach**

$$OCF = \text{Net income} + \text{Depreciation}$$

The **Top-Down Approach**   EBDIT= Sales - Costs

$$OCF = \text{Sales} - \text{Costs} - \text{Taxes}$$

The **Tax Shield Approach**   Dep tax shield

$$OCF = (\text{Sales} - \text{Costs}) \times (1 - T_C) + \text{Depreciation} \times T_C$$

Next slide will illustrate again

Example: Calculating OCF using the three approaches

Let us assume the following estimates:
Sales = $1,500
Costs = $700
Depreciation = $600
Tax rate 21%

EBDIT (Earing before depreciation, Interest and Taxes) = Sales – Costs
$$= 1,500 - 700$$
$$= \$800$$

EBIT (Earing before Interest and Taxes) = EBDIT – Depreciation
$$= 800 - 600$$
$$= \$200$$

Net Income = EBIT – Taxes $= \$200 - (200 \times .21)$
$$= 200 - 42$$
$$= \$158$$

Sales	1500
Less Costs	-700
EBDIT	800
Less dep	-600
EBIT	200
Less taxes	-42
Net Income (NI)	158

1) The **Bottom-Up Approach**

$$OCF = Net\ income + Depreciation$$

OCF = 158 + 600 = $758

2) The **Top-Down Approach**
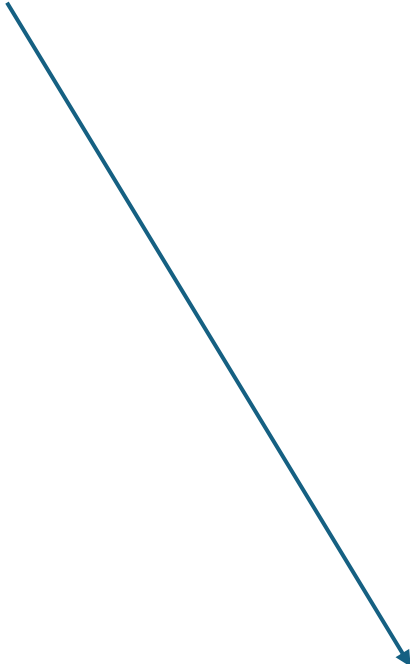
$$OCF = Sales - Costs - Taxes$$

OCF = 1,500 – 700 - 42 = $758

3) The **Tax Shield Approach**

$$OCF = (Sales - Costs) \times (1 - T_C) + Depreciation \times T_C$$

OCF = (1,500 – 700) x (1-.21) + (600 x .21)

     = 800 x .79 + 126

     = 632 + 126

     = $758

Sales	1500
Less Costs	-700
EBDIT	800
Less dep	-600
EBIT	200
Less taxes	-42
Net Income (NI)	158

Practice: Comprehensive Problem

- Assuming the following projections regarding a new expansion project:

- Number of unit sale = 15,000

- Price per unit = $5.00

- Cost per unit = $3.00

- Annal fixed cost = $3,000

- Initial capital investment = 50,000 (will be fully depreciated, using straight line depreciation, over the 5 years life of the project)

- Expected increase in Current Assets = $6,000

- Expected increase in Current Liabilities = $4,500

- Asset is expected to sell for 10% of its cost at the end of the 5 years

- Tax rate : 20%

- Required rate of return 15%

Calculate the following:

1) Operating cash flows using all three approaches

2) Change in Net Working Capital (NWC)

3) after tax cash flows from sale of asset in 5 years

4) Net present Value

5) Payback period

6) Internal Rate of Return

7) Profitability index

OCF: Bottom-up approach

$$OCF = \text{Net income} + \text{Depreciation}$$

OCF = Sales – Costs – Depreciation – Taxes + Depreciation

With the *bottom-up* approach, we begin with the accountant's bottom line (net income) and add back any noncash deductions, such as depreciation.

Crucial to remember this definition of operating cash flow (as net income plus depreciation) is correct only if there is no interest expense subtracted in the calculation of net income.

Bottom-up approach

Sales (15,000x5)	75,000.00
less costs (15,000x3)	(45,000.00)
less fixed costs	(3,000.00)
EBDIT	27,000.00
less dep (50,000 sL for 5 years)	(10,000.00)
EBT	17,000.00
less tax	(3,400.00)
NI	13,600.00
Plus dep	10,000.00
OFC	**23,600.00**

OCF: Top-Down approach

$$OCF = Sales - Costs - Taxes$$

$$= EBDIT - Taxes$$

Sales = 15,000 x 5 = 75,000
Costs = 15,000 x 3 = 45,000
Fixed costs = 3,000
EBDIT = 75,000 – 45,000 – 3,000 = 27,000
Taxes = 27,000 x .2 = 3,400
OCF = EBDIT – Taxes
       = 27,000 – 3,4000 = **$23,600**

Or in details:
OCF = 75,000 – 45,000 – 3,000 – 34,000 = **$23,600**

In the *top-down* approach, we start at the top of the income statement with sales and work our way down to net cash flow by subtracting costs, taxes, and expenses.

Leave out any strictly noncash items (For Example, depreciation).

OCF: The Tax Shield Approach

$$OCF = (Sales - Costs) \times (1 - T_C) + Depreciation \times T_C$$

OCF = EBDT – Taxes (without subtracting dep) + Depreciation tax shield

Sales = 15,000 x 5 = 75,000

Costs = 15,000 x 3 = 45,000

Fixed costs = 3,000

EBDIT = 75,000 – 45,000 – 3,000 = 27,000

EBT = 27,000 – 10,000 = 17,000

Taxes without subtracting depreciation = 27,000 x .2 = 5,400

Depreciation tax shield = 10,000 x .2 = 2,000

OCF = 27,000 - 5,400 + 2,000 = **$23,600**

OCF = (75,000 – 45,000 – 3,000) x (1- .2) + (10,000 x .2)

   = (27,000 x .8) + 2,000

   = 21,6000 + 2,000

   = **23,600**

Tax shield approach views OCF as having two components:
What the project's cash flow would be if there were no depreciation expense, or
Would-have-been cash flow

Depreciation multiplied by tax rate
   (That is, **depreciation tax shield**).

After-tax cash flow from the sale of an asset

Annual depreciation (straight line 5 years) = 50,000 / 5 = $10,000

Asset book value in 5 years = Asset cost – accumulated depreciation

Accumulated depreciation = 50,000 – (10,000 x 5)

$$= 50,000 – 50,000$$

$$= 0$$

We must pay taxes on the difference between sale price of $5,000 (50,000 x .1 = $5,000) and book value of $0.

Tax on the gain from sale of the asset (Tax consequences) = (Sale price – Book value) x Tax rate

$$= (5,000 – 0) \text{ x } .20$$

$$= \$1,000$$

After-tax cash flow from the sale of the asset = Sale price – Tax on gain

$$= 5,000 - 1,000$$

$$= \$4,000$$

Change in NWC

Change in NWC = Change in CA – Change in CL

Change in NWC = 6,000 – 4,500 = $1,500

Cash flow summary

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Operating cash flow		$23,600	$23,600	$23,600	$23,600	$23,600
Changes in NWC	(1,500.00)					1,500
Capital spending	(50,000.00)					4,000
Total project cash flow	(51,500.00)	$23,600	$23,600	$23,600	$23,600	$29,100

NPV, Payback period, IRR and PI

NPV = $23{,}600/(1.15)+23{,}600/(1.15)^2+23{,}600/(1.15)^3+23{,}600/(1.15)^4+25{,}100/(1.15)^5 - 51500$

    = $30,345.33

Payback Period : 2.18 years

		Remaining
0	51,500.00	
1	23,600.00	27,900.00
2	23,600.00	4,300.00
3	23,600.00	0.18
4	23,600.00	

IRR ; since NPV is positive IRR > 15% using trial and error to find rate that sets NPV to zero ---→ 36.22%

PI = $(23{,}600/(1.15)+23{,}600/(1.15)^2+23{,}600/(1.15)^3+23{,}600/(1.15)^4+29{,}100/(1.15)^5)$ / 51500

    = 81,845.33 / 51,500 = 1.59

You can also calculate PI by rearranging the formula and using :

PI = (NPV / I/O) + 1

    = (30,345.33 / 51500) + 1 = .59 + 1 = 1.59

NPV

CF0	-51,500	
CF1	23,600	
F1	4	
CF2	23,600+1,500+4,000	
F2	1	

NPV		
I		15
NPV		
CPT		30,345.33

IRR

CF0	-51,500
CF1	23,600
F1	4
CF2	23,600+1,500+4,000
F2	1

IRR

CPT → 37.22

Depreciation: Modified Accelerated Cost Recovery System (MACRS)

Depreciation is a noncash deductible and has cash flow consequences only because it influences the tax bill.

Accelerated cost recovery system (ACRS) is a depreciation method under U.S. tax law allowing for the accelerated write-off of property under various classifications.

- MACRS system has several classes of assets, each with a more-or-less arbitrary prescribed life called a recovery period or class life.

- Depreciable basis (depreciable value) under MACRS is equal to the purchase price of the asset plus any shipping and installation costs. No adjustment made for salvage value. the entire cost of an asset is expensed over its depreciable life.

- Half-year convention: Under MACRS it is assumed that the asset is placed in service in the middle of the first year.

  The effect of the half-year convention is to extend the recovery period out one more year. This is incorporated in the recovery allowance percentages.

- Computing depreciation under MACRS:
    - Need to know which asset class is appropriate for tax purposes
    - Depreciate to zero.

  Depreciation = Depreciable base x that year's MACRS recovery allowance percentage (depreciation rate)

Depreciation: Modified Arcs Depreciation (MACRS)

Modified ACRS depreciation (MACRS) is characterized by every asset being assigned to a particular class.

- Once an asset's tax life is determined, depreciation for each year is computed by multiplying the cost of the asset by a fixed percentage.

- Expected salvage value and expected economic life not explicitly considered in the calculation of depreciation.

- Typical depreciation classes are shown below:

Class	Examples
Three-year	Equipment used in research
Five-year	Autos, computers
Seven-year	Most industrial equipment

Depreciation: Modified Arcs Depreciation (MACRS)

- Consider an automobile, which are normally classified as five-year property, costing $12,000. Based on the table below, we see that the relevant figure for the first year of a five-year asset is 20%.

- **Property Class**

Year	Three-Year	Five-Year	Seven-Year
1	33.33%	20.00%	14.29%
2	44.45	32.00	24.49
3	14.81	19.20	17.49
4	7.41	11.52	12.49
5		11.52	8.93
6		5.76	8.92
7			8.93
8			4.46

- Depreciation in first year is $12,000 × .20 = $2,400.

- Relevant percentage in the second year is 32%, so depreciation in second year is $12,000 × .32 = $3,840.

Depreciation: Bonus Depreciation

- Prior to 2018, "bonus" depreciation was permitted.
  Based on the Protecting Americans from Tax Hikes (P A T H) Act of 2015, the size of the bonus in 2017 was 50%.

- This means a firm can take a depreciation deduction of 50% of the cost on an eligible asset in the first year and then depreciate the remaining 50% using the MACRS schedules.

- In late 2017, Congress passed the Tax Cuts and Jobs Act, which increased the bonus depreciation to 100% for 2018, lasting until the end of 2022.

- After 2022, it drops by 20% per year until it reaches zero after 2026.

- Implication is that most firms will not use the MACRS schedules until 2023 unless they wish to.

Depreciation: Book Value Versus Market Value

Book value of an asset can differ substantially from market value.

Recall the example on slide 16 of the $12,000 car:

- Book value after first year is $12,000 less first year's depreciation of $2,400, or $9,600.

- Remaining book values are summarized below:

Year	Beginning Book Value	Depreciation	Ending Book Value
1	$12,000.00	$2,400.00	$9,600.00
2	9,600.00	3,840.00	5,760.00
3	5,760.00	2,304.00	3,456.00
4	3,456.00	1,382.40	2,073.60
5	2,073.60	1,382.40	691.20
6	691.20	691.20	.00

Suppose we wanted to sell the car after five years and, based on historical averages, it is worth 25% of the purchase price, or $3,000 (12,000 x .25)

We must pay taxes at ordinary income tax rate on difference between sale price of $3,000 and book value of $691.20.

Example MACRS Depreciation
And total after-tax cash flow from the sale

The Staple Supply Co. has just purchased a new computerized information system with an installed <u>cost of $160,000</u>. The computer is treated as <u>five-year property</u> (the asset class).

1) What are the yearly depreciation allowances?

Based on historical experience, we think that the system will be worth only <u>$10,000</u> when Staple gets rid of it in four-years <u>(expected market value in 4 years</u>). Tax rate 21%

2) What are the tax consequences of the sale?

3) What is the total after-tax cash flow from the sale?

MACRS Depreciation

1) **What are the yearly depreciation allowances?**

Year	MACRS Percentage	Depreciation	Ending Book Value
1	20.00%	.2000 × $160,000 = $ 32,000	$128,000
2	32.00	.3200 × 160,000 = 51,200	76,800
3	19.20	.1920 × 160,000 = 30,720	46,080
4	11.52	.1152 × 160,000 = 18,432	27,648
5	11.52	.1152 × 160,000 = 18,432	9,216
6	5.76	.0576 × 160,000 = 9,216	0
	100.00%	$160,000	

Notice that we have also computed the book value of the system as of the end of each year. The book value at the end of Year 4 is $27,648. If Staple sells the system for $10,000 at that time, it will have a loss of $17,648 (the difference) for tax purposes. This loss, of course, is like depreciation because it isn't a cash expense.

What really happens? Two things. First, Staple gets $10,000 from the buyer. Second, it saves .21 × $17,648 = $3,706 in taxes. So, the total after-tax cash flow from the sale is a $13,706 cash inflow. (10,000 + 3,706)

2) What are the tax consequences of the sale?

Tax consequences of the sale = Tax rate x (selling price – Book Value)

$$= .21 \times (10{,}000 - 27{,}648)$$

$$= .21 \times (-17{,}648)$$

$$= - 3{,}706.08 \quad \text{Tax saving}$$

3)   What is the total after-tax cash flow from the sale?

After-tax cash flow from the asset = selling price – tax consequences

$$= 10{,}000 - (-3{,}706.08)$$

$$= 10{,}000 + 3{,}706.08$$

$$= 13{,}706.08$$

Practice: Comprehensive problem

- Assuming the following projections regarding a new expansion project:

- Number of unit sale = 15,000

- Price per unit = $5.00

- Cost per unit = $3.00

- Annal fixed cost = $3,000

- Initial capital investment = 50,000 (will be depreciated using 5-year MACRS)

- Expected increase in Current Assets = $6,000

- Expected increase in Current Liabilities = $4,500

- Asset is expected to sell for 10% of its cost at the end of the 5 years

- Tax rate : 20%

- Required rate of return 15%

Calculate the following:

1)   Calculate annual depreciation

2)   Operating cash flows using all three approaches

3)   Change in Net Working Capital (NWC)

4)   after tax cash flows from sale of asset in 5 years

5)   Net present Value

6)   Internal Rate of return

7)   Payback Period

8)   Profitability index

1) Calculate annual depreciation

MACRS rate	Depreciation	Ending book value
20.00%	10,000.00	40,000.00
32.00%	16,000.00	24,000.00
19.20%	9,600.00	14,400.00
11.52%	5,760.00	8,640.00
11.52%	5,760.00	**2,880.00**
5.76%	2,880.00	-

Book value after 5 years

2) Operating cash flows using Bottom-up approach

year	1	2	3	4	5
Sales (15,000x5)	75,000.00	75,000.00	75,000.00	75,000.00	75,000.00
less costs (15,000x3)	-45,000.00	-45,000.00	-45,000.00	-45,000.00	-45,000.00
less fixed costs	-3,000.00	-3,000.00	-3,000.00	-3,000.00	-3,000.00
EBDIT	27,000.00	27,000.00	27,000.00	27,000.00	27,000.00
less dep (from dep table above)	-10,000.00	-16,000.00	-9,600.00	-5,760.00	-5,760.00
EBT	17,000.00	11,000.00	17,400.00	21,240.00	21,240.00
less tax	-3,400.00	-2,200.00	-3,480.00	-4,248.00	-4,248.00
NI	13,600.00	8,800.00	13,920.00	16,992.00	16,992.00
Plus dep	10,000.00	16,000.00	9,600.00	5,760.00	5,760.00
OFC	23,600.00	24,800.00	23,520.00	22,752.00	22,752.00

3) Change in Net Working Capital (NWC)

Change in NWC = change in CA – change in CL
Change in NWC = 6,000 – 4,500 = $1,500

4) after tax cash flows from sale of asset in 5 years

Asset book value in 5 years (from depreciation table) = $2,880

Tax on the gain from sale of the asset (tax consequences) = (Sale price – Book value) x Tax rate
= (5,000 – 2,880) x .20
= 2,120 x .2
= $424

After-tax cash flow from the sale of the asset = Sale price – tax consequences

= 5,000 - 424

= $4,576

5) Net present Value

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Operating cash flow		23,600.00	24,800.00	23,520.00	22,752.00	22,752.00
Changes in NWC	-1,500.00					1,500.00
Capital spending	-50,000.00					4,576.00
Total project cash flow	-51,500.00	23,600.00	24,800.00	23,520.00	22,752.00	28,828.00

NPV using Calculator next slide

NPV

CF0	-51,500	CF3	23,520	NPV	
CF1	23,600	F3	1	I	15
F1	1	CF4	22,752	NPV	
		F4	1		
CF2	24,800	CF5	22,752+1500+4576	CPT	30,580.02
F2	1	F4	1		

6)   Internal Rate of return

CF0	-51,500
CF1	23,600
F1	1
CF2	18,400
F2	1
CF3	19,680
F3	1
CF4	20,448
F4	1
CF5	20,448+1500+4576
F4	1

IRR

CPT   37.56

7) Payback Period

Payback period = 2.13 years

		Remaining
0	51,500.00	
1	23,600.00	27,900.00
2	24,800.00	3,100.00
3	23,520.00	0.13180272

8) Profitability index

You can also calculate **PI** by rearranging the formula and using :

PI = (NPV / I/O) + 1 = (30,580.02/ 51,500) + 1 = 1.59

O/I is CF_0