

CHAPTER 21 CAPITAL BUDGETING AND COST ANALYSIS

21-31 (60 min.) NPV of JIT, income taxes.

1. Initial investment (Year 0):

Computer system	\$1,250,000
Materials handling equipment.	<u>450,000</u>
Total initial investment	<u><u>\$1,700,000</u></u>

Working- capital investment:

Reduced working capital of	\$150,000 at end of Year 1.
Increased working capital of	\$150,000 at end of Year 5.

Depreciation on initial investment:

$\$1,700,000 \div 5 \text{ years} = \$340,000 \text{ per year}$

Income tax cash savings from annual depreciation deductions:

$\$340,000 \times 0.40 = \$136,000$

After-tax flow from disposal of materials-handling equipment at end of Year 5:

$\$150,000 \times 0.60 = \$90,000$

Annual after tax flow from operations:

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue	\$800,000	\$880,000	\$968,000	\$1,064,800	\$1,171,280
Contribution margin, 60%	480,000	528,000	580,800	638,880	702,768
Rent savings	60,000	60,000	60,000	60,000	60,000
Materials ordering cost	<u>(50,000)</u>	<u>(50,000)</u>	<u>(50,000)</u>	<u>(50,000)</u>	<u>(50,000)</u>
Annual cash inflow from operation	490,000	538,000	590,800	648,880	712,768
Income tax, 40%	<u>196,000</u>	<u>215,200</u>	<u>236,320</u>	<u>259,552</u>	<u>285,107</u>
After-tax annual cash inflow from operations	<u><u>\$294,000</u></u>	<u><u>\$322,800</u></u>	<u><u>\$354,480</u></u>	<u><u>\$389,328</u></u>	<u><u>\$427,661</u></u>

Solution Exhibit 21-31 reports the net present value to be \$246,111.

2. Rosen will have a NPV of \$246,111 with the new JIT system. Based on financial quantitative factors, this is an attractive investment. Qualitative factors could make the JIT system even more attractive. For example, if a competitor adopts JIT but Rosen does not, Rosen could be at a sizable competitive disadvantage. Not adopting JIT does not mean the status quo will remain. Rosen's workers can also gain additional shop-floor expertise when using the JIT system that can be beneficially employed on other Rosen projects.

SOLUTION EXHIBIT 21-31

	Total Present Value	Present Value Discount Factors at 10%	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
1a. Net initial investment	\$(1,700,000)	← 1.000 ←	← \$(1,700,000)					
1b. Working capital recovery	136,350	← 0.909 ←		← \$150,000				
2a. Annual after-tax cash flow from operations								
Year 1	267,246	← 0.909 ←		← 294,000				
Year 2	266,633	← 0.826 ←			← 322,800			
Year 3	266,214	← 0.751 ←				← 354,480		
Year 4	265,911	← 0.683 ←					← 389,328	
Year 5	265,577	← 0.621 ←						← 427,661
2b. Income tax cash savings from annual deprec. deductions								
Year 1	123,624	← 0.909 ←		← 136,000				
Year 2	112,336	← 0.826 ←			← 136,000			
Year 3	102,136	← 0.751 ←				← 136,000		
Year 4	92,888	← 0.683 ←					← 136,000	
Year 5	84,456	← 0.621 ←						← 136,000
3. After-tax cash flow from:								
a. Terminal disposal of machine	55,890	← 0.621 ←						← 90,000
b. Increase in working capital	<u>(93,150)</u>	← 0.621 ←						← (150,000)
Net present value	<u>\$246,111</u>							

21-32 (40 min.) Replacement of a machine, income taxes, sensitivity.

1. WRL Company should retain the old equipment because the net present value of the incremental cash flows is negative. The computations are presented below. In this format the present value factors appear at the bottom. All cash flows, year by year, are then converted into present values.

	After-Tax Cash Flows				
	1999 ^a	2000	2001	2002	2003
Initial machine investment	\$(120,000)				
Current disposal price of old machine	40,000				
Tax savings from loss on disposal of old machine ^b	4,000				
Recurring after-tax cash-operating savings:					
Variable					
(\$0.06 × 300,000 × 0.6) ^c		\$10,800	\$10,800	\$10,800	\$10,800
Fixed (\$1,000 × 0.6) ^d		600	600	600	600
Difference in income tax cash savings from depreciation deductions ^e		6,000	6,000	6,000	6,000
Additional after-tax cash flow from terminal disposal of new machine over old machine (\$20,000 – \$8,200) ^f					11,800
Net after-tax cash flows	<u>\$(76,000)</u>	<u>\$17,400</u>	<u>\$17,400</u>	<u>\$17,400</u>	<u>\$29,200</u>
Present value discount factors	1.000	0.862	0.743	0.641	0.552
Present value	<u><u>\$(76,000)</u></u>	<u><u>\$14,999</u></u>	<u><u>\$12,928</u></u>	<u><u>\$11,153</u></u>	<u><u>\$16,118</u></u>
Net present value	<u><u>\$(20,802)</u></u>				

a. Actually January 1, 2000

b. Original cost of old machine:	\$80,000
Depreciation taken during the first 3 years {[(80,000 – 10,000) ÷ 7] × 3}	<u>30,000</u>
Book value	50,000
Current disposal price:	<u>40,000</u>
Loss on disposal	\$10,000
Tax rate	<u>x 0.40</u>
Tax savings from loss on disposal of old machine	<u><u>\$ 4,000</u></u>

21-32 (Cont'd.)

c. Difference in recurring after-tax variable cash-operating savings, with 40% tax rate:

$$(\$0.20 - \$0.14) \times (300,000) \times (1 - 0.40) = \$10,800$$

d. Difference in after-tax fixed cost savings, with 40% tax rate:

$$(\$15,000 - \$14,000) \times (1 - 0.40) = \$600$$

	<u>Old Machine</u>	<u>New Machine</u>
e. Initial machine investment	\$80,000	\$120,000
Terminal disposal price at end of useful life	<u>10,000</u>	<u>20,000</u>
Depreciable base	<u>\$70,000</u>	<u>\$100,000</u>
Annual depreciation using straight-line (7-year life)	\$10,000	
Annual depreciation using straight-line (4-year life):		\$ 25,000

Year (1)	Depreciation on Old Machine (2)	Depreciation on New Machine (3)	Additional Depreciation Deductions on New Machine (4) = (3) - (2)	Income Tax Cash Savings from Difference in Depreciation Deductions at 40% (4) × 40%
2000	\$10,000	\$25,000	\$15,000	\$6,000
2001	10,000	25,000	15,000	6,000
2002	10,000	25,000	15,000	6,000
2003	10,000	25,000	15,000	6,000

	<u>Old Machine</u>	<u>New Machine</u>
f. Original cost	\$80,000	\$120,000
Total depreciation	<u>70,000</u>	<u>100,000</u>
Book value of machines on Dec. 31, 2003	10,000	20,000
Terminal disposal price of machines on Dec. 31, 2003	<u>7,000</u>	<u>20,000</u>
Loss on disposal of machines	3,000	0
Add tax savings on loss (40% of \$3,000; 40% of \$0)	<u>1,200</u>	<u>0</u>
After-tax cash flow from terminal disposal of machines (\$7,000 + \$1,200; \$20,000 - \$0)	<u>\$ 8,200</u>	<u>\$ 20,000</u>
Additional after-tax cash flow from terminal disposal of machines: \$20,000 - \$8,200 = \$11,800.		

2. Let the *additional* recurring after-tax variable cash operating savings required to make NPV = \$0 be \$X each year.

The present value of an annuity of \$1 per year for 4 years discounted at 16% = 2.798 (Appendix C, Table 4)

To make NPV = 0, we need to generate cash savings with NPV of \$20,802.

$$\text{That is } \$X (2.798) = \$20,802$$

$$X = 20,802 \div 2.798 = \$7,435$$

WRL must generate additional annual after-tax variable cash operating savings of \$7,435.

3. The nonquantitative factors that are important to WRL Company's decision include the following:

- a. The lower operating costs (variable and fixed) of the new machine would enable WRL to meet future competitive or inflationary pressures to a greater degree than it could using the old machine.
- b. If the increased efficiency of the new machine provides a labor or energy cost savings, then additional increases in these costs in the future would make the new machine more attractive.
- c. Maintenance and servicing of both machines should be reviewed in terms of reliability of the manufacturer and the costs.
- d. Potential technological advances in machinery over the next four years should be evaluated.
- e. Space requirements for the new machine should be reviewed and compared with the space requirements of the present equipment to determine if more or less space is required.

21-35 (30 min.) Relevant costs, outsourcing, capital budgeting, income taxes.

1. Relevant operating cash outflows and operating cash savings each year if Part No. 789 is outsourced:

	<u>2000</u>	<u>2001 to 2004</u>
Operating cash outflows for purchasing Part No. 789	\$(50,000)	\$(50,000)
Relevant operating cash savings from outsourcing Part No. 789:		
Direct materials	22,000	22,000
Direct manufacturing labor	11,000	11,000
Variable overhead	7,000	7,000
Product and process engineering	-	4,000
Rent	<u>1,000</u>	<u>1,000</u>
Total relevant operating cash savings	<u>41,000</u>	<u>45,000</u>
Net relevant operating cash outflows if Part No.789 purchased from Gabriella	<u>\$(9,000)</u>	<u>\$(5,000)</u>

NPV of cash inflows and outflows if Part No. 789 purchased from outside (in thousands):

End of Year	Total Present Value	Present Value of \$1 Discounted at 12%	Sketch of Relevant Cash Flows						
			1999	2000	2001	2002	2003	2004	
1. Disposal price of machine	\$15.000	◆ — 1.000	◆ — \$15						
2. Recurring operating cash flows	\$(8.037)	◆ — 0.893	◆ ————— \$ (9)						
	(3.985)	◆ — 0.797	◆ ————— \$ (5)						
	(3.560)	◆ — 0.712	◆ ————— \$ (5)						
	(3.180)	◆ — 0.636	◆ ————— \$ (5)						
	<u>(2.835)</u>	◆ — 0.567	◆ ————— \$ (5)						

Net present value

\$(6,597)

The decision to purchase Part No. 789 from Gabriella has a negative NPV of \$6,597. Strubel should continue to make Part No. 789 in-house based on quantitative, financial considerations.

Note the following:

- a. Equipment depreciation is a noncash cost and, hence, irrelevant for the NPV analysis.
- b. Product and process engineering is irrelevant for 19_5, since \$4,000 in costs will be incurred in 2000 whether Part No. 789 is outsourced or manufactured in-house. But product and process engineering is relevant from 2001 to 2004. These cash costs will be saved if Strubel decides to outsource Part No. 789.
- c. The allocated rent costs of \$2,000 are irrelevant for NPV analysis, but the \$1,000 rent saved for outside storage if Strubel outsources Part No. 789 is a relevant cash savings, under the "outsourcing" alternative.
- d. Allocation of general plant overhead costs of \$5,000 is irrelevant since these costs will not change in total whether Part No. 789 is outsourced or manufactured in-house.

21-35 (Cont'd)

2. Sensitivity analysis with respect to the quantity of Part No. 789 required seems desirable.
 - If demand for Part No. 789 decreases, Gabriella is willing to supply a lower quantity at the same price of \$50 per part. If Strubel continued to manufacture part No. 789, the costs it would incur may not decrease quite as fast with lower quantities of production because of fixed costs. Furthermore, the net cash outflows of outsourcing calculated in requirement 1 will be smaller if lower quantities of Part No. 789 are demanded. For example, if only 900 units per year are required, the net relevant cash outflows if Part No. 789 is purchased from Gabriella will be less by \$5,000 in years 2001 through 2004. Note that cash inflow from selling the machine is still \$15,000. This would make outsourcing Part No. 789 more attractive.
 - If, on the other hand, Strubel's demand for Part No. 789 increases, Strubel will continue to prefer manufacturing the part in-house.
3. Other nonfinancial and qualitative factors that Lin should consider before making a decision are:
 - a. Whether Gabriella will deliver Part No. 789 according to the agreed-upon delivery schedule.
 - b. Whether Gabriella will produce Part No. 789 according to the desired quality standards.
 - c. Whether Gabriella will be in a position to accommodate modifications in Part No. 789 if Strubel's requirements change.
 - d. Whether Gabriella will continue in business for the next five years and continue to make Part No. 789 based on Strubel's demands.
4. Compute the effects of relevant items on operating income under the alternatives of outsourcing versus making Part No. 789 in-house.

Increase (Decrease) in

**Strubel's Operating
Income in 2000
(in thousands)**

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<i>Cost of Making Part No. 789 in-house</i>	
Direct materials	\$22,000
Direct manufacturing labor	11,000
Variable manufacturing overhead	7,000
Depreciation on machine	<u>10,000</u>
Relevant costs for operating income calculations if Part No. 789 is manufactured in-house	<u>\$50,000</u>
<i>Cost of outsourcing part No. 789</i>	
Purchase costs of Part No. 789	\$50,000
Savings in rent	(1,000)
Loss on sale of machine ^a	<u>35,000</u>
Relevant costs to consider for operating income computations if Part No. 789 is outsourced	<u>\$84,000</u>
^a Proceeds from sale of machine	\$15,000
Deduct book value of machine (\$60,000 – \$10,000)	<u>50,000</u>
Loss on sale of machine	<u>\$35,000</u>

Lin will maximize reported operating income in 2000 by manufacturing Part No. 789 in-house (relevant costs of \$50,000 by manufacturing in-house versus \$84,000 by outsourcing). In this case, there is no conflict between the conclusion Lin will reach based on NPV and operating income analysis. Note, however, that if the sale of the machine was postponed for another year, Lin will prefer to outsource Part No. 789 (relevant outsourcing costs of \$49,000 versus relevant manufacturing costs of \$50,000).

Note the following:

- a. Machine depreciation is relevant for operating income computations. This cost will only be incurred if Strubel continues to manufacture Part No. 789.
- b. Product and process engineering costs, allocated rent and allocated general plant overhead costs are irrelevant because these costs will continue to be incurred in total whether Part No. 789 is outsourced or manufactured in-house. The savings in rent of \$1,000 will only occur if Part No. 789 is outsourced. These savings are relevant and are, therefore, included in the calculation of operating income under the "outsource Part No. 789" alternative.