Basic Concepts

Hampton Company is considering an investment in equipment that is capable of producing electronic parts twice as fast as existing technology. The outlay required is $2,340,000. The equipment is expected to last five years and will have no salvage value. The expected cash flows associated with the project are as follows:

Year	*Cash Revenues*	*Cash Expenses*
1	$3,042,000	$2,340,000
2	3,042,000	2,340,000
3	3,042,000	2,340,000
4	3,042,000	2,340,000
5	3,042,000	2,340,000

Required:

1. Compute the project's payback period.
2. Compute the project's accounting rate of return on:
   a. Initial investment
   b. Average investment
3. Compute the project's net present value, assuming a required rate of return of 10 percent.
4. Compute the project's internal rate of return.

20–4

1. Payback period = Original investment/Annual cash inflow
   = $2,340,000/($3,042,000 – $2,340,000)
   = $2,340,000/$702,000
   = 3.33 years

2. a. Initial investment (Depreciation = $468,000):

   Accounting rate of return = Average income/Investment
   = ($702,000 – $468,000)/$2,340,000
   = 10%

   b. Average investment:

   Accounting rate of return = ($702,000 – $468,000)/[($2,340,000 + $0)/2]
   = $234,000/$1,170,000
   = 20%

3.

Year	Cash Flow	Discount Factor	Present Value
0.....	$(2,340,000)	1.000	$(2,340,000)
1–5.....	702,000	3.791	2,661,282
NPV			$ 321,282

4. P = CF(df) = I for the IRR, thus,

df = Investment/Annual cash flow
= $2,340,000/$702,000
= 3.333

For five years and a df of 3.333, the IRR is between 14% and 16% (approximately 15.3%).

NPV

A hospital is considering the possibility of two new purchases: new X-ray equipment and new biopsy equipment. Each project would require an investment of $750,000. The expected life for each is five years with no expected salvage value. The net cash inflows associated with the two independent projects are as follows:

Year	*X-Ray Equipment*	*Sonogram Equipment*
1	$375,000	$ 75,000
2	150,000	75,000
3	300,000	525,000
4	150,000	600,000
5	75,000	675,000

Required:

Compute the net present value of each project, assuming a required rate of 12 percent.

20–5

X-ray equipment:

Year	Cash Flow	Discount Factor	Present Value
0	$(750,000)	1.000	$(750,000)
1	375,000	0.893	334,875
2	150,000	0.797	119,550
3	300,000	0.712	213,600
4	150,000	0.636	95,400
5	75,000	0.567	42,525
NPV			$ 55,950

Biopsy equipment:

Year	Cash Flow	Discount Factor	Present Value
0	$(750,000)	1.000	$(750,000)
1	75,000	0.893	66,975
2	75,000	0.797	59,775
3	525,000	0.712	373,800
4	600,000	0.636	381,600
5	675,000	0.567	382,725
NPV			$ 514,875

NPV versus IRR

Sattler Pharmacies has decided to automate its insurance claims process. Two networked computer systems are being considered. The systems have an expected life of two years. The net cash flows associated with the systems are as follows. The cash benefits represent the savings created by switching from a manual to an automated system.

Year	*System I*	*System II*
0	$(120,000)	$(120,000)
1	—	76,628
2	162,708	76,628

The company's cost of capital is 10 percent.

Required:

1. Compute the NPV and the IRR for each investment.
2. Show that the project with the larger NPV is the correct choice for the company.

20–10

1. NPV System I:

Year	Cash Flow	Discount Factor	Present Value
0	$(120,000)	1.000	$(120,000)
1	—	—	—
2	162,708	0.826	134,397
NPV			$ 14,397

NPV System II:

Year	Cash Flow	Discount Factor	Present Value
0	$(120,000)	1.000	$(120,000)
1–2	76,628	1.736	133,026
NPV			$ 13,026

System I should be chosen using NPV.

20–10 Concluded

IRR System I:

$$
\begin{aligned}
I &= df \times CF \\
\$120{,}000 &= \$162{,}708/(1 + i)^2 \\
(1 + i)^2 &= \$162{,}708/\$120{,}000 \\
&= 1.3559 \\
1 + i &= 1.1645 \\
IRR &= 16.5\%
\end{aligned}
$$

IRR System II:

$$
\begin{aligned}
df &= I/CF \\
&= \$120{,}000/\$76{,}628 \\
&= 1.566
\end{aligned}
$$

From Exhibit 20B-2, IRR = 18%

System II should be chosen using IRR.

2. Modified comparison:

Year	System I	System II
0.....	$(120,000)	$(120,000)
1.....	—	—
2.....	162,708	160,919*

*($76,628 × 1.10) + $76,628

Notice that the future value of System I is greater than that of System II and thus maximizes the value of the firm. NPV signals the correct choice, whereas IRR would have chosen System II.

Various Cash Flow Computations

Required:

Solve each of the following independent cases:

1. A printing company has decided to purchase a new printing press. Its old press will be sold for $10,000. (It has a book value of $25,000.) The new press will cost $50,000. Assuming that the tax rate is 40 percent, compute the net after-tax cash outflow.
2. The maintenance department is purchasing new diagnostic equipment costing $30,000. Additional cash expenses of $2,000 per year are required to operate the equipment. MACRS depreciation will be used (five-year property qualification). Assuming a tax rate of 40 percent, prepare a schedule of after-tax cash flows for the first four years.
3. The projected income for a project during its first year of operation is as follows:

Cash revenues	$120,000
Less: Cash expenses	(50,000)
Depreciation	(20,000)
Income before income taxes	$ 50,000
Less: Income taxes	20,000
Net income	$ 30,000

Compute the following:

a. After-tax cash flow
b. After-tax cash flow from revenues
c. After-tax cash expenses
d. Cash inflow from the shielding effect of depreciation

20–13

1.	$10,000 – $25,000 =	$(15,000)	loss
		× 0.40	tax rate
		$ 6,000	tax savings

Sales price	$10,000
Tax savings	6,000
Net proceeds ...	$16,000

Total cost of new press	$50,000
Less: net proceeds of old press	(16,000)
Net investment (cash outflow).....	$34,000

2.

Year	$(1 – t)C^a$	tNC^b	CF
1.....	$(1,200)	2,400	$1,200
2.....	(1,200)	3,840	2,640
3.....	(1,200)	2,304	1,104
4.....	(1,200)	1,382	182

[a] (1 – 0.40) × $2,000.

[b] (0.40)($30,000)(0.2000).
(0.40)($30,000)(0.3200).
(0.40)($30,000)(0.1920).
(0.40)($30,000)(0.1152).

3. a. After-tax cash flow (CF):

CF = $50,000
= $30,000 (NI) + $20,000 (depreciation)

b. After-tax cash flow from revenues = $72,000 = [(1 – 0.4)$120,000]

c. After-tax cash expenses = $30,000 = [(1 – 0.4)$50,000]

d. Cash inflow tax effect of depreciation = $8,000 = (0.4 × $20,000)

Pollution Prevention, P2 Investment

Hatfield Company produces jewelry that requires electroplating with gold, silver, and other valuable metals. Electroplating uses large amounts of water and chemicals, producing wastewater with a number of toxic residuals. Currently, Hatfield uses settlement tanks to remove waste; unfortunately, the approach is inefficient, and much of the toxic residue is left in the water that is discharged into a local river. The amount of toxic discharge exceeds the legal, allowable amounts, and the company is faced with substantial, ongoing environmental fines. The environmental violations are also drawing unfavorable public reaction, and sales are being affected. A lawsuit is also impending, which could prove to be quite costly.

Management is now considering the installation of a zero-discharge, closed-loop system to treat the wastewater. The proposed closed-loop system would not only purify the wastewater, but it would also produce cleaner water than that currently being used, increasing plating quality. The closed-loop system would produce only four pounds of sludge, and the sludge would be virtually pure metal, with significant market value. The system requires an investment of $420,000 and will cost $30,000 in increased annual operation plus an annual purchase of $5,000 of filtration medium. However, management projects the following savings:

Water usage	$ 45,000
Chemical usage	28,000
Sludge disposal	60,000
Recovered metal sales	30,000
Sampling of discharge	80,000
Total	$243,000

The equipment qualifies as a seven-year MACRS asset. Management has decided to use straight-line depreciation for tax purposes, using the required half-year convention. The tax rate is 40 percent. The projected life of the system is 10 years. The hurdle rate is 16 percent for all capital budgeting projects, although the company's cost of capital is 12 percent.

Required:

1. Based on the financial data provided, prepare a schedule of expected cash flows.
2. What is the payback period?
3. Calculate the NPV of the closed-loop system. Should the company invest in the system?
4. The calculation in Requirement 3 ignored several factors that could affect the project's viability: savings from avoiding the annual fines, positive effect on sales due to favorable environmental publicity, increased plating quality from the new system, and the avoidance of the lawsuit. Can these factors be quantified? If so, should they have been included in the analysis? Suppose, for example, that the annual fines being incurred are $50,000, the sales effect is $40,000 per year, the quality effect is not estimable, and that cancellation of the lawsuit because of the new system would avoid an expected settlement at the end of Year 3 (including legal fees) of $200,000. Assuming these are all after-tax amounts, what effect would their inclusion have on the payback period? On the NPV?

20–14

1.	**Year 0**	**$ (420,000)**
	Year 1:	
	Operating costs (0.60 × $35,000)	**$ (21,000)**
	Savings (0.60 × $243,000)	**145,800**
	Depreciation shield [0.40 × ($420,000/7) × 0.5]	**12,000**
	Total	**$ 136,800**
	Years 2–7:	
	Operating costs	**$ (21,000)**
	Savings	**145,800**
	Depreciation shield (0.40 × $60,000)	**24,000**
	Total	**$ 148,800**
	Year 8:	
	Operating costs (0.60 × $35,000)	**$ (21,000)**
	Savings (0.60 × $243,000)	**145,800**
	Depreciation shield (0.40 × $30,000)	**12,000**
	Total	**$ 136,800**
	Years 9–10:	
	Operating costs (0.60 × $35,000)	**$ (21,000)**
	Savings (0.60 × $243,000)	**145,800**
	Total	**$ 124,800**

2. **Payback period:**

$136,800	1.00 year	
148,800	1.00	
134,400	0.90	($134,400/$148,800)
$420,000	2.90 years	

3.

Year	Cash Flow	Discount Factor	Present Value
0.....	$(420,000)	1.000	$(420,000)
1.....	136,800	0.862	117,922
2–7.....	148,800	3.176	472,589
8.....	136,800	0.305	41,724
9.....	124,800	0.263	32,822
10.....	124,800	0.227	28,330
NPV			$ 273,387

The NPV is positive and signals the acceptance of the project.

20–14 Concluded

4. **Most of the factors mentioned can be quantified. Furthermore, they should be included in the analysis. All direct and indirect costs as well as costs of intangible factors should be included; otherwise, it is possible to miss out on a very profitable investment. The exclusion of the environmental fine is especially puzzling—it is easily quantified, and certainly its avoidance is an important savings. The effect on sales may also be estimated—there is already some indication that the company is assessing this outcome. Similarly, it should not be especially hard to get some handle on the potential litigation costs. There should be ample cases.**

   Annual cash flows increase by $90,000 (fines and sales effect) [e.g., cash inflows increase to $226,800 in Year 1 ($136,800 + $90,000) and $238,800 for Years 2–7 ($148,800 + $90,000)].

Payback:

$226,800	1.00 year	
193,200	0.81	($193,200/$238,800)
$420,000	1.81 years	

The payback is reduced by 1.09 years.

NPV is increased by the following amount:

Fines and sales effect ($90,000 × 4.833)....	$434,970
Lawsuit avoidance ($200,000 × 0.641).....	128,200
Total increase in NPV.....	$563,170

The effect of the omitted factors is greater than the included factors. While this may not be the normal state, it emphasizes the importance of including all related factors in the analysis. As mentioned, their exclusion may cause a company to pass up a profitable investment opportunity.

Replacement Decision, Computing After-Tax Cash Flows, Basic NPV Analysis

Mitchell Hospital (a large metropolitan for-profit hospital) is considering replacing its MRI equipment with a new model manufactured by a different company. The old MRI equipment was acquired three years ago, has a remaining life of five years, and will have a salvage value of $100,000. The book value is $2,000,000. Straight-line depreciation with a half-year convention is being used for tax purposes. The cash operating costs of the existing MRI equipment total $1,000,000 per year.

The new MRI equipment has an initial cost of $5,000,000 and will have cash operating costs of $500,000 per year. The new MRI will have a life of five years and a salvage value of $1,000,000 at the end of the fifth year. MACRS depreciation will be used for tax purposes. If the new MRI equipment is purchased, the old one will be sold for $500,000. The company needs to decide whether to keep the old MRI equipment or buy the new one. The cost of capital is 12 percent. The combined federal and state tax rate is 40 percent.

Required:

Compute the NPV of each alternative. Should the company keep the old MRI equipment or buy the new one?

Alt 1 : Old MRI Equip

($K)
N = 4
$d_t = \frac{B-S}{N}$

Yr	BTCF	SL* Depr	Taxable Income	40% Income Tax	ATCF	12% (P/F)	PV
0	-2000K	-	-	-	-2000	1	-2000
1	-1000	2375	-1237.5	+495	-505	0.893	-451
2	-1000	475	-1475	+570	-430	0.797	-343
3	-1000	475	-1475	+570	-430	0.712	-306
4	-1000	475	-1475	+570	-430	0.636	-273
5	-1000 +100	2375	-1237.5 0	+495	-505 +100	0.567	-230
		$\Sigma = 1900$					NPV = Σ = -$3603

$\Rightarrow BV = 2000K - 1900 = 100K$

*$d_t = \frac{2000 - 100}{4} = 475$; Ck: MV - BV = 100K - 100K = 0

Alt 2 : New MRI

($K)

Yr	BTCF	MACRS Depr	Taxable Income	40% Inc Tax	ATCF	12% (P/F)	PV
0	-5000K +500K	-	-	-	-4500	1	-4500
1	-500	1000	-1500	+600	100	0.893	89
2	-500	1600	-2100	+840	340	0.797	271
3	-500	960	-1460	+584	84	0.712	60
4	-500	576	-1076	+430	-70	0.636	-44
5	-500 1,000	576	-1076 +712	+146	-354 1,000	0.567	366
		$\Sigma = 4712$					NPV = Σ = -3758

MACRS $d_t = B_t r_t$ $r_t = \{20\%, 32\%, 19.2\%, 11.52\%, 11.52\% \ldots\}$ $4B = \$5000K$

Assume Full 5th yr depreciation $BV = B - \Sigma d_t = 5000 - 4712 = 288$

Ck MV - BV = 1000 - 288 = 712 depreciation recapture

Selection Criterion : MAX NPV

Since $NPV_{\text{Old MRI}} > NPV_{\text{New MRI}}$

→ Choose Old MRI alt 1

Corporate Profiles

Major Banks and Financial Services Corporations Next Week

- HSBS (UK)
- JP Morgan Chase (US)
- Deutsche Bank (German)
- Credit Suisse (Swiss)

Corporate Profiles

Next Week - 10 minute MAX!

Major US Pharmaceutical Companies and Drug Stores

- Phizer
- Johnson & Johnson
- CVS
- Walgreen