CHAPTER 21

**CAPITAL BUDGETING AND COST ANALYSIS**

**21-1** No. Capital budgeting focuses on an individual investment project throughout its life, recognizing the time value of money. The life of a project is often longer than a year. Accrual accounting focuses on a particular accounting period, often a year, with an emphasis on income determination.

**21-2** The five stages in capital budgeting are the following:

1. An *identification stage* to determine which types of capital investments are available to accomplish organization objectives and strategies.

2. An *information-acquisition stage* to gather data from all parts of the value chain in order to evaluate alternative capital investments.

3. A *forecasting stage* to project the future cash flows attributable to the various capital projects.

4. An *evaluation stage* where capital budgeting methods are used to choose the best alternative for the firm.

5. A *financing*, *implementation, and control* stage to fund projects, get them under way, and monitor their performance.

**21-3** In essence, the discounted cash-flow method calculates the expected cash inflows and outflows of a project as if they occurred at a single point in time so that they can be aggregated (added, subtracted, etc.) in an appropriate way. This enables comparison with cash flows from other projects that might occur over different time periods.

**21-4** No. Only quantitative outcomes are formally analyzed in capital budgeting decisions. Many effects of capital budgeting decisions, however, are difficult to quantify in financial terms. These nonfinancial or qualitative factors (for example, the number of accidents in a manufacturing plant or employee morale) are important to consider in making capital budgeting decisions.

**21-5** Sensitivity analysis can be incorporated into DCF analysis by examining how the DCF of each project changes with changes in the inputs used. These could include changes in revenue assumptions, cost assumptions, tax rate assumptions, and discount rates.

**21-6** The payback method measures the time it will take to recoup, in the form of expected future net cash inflows, the net initial investment in a project. The payback method is simple and easy to understand. It is a handy method when screening many proposals and particularly when predicted cash flows in later years are highly uncertain. The main weaknesses of the payback method are its neglect of the time value of money and of the cash flows after the payback period. The first drawback, but not the second, can be addressed by using the discounted payback method.

**21-7** The accrual accounting rate-of-return (AARR) method divides an accrual accounting measure of average annual income of a project by an accrual accounting measure of investment. The strengths of the accrual accounting rate of return method are that it is simple, easy to understand, and considers profitability. Its weaknesses are that it ignores the time value of money and does not consider the cash flows for a project.

**21-8** No. The discounted cash-flow techniques implicitly consider depreciation in rate of return computations; the compound interest tables automatically allow for recovery of investment. The net initial investment of an asset is usually regarded as a lump-sum outflow at time zero. Where taxes are included in the DCF analysis, depreciation costs are included in the computation of the taxable income number that is used to compute the tax payment cash flow.

**21-9** A point of agreement is that an exclusive attachment to the mechanisms of any single method examining only quantitative data is likely to result in overlooking important aspects of a decision.

Two points of disagreement are (1) DCF can incorporate those strategic considerations that can be expressed in financial terms, and (2) “practical considerations of strategy” not expressed in financial terms can be incorporated into decisions *after* DCF analysis.

**21-10** All overhead costs are not relevant in NPV analysis. Overhead costs are relevant only if the capital investment results in a change in total overhead cash flows. Overhead costs are not relevant if total overhead cash flows remain the same but the overhead allocated to the particular capital investment changes.

**21-11** The Division Y manager should consider why the Division X project was accepted and the Division Y project rejected by the president. Possible explanations are

1. The president considers qualitative factors not incorporated into the IRR computation and this leads to the acceptance of the X project and rejection of the Y project.
2. The president believes that Division Y has a history of overstating cash inflows and understating cash outflows.
3. The president has a preference for the manager of Division X over the manager of Division Y—this is a corporate politics issue.

Factor a. means qualitative factors should be emphasized more in proposals. Factor b. means Division Y needs to document whether its past projections have been relatively accurate. Factor c. means the manager of Division Y has to play the corporate politics game better.

**21-12** The categories of cash flow that should be considered in an equipment-replacement decision are:

1. a. Initial machine investment,

b. Initial working-capital investment,

c. After-tax cash flow from current disposal of old machine,

2. a. Annual after-tax cash flow from operations (excluding the depreciation effect),

b. Income tax cash savings from annual depreciation deductions,

3. a. After-tax cash flow from terminal disposal of machines, and

b. After-tax cash flow from terminal recovery of working-capital investment.

**21-13** Income taxes can affect the cash inflows or outflows in a motor vehicle replacement decision as follows:

1. Tax is payable on gain or loss on disposal of the existing motor vehicle.
2. Tax is payable on any change in the operating costs of the new vehicle vis-à-vis the existing vehicle.
3. Tax is payable on gain or loss on the sale of the new vehicle at the project termination date.
4. Additional depreciation deductions for the new vehicle result in tax cash savings.

**21-14** A cellular telephone company manager responsible for retaining customers needs to consider the expected future revenues and the expected future costs of “different investments” to retain customers. One such investment could be a special price discount. An alternative investment is offering loyalty club benefits to long-time customers.

**21-15** These two rates of return differ in their elements:

|  |  |
| --- | --- |
| **Real-rate of return** | **Nominal rate of return** |
| 1. Risk-free element | 1. Risk-free element |
| 2. Business-risk element | 2. Business-risk element |
|  | 3. Inflation element |

The inflation element is the premium above the real rate of return that is demanded for the anticipated decline in the general purchasing power of the monetary unit.

**21-16** **Exercises in compound interest, no income taxes.**

The answers to these exercises are printed after the last problem, at the end of the chapter.

**21-17** (20–25 min.) **Capital budgeting methods, no income taxes.**

1a. The table for the present value of annuities (Appendix A, Table 4) shows:

8 periods at 8% = 5.747

Net present value = $65,000 (5.747) – $250,000

= $373,555 – $250,000 = $123,555

1b. Payback period = $250,000 ÷ $65,000 = 3.85 years

1c. Discounted Payback Period

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Period** | **Cash Savings** | **Discount Factor (8%)** | **Discounted Cash Savings** | **Cumulative Discounted Cash Savings** | **Unrecovered Investment** |
| 0 |  |  |  |  | -$250,000 |
| 1 | $65,000 | 0.926 | $60,190 | $60,190 | ($189,810) |
| 2 | $65,000 | 0.857 | $55,705 | $115,895 | ($134,105) |
| 3 | $65,000 | 0.794 | $51,610 | $167,505 | ($ 82,495) |
| 4 | $65,000 | 0.735 | $47,775 | $215,280 | ($ 34,720) |
| 5 | $65,000 | 0.681 | $44,265 | $259,545 |  |

$34,720/$44,625 = 0.7844

Discounted Payback period = 4.78 years

1d. Internal rate of return:

$250,000 = Present value of annuity of $65,000 at R% for 8 years, or what factor (F) in the table of present values of an annuity (Appendix A, Table 4) will satisfy the following equation.

$250,000 = $65,000F

F = 250000/65000= 3.85

On the eight-year line in the table for the present value of annuities (Appendix A, Table 4), find the column closest to 3.85; it is between a rate of return of 18% and 20%.

Interpolation is necessary:

Present Value Factors

18% 4.078 4.078

IRR rate – 3.850

20% 3.837 ––

Difference 0.241 0.228

Internal rate of return = 18% + (0.228/0.241) × (2%)

= 18% + 0.946 (2%) = 19.89%

1d. Accrual accounting rate of return based on net initial investment:

Net initial investment = $250,000

Estimated useful life = 8 years

Annual straight-line depreciation = $250,000 ÷ 8 = $31,250

= 

= ($65,000 – $31,250) / $250,000 = $33,750 / $250,000 = 13.5%

Note how the accrual accounting rate of return can produce results that differ markedly from the internal rate of return.

2. Other than the NPV, rate of return and the payback period on the new computer system, factors that Riverbend should consider are the following:

* Issues related to the financing the project, and the availability of capital to pay for the system.
* The effect of the system on employee morale, particularly those displaced by the system. Salesperson expertise and real-time help from experienced employees is key to the success of a hardware store.
* The benefits of the new system for customers (faster checkout, fewer errors).
* The upheaval of installing a new computer system. Its useful life is estimated to be eight years. This means that Riverbend could face this upheaval again in eight years. Also, ensure that the costs of training and other “hidden” start-up costs are included in the estimated $250,000 cost of the new computer system.

**21-18** (25 min.)  **Capital budgeting methods, no income taxes.**

The table for the present value of annuities (Appendix A, Table 4) shows:

10 periods at 14% = 5.216

1a. Net present value = $28,000 (5.216) – $110,000

= $146,048 – $110,000 = $36,048

b. Payback period = = 3.93 years

c. For a $110,000 initial outflow, the project generates $28,000 in cash flows at the end of each of years one through ten.

Using either a calculator or Excel, the internal rate of return for this stream of cash flows is found to be 21.96%.

d. Accrual accounting rate of return based on net initial investment:

Net initial investment = $110,000

Estimated useful life = 10 years

Annual straight-line depreciation = $110,000 ÷ 10 = $11,000

Accrual accounting rate of return = 

= = 15.45%

e. Accrual accounting rate of return based on average investment:

Average investment = ($110,000 + $0) / 2

= $55,000

Accrual accounting rate of return = = 30.91%.

1. Factors City Hospital should consider include the following:
2. Quantitative financial aspects
3. Qualitative factors, such as the benefits to its customers of a better eye-testing machine and the employee-morale advantages of having up-to-date equipment
4. Financing factors, such as the availability of cash to purchase the new equipment

**21-19** (35 min.) **Capital budgeting, income taxes.**

1a. Net after-tax initial investment = $110,000

Annual after-tax cash flow from operations (excluding the depreciation effect):

|  |  |
| --- | --- |
| Annual cash flow from operation with new machine | $28,000 |
| Deduct income tax payments (30% of $28,000) | 8,400 |
| Annual after-tax cash flow from operations | $19,600 |
|  |  |
| Income tax cash savings from annual depreciation deductions |  |
| 30% × $11,000 | $3,300 |

These three amounts can be combined to determine the NPV:

|  |  |
| --- | --- |
| Net initial investment;  $110,000 × 1.00 | $(110,000) |
| 10-year annuity of annual after-tax cash flows from operations;  $19,600 × 5.216 | 102,234 |
| 10-year annuity of income tax cash savings from annual depreciation deductions;  $3,300 × 5.216 | 17,213 |
| Net present value | $ 9,447 |

b. Payback period

= 

= 

= 4.80 years

c. For a $110,000 initial outflow, the project now generates $22,900 in after-tax cash flows at the end of each of years one through ten.

Using either a calculator or Excel, the internal rate of return for this stream of cash flows is found to be 16.17%.

d. Accrual accounting rate of return based on net initial investment:

AARR =  = 

= 10.82%

e. Accrual accounting rate of return based on average investment:

AARR =  = 

= 21.64%

2a. Increase in NPV.

To get a sense for the magnitude, note that from Table 2, the present value factor for 10 periods at 14% is 0.270. Therefore, the $10,000 terminal disposal price at the end of 10 years would have an after-tax NPV of:

$10,000 × (1 − 0.30) × 0.270 = $1,890

b. No change in the payback period of 4.80 years. The cash inflow occurs at the end of year 10.

c. Increase in internal rate of return. The $10,000 terminal disposal price would raise the IRR because of the additional inflow. (The new IRR is 16.54%.)

d. The AARR on net initial investment would increase because accrual accounting income in year 10 would increase by the $7,000 ($10,000 gain from disposal, less 30% × $10,000) after-tax gain on disposal of equipment. This increase in year 10 income would result in higher average annual accounting income in the numerator of the AARR formula.

e. The AARR on average investment would also increase for the same reasons given in the previous answer. Note that the denominator is unaffected because the investment is still depreciated down to zero terminal disposal value, and so the average investment remains $55,000.

**21-20** (25 min.) **Capital budgeting with uneven cash flows, no income taxes.**

1. Present value of savings in cash operating costs:

$25,000 × 0.847 $ 21,175

22,000 × 0.718 5,796

21,000 × 0.609 12,789

20,000 × 0.516 10,320

Present value of savings in cash operating costs 60,080

Net initial investment (65,000)

Net present value $ (4,920)

2. Payback period:

**Cumulative Initial Investment Yet to Be**

**Year Cash Savings Cash Savings Recovered at End of Year**

0 – – $65,000

1 $25,000 $25,000 40,000

2 22,000 47,000 18,000

3 21,000 68,000 -

Payback period = 2 years +  = 2.86 years

3. Discounted Payback Period

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Period** | **Cash Savings** | **Disc Factor (18%)** | **Discounted Cash Savings** | **Cumulative Discounted. Cash Savings** | **Unrecovered Investment** |
| 0 |  |  |  |  | –$65,000 |
| 1 | $25,000 | 0.847 | $21,175 | $21,175 | –$43,825 |
| 2 | $22,000 | 0.718 | $15,796 | $36,971 | –$28,029 |
| 3 | $21,000 | 0.609 | $12,789 | $49,760 | –$15,240 |
| 4 | $20,000 | 0.516 | $10,320 | $60,080 | –$ 4,920 |

At an 18% rate of return, this project does not save enough to make it worthwhile using the discounted payback method.

4. From requirement 1, the net present value is negative with a 18% required rate of return. Therefore, the internal rate of return must be less than 18%. We use a trial-and-error approach to determine the approximate internal rate of return and then apply straight-line interpolation.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** **(1)** | **Cash**  **Savings**  **(2)** | **P.V. Factor** **at 14%**  **(3)** | **P.V.**  **at 14%**  **(4) =**  **(2) × (3)** | **P.V. Factor** **at 12%**  **(5)** | **P.V.**  **at 12%**  **(6) =**  **(2) × (5)** | **P.V. Factor** **at 10%**  **(7)** | **P.V.**  **at 10%**  **(8) =**  **(2) × (7)** |
| 1 | $25,000 | 0.877 | $ 21,925 | 0.893 | $22,325 | 0.909 | $22,725 |
| 2 | 22,000 | 0.769 | 16,918 | 0.797 | 17,534 | 0.826 | 18,172 |
| 3 | 21,000 | 0.675 | 14,175 | 0.712 | 14,952 | 0.751 | 15,771 |
| 4 | 20,000 | 0.592 | 11,840 | 0.636 | 12,720 | 0.683 | 13,660 |
|  |  |  | $64,858 |  | $67,531 |  | $70,328 |

Net present value at 14% = $64,858 – $65,000 = $(142)

Net present value at 12% = $67,531 – $65,000 = $2,531

Internal rate of return = 12% +  × (2%)

= 12% + (0.947) × (2%) = 13.89%

5.Accrual accounting rate of return based on net initial investment:

Average annual savings in cash operating costs =  = $22,000

Annual straight-line depreciation =  = $16,250

Accrual accounting rate of return = 

=  = 8.85%

**21-21** (30 min.) **Comparison of projects, no income taxes.**

**Note: In some print versions of the text, the name of the company is referred to in one place as New Bio rather than the correct name of New Tech Corporation.**

1.

### **Total Present Value** **Year**

**Present Discount**

### **Value Factors at 8% 0 1 2 3**

#### *Plan I*

$ (325,000) 1.000 $ (325,000)

(4,135,025) 0.857 $(4,825,000)

$(4,460,025)

#### *Plan II*

$(1,675,000) 1.000 $(1,675,000)

(1,551,050) 0.926 $(1,675,000)

(1,435,475) 0.857 $(1,675,000)

$(4,661,525)

#### *Plan III*

$ (425,000) 1.000 $ (425,000)

(1,527,900) 0.926 $(1,650,000)

(1,414,050) 0.857 $(1,650,000)

(1,310,100) 0.794 $(1,650,000)

$(4,677,050)

2. Plan I has the lowest net present value cost, and is therefore preferable on financial criteria.

3. Factors to consider, in addition to NPV, are the following:

1. Financial factors include

* Competing demands for cash
* Availability of financing for project

b. Nonfinancial factors include

* Risk of building contractor not remaining solvent. Plan II exposes New Tech most if the contractor becomes bankrupt before completion because it requires more of the cash to be paid earlier.
* Ability to have leverage over the contractor if quality problems arise or delays in construction occur. Plans I and III give New Tech more negotiation strength by being able to withhold sizable payment amounts if, say, quality problems arise in Year 1.
* Investment alternatives available. If New Tech has capital constraints, the new building project will have to compete with other projects for the limited capital available.

**21-22** (30 min.) **Payback and NPV methods, no income taxes.**

1a. Payback measures the time it will take to recoup, in the form of expected future cash flows, the net initial investment in a project. Payback emphasizes the early recovery of cash as a key aspect of project ranking. Some managers argue that this emphasis on early recovery of cash is appropriate if there is a high level of uncertainty about future cash flows. Projects with shorter paybacks give the organization more flexibility because funds for other projects become available sooner.

### *Strengths*

* Easy to understand
* One way to capture uncertainty about expected cash flows in later years of a project (although sensitivity analysis is a more systematic way)

### *Weaknesses*

* Fails to incorporate the time value of money, unless discounted payback is used
* Does not consider a project’s cash flows after the payback period

1b.

### *Project A*

Outflow, $3,000,000

Inflow, $1,000,000 (Year 1) + $1,000,000 (Year 2) + $1,000,000(Year 3) + $1,000,000(Year 4)

Payback = 3 years

### *Project B*

Outflow, $1,500,000

Inflow, $400,000 (Year 1) + $900,000(Year 2) + $800,000(Year 3)

Payback = 2 years +  = 2.25 years

### *Project C*

Outflow, $4,000,000

Inflow, $2,000,000(Year 1) + $2,000,000(Year 2) + $200,000 (Year 3) + $100,000 (Year 4)

Payback = 2 years

|  |  |
| --- | --- |
|  | Payback Period |
| 1. Project C | 2 years |
| 2. Project B | 2.25 years |
| 3. Project A | 3 years |

If payback period is the deciding factor, Andrews will choose only Project C (payback period =   
2 years; investment = $4,000,000). Assuming that each of the projects is an all-or-nothing investment, Andrews will have $1,000,000 left over in the capital budget, not enough to make the $1,500,000 investment in Project B, the next best option.

2. Solution Exhibit 21-22 shows the following ranking:

|  |  |
| --- | --- |
|  | NPV |
| 1. Project B | $ 207,800 |
| 2. Project A | $ 169,000 |
| 3. Project C | $(311,500) |

3. Using NPV rankings, Projects B and A, which require a total investment of $3,000,000 + $1,500,000 = $4,500,000, which is less than the $5,000,000 capital budget, should be funded. This does not match the rankings based on payback period because Projects B and A have substantial cash flows after the payback period, cash flows that the payback period ignores.

Nonfinancial qualitative factors should also be considered. For example, are there differential worker safety issues across the projects? Are there differences in the extent of learning that can benefit other projects? Are there differences in the customer relationships established with different projects that can benefit Andrews Construction in future projects?

**SOLUTION EXHIBIT 21-22**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Total Present Value** | **Present Value Discount Factors at 10%** | **Sketch of Relevant Cash Flows** | | | | |
|  | 0 | 1 | 2 | 3 | 4 |
| PROJECT A |  |  |  |  |  |  |  |
| Net initial invest. | $(3,000,000) | 1.000 | $(3,000,000) |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Annual cash inflow | 909,000 | 0.909 |  | $1,000,000 |  |  |  |
|  | 826,000 | 0.826 |  |  | $1,000,000 |  |  |
|  | 751,000 | 0.751 |  |  |  | $1,000,000 |  |
|  | 683,000 | 0.683 |  |  |  |  | $1,000,000 |
| Net present value | $ 169,000 |  |  |  |  |  |  |
| PROJECT B |  |  |  |  |  |  |  |
| Net initial invest. | $(1,500,000) | 1.000 | $(1,500,000) |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Annual cash inflow | 363,600 | 0.909 |  | $ 400,000 |  |  |  |
|  | 743,400 | 0.826 |  |  | $ 900,000 |  |  |
|  | 600,800 | 0.751 |  |  |  | $ 800,000 |  |
| Net present value | $ 207,800 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| PROJECT C |  |  |  |  |  |  |  |
| Net initial invest. | $(4,000,000) | 1.000 | $(4,000,000) |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Annual cash inflow | 1,818,000 | 0.909 |  | $2,000,000 |  |  |  |
|  | 1,652,000 | 0.826 |  |  | $2,000,000 |  |  |
|  | 150,200 | 0.751 |  |  |  | $ 200,000 |  |
|  | 68,300 | 0.683 |  |  |  |  | $ 100,000 |
| Net present value | $ (311,500) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

**21-23** (25–30 min.) **DCF, accrual accounting rate of return, working capital, evaluation of performance, no income taxes.**

1. Present value of annuity of savings in cash operating costs

($31,250 per year for 8 years at 14%): $31,250 × 4.639 $144,969

Present value of $37,500 terminal disposal price of machine at

end of year 8: $37,500 × 0.351 13,163

Present value of $10,000 recovery of working capital at

end of year 8: $10,000 × 0.351 3,510

Gross present value 161,642

Deduct net initial investment:

Centrifuge machine, initial investment $137,500

Additional working capital investment 10,000 147,500

Net present value $ 14,142

1. The sequence of cash flows from the project is:

For a $147,500 initial outflow, the project generates $31,250 in cash flows at the end of each of years one through seven and $78,750 (= $31,250 + $37,500 + $10,000) at the end of year 8.

Using either a calculator or Excel, the internal rate of return for this stream of cash flows is found to be 16.51%.

3. Accrual accounting rate of return based on net initial investment:

Net initial investment = $137,500 + $10,000

= $147,500

Annual depreciation

($137,500 – $37,500) ÷ 8 years = $12,500

Accrual accounting rate of return = = 12.71%.

4. Accrual accounting rate of return based on average investment:

Net terminal cash flow = $37,500 terminal disposal price

+ $10,000 working capital recovery

= $47,500

Average investment = ($147,500 + $47,500) / 2

= $97,500

Accrual accounting rate of return = = 19.23%.

5. If your decision is based on the DCF model, the purchase would be made because the net present value is positive, and the 16.51% internal rate of return exceeds the 14% required rate of return. However, you may believe that your performance may actually be measured using accrual accounting. This approach would show a 12.71% return on the initial investment, which is below the required rate. Your reluctance to make a “buy” decision would be quite natural unless you are assured of reasonable consistency between the decision model and the performance evaluation method.

**21-24** (40 min.) **New equipment purchase, income taxes.**

**Note: In some print versions of the text, the last line of the data table has a typo. It refers to “over” rather than “oven.”**

1. The after-tax cash inflow per year is $29,600 ($21,600 + $8,000), as shown below:

Annual cash flow from operations $77,000

Deduct income tax payments (0.35 × $36,000) 26,950

Annual after-tax cash flow from operations $50,050

###### Annual depreciation on machine

[($186,000 – $6,000) ÷ 4] $45,000

Income tax cash savings from annual depreciation deductions

(0.35 × $45,000) $15,750

a. Solution Exhibit 21-24 shows the NPV computation. NPV = $9,228

b. Payback = $186,000 ÷ ($50,050 + $15,750) = 2.83 years

c. For a $186,000 initial outflow, the project generates $65,800 ($50,050 + $15,750) in after-tax

cash flows at the end of each of years one through four and an additional $6,000 at the end of year 4.

Using either a calculator or Excel, the internal rate of return for this stream of cash flows

is found to be 16.38%.

2. Accrual accounting rate of return based on net initial investment:

Net initial investment = $186,000

Annual after-tax operating income = $65,800 - $45,000 depreciation

= $20,800

Accrual accounting rate of return = = 11.18%.

**SOLUTION EXHIBIT** **21-24**

**Present**

**Value**

**Total Discount**

**Present Factor**

**Value at 14% Sketch of Relevant After-Tax Cash Flows**

0 1 2 3 4

1a. Initial machine

investment $(186,000) 1.000 $(186,000)

1b. Initial working

capital investment 0 1.000 $0

2a. Annual after-tax

cash flow from

operations (excl. depr.)

Year 1 43,894 0.877 $50,050

###### Year 2 38,488 0.769 $50,050

###### Year 3 33,784 0.675 $50,050

Year 4 29,630 0.592 $50,050

2b. Income tax

cash savings

from annual

depreciation

deductions

Year 1 13,813 0.877 $15,750

Year 2 12,112 0.769 $15,750

Year 3 10,631 0.675 $15,750

Year 4 9,324 0.592 $15,750

3. After-tax

cash flow from:

a. Terminal

disposal of

machine 3,552 0.592 $6,000

b. Recovery of

working capital 0 0.592 $0

Net present

value if new

machine is

purchased $ 9,228

**21-25** (40 min.) **New equipment purchase, income taxes.**

1. The after-tax cash inflow per year is $22,500 ($17,500 + $5,000), as shown below:

|  |  |
| --- | --- |
| Annual cash flow from operations | $25,000 |
| Deduct income tax payments (0.30 × $25,000) | 7,500 |
| Annual after-tax cash flow from operations | $17,500 |
|  |  |
| Annual depreciation on motor ($75,000 ÷ 5 years) | $15,000 |
| Income tax cash savings from annual depreciation deductions  (0.30 × $15,000) | $ 4,500 |

1. Solution Exhibit 21-25 shows the NPV computation. NPV= $8,380

An alternative approach:

Present value of 5-year annuity of $22,000 at 10%

$22,000 × 3.791 $83,402

Present value of cash outlays, $75,000 × 1.000 75,000

Net present value\* $ 8,402

\* Minor difference from solution exhibit 21-25 due to rounding.

b. Payback = $75,000 ÷ $22,500

= 3.33 years

c. Discounted Payback Period

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Period** | **Cash Savings** | **Disc Factor (10%)** | **Discounted Cash Savings** | **Cumulative Disc Cash Savings** | **Unrecovered Investment** |
| 0 |  |  |  |  | –$75,000 |
| 1 | $22,000 | 0.909 | $19,998 | $19,998 | –$55,002 |
| 2 | $22,000 | 0.826 | $18,172 | $38,170 | –$36,830 |
| 3 | $22,000 | 0.751 | $16,522 | $54,692 | –$20,308 |
| 4 | $22,000 | 0.683 | $15,026 | $69,718 | –$ 5,282 |
| 5 | $22,000 | 0.621 | $13,662 | $83,380 |  |

$5,282/$13,662 = .39

Discounted Payback Period = 4.39 years

d. For a $75,000 initial outflow, the project generates $22,000 in after-tax cash flows at the end of each of years one through five.

Using either a calculator or Excel, the internal rate of return for this stream of cash flows is found to be 14.29%.

2. Both the net present value and internal rate of return methods use the discounted cash flow approach in which *all* expected future cash inflows and outflows of a project are measured as if they occurred at a single point in time. The net present value approach computes the surplusgenerated by the project in today’s dollars, while the internal rate of return attempts to measure its effective return on investment earned by the project.

The payback method, by contrast, considers nominal cash flows (without discounting) and measures the time at which the project’s expected future cash inflows recoup the net initial investment in a project. The payback method thus ignores the profitability of the project’s entire stream of future cash flows. The discounted payback method shares this last defect but looks at the time taken to recoup the initial investment based on the discounted present value of cash inflows. The two payback methods are becoming increasingly important in the global economy. When the local environment in an international location is unstable and therefore highly risky for a potential investment, a company would likely pay close attention to the payback period for making its investment decision. In general, the more unstable the environment, the shorter the payback period desired.

**SOLUTION EXHIBIT 21-25**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Total Present Value** | **Present Value**  **Discount**  **Factors**  **At 10%** | | **Sketch of Relevant After-Tax Cash Flows** | | | | | | | | | | |
|  |  |  |  | 0 | | | 1 | 2 | | 3 | | 4 | 5 | |
| 1a. Initial  motor  investment | $(75,000) | 1.000 |  | $(75,000) | | |  |  | |  | |  |  | |
| 1b. Initial working capital investment | 0 | 1.000 |  | $0 | | |  |  | |  | |  |  | |
| 2a. Annual after-  tax cash flow from  operations (excl. depr.) | |  |  |  | | |  |  | |  | |  |  | |
| Year 1 | 15,908 | 0.909 |  |  | | | $17,500 |  | |  | |  |  | |
| Year 2 | 14,455 | 0.826 |  |  | | |  | $17,500 | |  | |  |  | |
| Year 3 | 13,143 | 0.751 |  |  | | |  |  | | $17,500 | |  |  | |
| Year 4 | 11,953 | 0.683 |  |  | | |  |  | |  | | $17,500 |  | |
| Year 5 | 10,868 | 0.621 |  |  | | |  |  | |  | |  | $17,500 | |
| 2b Income tax cash savings from annual deprec. Deductions |  |  |  |  | | |  |  |  | |
| Year 1 | 4,091 | 0.909 |  |  | | | $4,500 |  | |  | |  | |  |
| Year 2 | 3,717 | 0.826 |  |  | | |  | $4,500 | |  | |  | |  |
| Year 3 | 3,380 | 0.751 |  |  | | |  |  | | $4,500 | |  | |  |
| Year 4 | 3,074 | 0.683 |  |  | | |  |  | |  | | $4,500 | |  |
| Year 5 | 2,795 | 0.621 |  |  | | |  |  | |  | |  | | $4,500 |
| 3. After-tax cash flow from: |  |  |  | | |  |  |  |  | |
| a. Terminal disposal of  motor | 0 | 0.621 |  | |  | |  |  | |  | |  | | $0 |
| b. Recovery of working capital | 0 | 0.621 |  | |  | |  |  | |  | |  | | $0 |
| Net present value if new motor is purchased | $ 8,380 |  |  | |  | |  |  | |  | |  | |  |

**21-26** (20 min.) **Project choice, taxes.**

1. The after-tax cash inflow per year is $24,400 ($19,600 + $4,800), as shown below:

|  |  |
| --- | --- |
| Annual cash flow from operations ($43,000 – $15,000) | $28,000 |
| Deduct income tax payments (0.30 × $28,000) | 8,400 |
| Annual after-tax cash flow from operations | $19,600 |
|  |  |
| Annual depreciation on upgrades ($80,000 ÷ 5 years) | $16,000 |
| Income tax cash savings from annual depreciation deductions  (0.30 × $16,000) | $ 4,800 |

The expected increase in net annual income is $8,400, the difference between the after-tax cash inflow of $24,400 and the annual depreciation of $16,000. This can also be computed directly as follows:

|  |  |
| --- | --- |
| Incremental margins | $43,000 |
| Deduct incremental cash expenses | 15,000 |
| Deduct depreciation on upgrades | 16,000 |
| Pre-tax incremental income | $12,000 |
| Incremental tax (0.30 × $12,000) | 3,600 |
| After-tax incremental income | $ 8,400 |
|  |  |
|  |  |

2. The average level of investment in the project is  = $60,000.

The after-tax incremental income from the project (from requirement 1) is $8,400.

The accrual accounting rate of return on average investment is therefore

 = 14%.

1. The project is not worth investing in from an NPV standpoint. Its NPV is $(698),

calculated as follows:

Present value of 5-year annuity of $24,400 at 12%

$24,400 × 3.605 $ 87,962

Present value of $20,000 disposal value at end of 5 years

$20,000 × 0.567 11,340

Present value of cash outlays, $100,000 × 1.000 (100,000)

Net present value $ (698)

4. The first effect of the change in depreciation policy is that Harrison can depreciate $20,000 of the asset each period rather than $16,000. This will increase its income tax cash savings from annual depreciation to $6,000 (0.30 × $20,000) and increase the overall after-tax annual cash inflow to $25,600 ($19,600 + $6,000).

The second effect is that now when Harrison disposes of the project at the end of year 5 for $20,000, it owes tax on the gain in sale of the asset (which has now been depreciated to $0). It will receive a net cash flow of $14,000 (0.70 × $20,000) at that time.

The project is now worth investing in from an NPV standpoint. Its NPV is $226, calculated as follows:

Present value of 5-year annuity of $25,600 at 12%

$25,600 × 3.605 $ 92,288

Present value of $14,000 net disposal value at end of 5 years

$14,000 × 0.567 7,938

Present value of cash outlays, $100,000 × 1.000 (100,000)

Net present value $ 226

From Harrison’s standpoint, the new depreciation policy is clearly better and leads to a switch in its decision regarding acceptance of the project. In general, for purposes of capital budgeting, any policy that permits a firm to accelerate depreciations or write-downs is better, even if it entails paying taxes on disposal later, because of the time value of receiving the cash flows earlier.

**21-27** (40 min.) **Customer value.**

1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Square** | **Annual Increases\*** | **2014** | **2015** | **2016** | **2017** |
| Cash Revenues | 6% | $567,000 | $601,020 | $961,632 | $1,019,330 |
| Cash Expenses | 5% | 364,800 | 383,040 | 402,192 | 422,302 |
| Net Cash Flows |  | $202,200 | $217,980 | $559,440 | $ 697,028 |
|  |  |  |  |  |  |
| **Cloudburst** | **Annual Increases\*** | **2014** | **2015** | **2016** | **2017** |
| Cash Revenues | 5.5% | $3,510,000 | $3,703,050 | $3,906,718 | $4,121,587 |
| Cash Expenses | 4.5% | 3,060,000 | 3,197,700 | 3,341,597 | 3,491,968 |
| Net Cash Flows |  | $ 450,000 | $ 505,350 | $ 565,121 | $ 629,619 |
|  |  |  |  |  |  |

\*Given in the problem.

2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Square** | | **Cloudburst** | |
| **Year** | **PV Factor**  **for 12%** | **Net Cash Flows** | **Present Value** | **Net Cash Flows** | **Present Value** |
| 2015 | 0.893 | $217,980 | $194,656 | $505,350 | $451,278 |
| 2016 | 0.797 | 559,440 | 445,874 | 565,121 | 450,401 |
| 2017 | 0.712 | 697,028 | 496,284 | 629,619 | 448,289 |
|  |  |  | $1,136,814 |  | $1,349,968 |
|  |  |  |  |  |  |

Based on NPV at 12%, Cloudburst is the more valuable customer.

3. Assuming a 10% discount on the revenues for Cloudburst calculated in requirement 1, we have

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cloudburst** | **Annual Increases** | **2014** | **2015** | **2016** | **2017** |
| Cash Revenues\* | 5.5% | $3,510,000 | $3,332,745 | $3,516,046 | $3,709,428 |
| Cash Expenses | 4.5% | 3,060,000 | 3,197,700 | 3,341,597 | 3,491,968 |
| Net Cash Flows |  | $ 450,000 | $ 135,045 | $ 174,449 | $ 217,460 |

\* Cloudburst’s revenue from requirement 1 reduced by 10% each year from 2015 onwards.

Net present value if revenues are reduced by 10% each year relative to original estimates:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Cloudburst** | |
| **Year** | **PV Factor**  **for 12%** | **Net Cash Flows** | **Present Value** |
| 2015 | 0.893 | $135,045 | $120,595 |
| 2016 | 0.797 | 174,449 | 139,036 |
| 2017 | 0.712 | 217,460 | 154,832 |
|  |  |  | $414,463 |
|  |  |  |  |

The 10% discount and reduced subsequent annual revenue reduces the NPV substantially from $1,349,968 to $414,463. The NPV is still positive, and so Ortel should continue to sell to Cloudburst. However, this is almost a 70% drop in NPV from Cloudburst, and it makes Square the more profitable customer.

Ortel should consider whether the price discount demanded by Cloudburst needs to be met in its entirety to keep the account. The implication of meeting the full demand is that the account is minimally profitable. A serious concern is whether Square will also demand comparable price discounts if Cloudburst’s demands are met. This could result in large reductions in the NPVs of all of Ortel’s customers.

Ortel should also consider the reliability of the growth estimates used in computing the NPVs. Are the predicted differences in revenue growth rates based on reliable information? Many revenue growth estimates by salespeople turn out to be overestimates or occur over a longer time period thaninitially predicted.

**21-28** (60 min.) **Selling a plant, income taxes.**

1. *Option 1*

Current disposal price $900,000

Deduct current book value 0

Gain on disposal 900,000

Deduct 35% tax payments 315,000

Net present value $585,000

*Option 2*

Lucky Seven receives three sources of cash inflows:

a. Rent. Four annual payments of $220,000. The after-tax cash inflow is:

$220,000 × (1 – 0.35) = $143,000 per year

b.Discount on material purchases, payable at year-end for each of the four years: $40,000

The after-tax cash inflow is: $40,000 × (1 – 0.35) = $26,000

c. Sale of plant at year-end 2018. The after-tax cash inflow is:

$150,000 × (1 – 0.35) = $97,500

**Present Value**

**Total Discount**

**Present Factors at**

**Value 10% Sketch of Relevant After-Tax Cash Flows**

0 1 2 3 4

1. Rent

$129,987 0.909 $143,000

118,118 0.826 $143,000

107,393 0.751 $143,000

97,669 0.683 $143,000

2. Discount on

Purchases $23,634 0.909 $26,000

21,476 0.826 $26,000

19,526 0.751 $26,000

17,758 0.683 $26,000

3. Sale of plant $ 66,593 0.683 $97,500

Net present value $602,154

*Option 3*

Contribution margin per jacket:

Selling price $55.00

Variable costs 43.00

Contribution margin $12.00

**2015 2016 2017 2018**

Contribution margin

$12.00 × 18,000; 26,000;

30,000; 10,000 $216,000 $312,000 $360,000 $120,000

Fixed overhead (cash) costs 20,000 20,000 20,000 20,000

Annual cash flow from operations 196,000 292,000 340,000 100,000

Income tax payments (35%) 68,600 102,200 119,000 35,000

After-tax cash flow from

operations (excl. depcn.) $127,400 $189,800 $221,000 $65,000

Depreciation: $160,000 ÷ 4 = $40,000 per year

Income tax cash savings from depreciation deduction: $40,000 × 0.35 = $14,000 per year

Sale of plant at end of 2018: $270,000 × (1 – 0.35) = $175,500

Solution Exhibit 21-28 presents the NPV calculations: NPV = $487,181

**SOLUTION EXHIBIT 21-28**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Total**  **Present Value** | **Present Value Discount Factors at 10%** | | **Sketch of Relevant After-Tax Cash Flows** | | | | |
|  |  | |  | 2014 | 2015 | 2016 | 2017 | 2018 |
| 1a. Initial plant equipment  upgrade investment | $(160,000) | | 1.000 | $(160,000) | |  |  |  |
| 1b. Initial working capital  investment | 0 | 1.000 | | $0 |  |  |  |  |
| 2a. Annual after-tax cash  flow from operations  (excluding depreciation  effects) | | | | | | | | |
| Year 1 | 115,807 | 0.909 | |  | $127,400 |  |  |  |
| Year 2 | 156,775 | 0.826 | |  |  | $189,800 |  |  |
| Year 3 | 165,971 | 0.751 | |  |  |  | $221,000 |  |
| Year 4 | 44,395 | 0.683 | |  |  |  |  | $65,000 |
| 2b. Income tax cash savings  from annual depreciation  deductions | | | | | | | | |
| Year 1 | 12,726 | 0.909 | |  | $14,000 |  |  |  |
| Year 2 | 11,564 | 0.826 | |  |  | $14,000 |  |  |
| Year 3 | 10,514 | 0.751 | |  |  |  | $14,000 |  |
| Year 4 | 9,562 | 0.683 | |  |  |  |  | $14,000 |
| 3. After-tax cash flow  From |  |  | |  |  |  |  |  |
| a. Terminal disposal  of plant | 119,867 | 0.683 | |  |  |  | $175,500 | |
| b. Recovery of working  capital | 0 | 0.683 | |  |  |  |  | $0 |
| Net present value | $487,181 |  | |  |  |  |  |  |

Option 2 has the highest NPV:

NPV

Option 1 $585,000

Option 2 $602,154

Option 3 $487,181

1. Nonfinancial factors that Lucky Seven should consider include the following:

* Option 1 gives Lucky Seven immediate liquidity that it can use for other projects.
* Option 2 has the advantage of Lucky Seven having a closer relationship with the supplier. However, it limits Lucky Seven’s flexibility if Preston Corporation’s quality is not comparable to that of competitors.
* Option 3 has Lucky Seven entering a new line of business. If this line of business is successful, it could be expanded to cover souvenir jackets for other major events. The risks of selling the predicted number of jackets should also be considered.

**21-29** (60 min.) **Equipment replacement, no income taxes.**

1. Cash flows for modernizing alternative:

**Net Cash Initial Sale of Equip.**

**Year Units Sold Contributions Investments at Termination**

**(1) (2) (3) = (2)** × **$19,500a (4) (5)**

Jan. 1, 2015 –– –– $(36,800,000) ––

Dec. 31, 2015 535 $10,432,500

Dec. 31, 2016 600 11,700,000

Dec. 31, 2017 665 12,967,500

Dec. 31, 2018 730 14,235,000

Dec. 31, 2019 795 15,502,500

Dec. 31, 2020 860 16,770,000

Dec. 31, 2021 925 18,037,500 $7,000,000

a $55,000 – $35,500 = $19,500 cash contribution per prototype.

Cash flows for replacement alternative:

**Net Cash Initial Sale of Equip.**

**Year Units Sold Contributions Investments**

**(1) (2) (3) = (2)** × **$29,000b (4) (5)**

Jan. 1, 2015 –– –– $(61,700,000) $4,300,000

Dec. 31, 2015 535 $15,515,000

Dec. 31, 2016 600 17,400,000

Dec. 31, 2017 665 19,285,000

Dec. 31, 2018 730 21,170,000

Dec. 31, 2019 795 23,055,000

Dec. 31, 2020 860 24,940,000

Dec. 31, 2021 925 26,825,000 $17,000,000

b $55,000 – $26,000 = $29,000 cash contribution per prototype.

1. Payback period calculations for modernizing alternative:

**Cumulative Net Initial Investment**

**Year Cash Inflow Cash Inflow Unrecovered at End of Year**

**(1) (2) (3)(4)**

Jan. 1, 2015 –– –– $36,800,000

Dec. 31, 2015 $10,432,500 $10,432,500 26,367,500

Dec. 31, 2016 11,700,000 22,132,500 14,667,500

Dec. 31, 2017 12,967,500 35,100,000 1,700,000

Dec. 31, 2018 14,235,000

Payback = 3 + ($1,700,000 ÷ $14,235,000)

= 3.12 years

Payback period calculations for replace alternative:

**Cumulative Net Initial Investment**

**Year Cash Inflow Cash Inflow Unrecovered at End of Year (1) (2) (3)(4)**

Jan. 1, 2015 –– –– $57,400,000

Dec. 31, 2015 $15,515,000 $15,515,000 41,885,000

Dec. 31, 2016 17,400,000 32,915,000 24,485,000

Dec. 31, 2017 19,285,000 52,200,000 5,200,000

Dec. 31, 2018 21,170,000

Payback = 3 + ($5,200,000 ÷ $21,170,000)

= 3.25 years

1. Modernizing alternative:

**Present Value**

**Discount Factors Net Cash Present**

**Year At 10% Flow Value**

Jan. 1, 2015 1.000 $(36,800,000) $(36,800,000)

Dec. 31, 2015 0.909 10,432,500 9,483,143

Dec. 31, 2016 0.826 11,700,000 9,664,200

Dec. 31, 2017 0.751 12,967,500 9,738,593

Dec. 31, 2018 0.683 14,235,000 9,722,505

Dec. 31, 2019 0.621 15,502,500 9,627,053

Dec. 31, 2020 0.564 16,770,000 9,458,280

Dec. 31, 2021 0.513 25,037,500 12,844,238

Total $33,738,010

Replace Alternative:

**Present Value**

**Discount Factors Net Cash Present**

**Year At 10% Flow Value**

Jan. 1, 2015 1.000 $(57,400,000) $(57,400,000)

Dec. 31, 2015 0.909 15,515,000 14,103,135

Dec. 31, 2016 0.826 17,400,000 14,372,400

Dec. 31, 2017 0.751 19,285,000 14,483,035

Dec. 31, 2018 0.683 21,170,000 14,459,110

Dec. 31, 2019 0.621 23,055,000 14,317,155

Dec. 31, 2020 0.564 24,940,000 14,066,160

Dec. 31, 202 1 0.513 43,825,000 22,482,225

Total $50,883,220

4. Using the payback period, the modernize alternative is preferred to the replace alternative. On the other hand, the replace alternative has a significantly higher NPV than the modernize alternative and so should be preferred. Of course, the NPV amounts are based on best estimates of cash flows going out into the future. Clean Chips should examine the sensitivity of the NPV amounts to variations in the estimates.

Nonfinancial qualitative factors should be considered. These could include the quality of the prototypes produced by the modernize and replace alternatives. These alternatives may differ in capacity and their ability to meet surges in demand beyond the estimated amounts. The alternatives may also differ in how workers increase their shop floor-capabilities. Such differences could provide labor force externalities that can be the source of future benefits to Clean Chips.

**21-30** (40 min.) **Equipment replacement, income taxes (continuation of 21-29).**

1. & 2. Income tax rate = 30%

*Modernize Alternative*

Annual depreciation:

$36,800,000 ÷ 7 years = $5,257,143 a year.

Income tax cash savings from annual depreciation deductions:

$5,257,143 × 0.3 = $1,577,143 a year.

Terminal disposal of equipment = $7,000,000.

After-tax cash flow from terminal disposal of equipment:

$7,000,000 × 0.70 = $4,900,000.

The NPV components are:

a. Initial investment: **NPV**

Jan. 1, 2015 $(36,800,000) × 1.000 $(36,800,000)

b. Annual after-tax cash flow from operations

(excluding depreciation):

Dec. 31, 2015 10,432,500 × 0.70 × 0.909 $6,638,200

2016 11,700,000 × 0.70 × 0.826 6,764,940

2017 12,967,500 × 0.70 × 0.751 6,817,015

2018 14,235,000 × 0.70 × 0.683 6,805,754

2019 15,502,000 × 0.70 × 0.621 6,738,937

2020 16,770,000 × 0.70 × 0.564 6,620,796

2021 18,037,000 × 0.70 × 0.513 6,477,266

c. Income tax cash savings from annual depreciation

deductions ($1,577,143 each year for 7 years):

$1,577,143 × 4.868 7,677,532

d. After-tax cash flow from terminal sale of equipment:

$4,900,000 × 0.513 2,513,700

Net present value of modernize alternative $ 20,254,140

*Replace alternative*

Initial machine replacement = $61,700,000

Sale on Jan. 1, 2015, of equipment = $4,300,000

After-tax cash flow from sale of old equipment: $4,300,000 × 0.70 = $3,010,000

Net initial investment: $61,700,000 − $3,010,000 = $58,690,000

Annual depreciation: $61,700,000 ÷ 7 years = $8,814,286 a year

Income-tax cash savings from annual depreciation deductions: $8,814,286 × 0.30 = $2,644,286

After-tax cash flow from terminal disposal of equipment: $17,000,000 × 0.70 = $11,900,000

The NPV components of the replace alternative are:

|  |  |  |  |
| --- | --- | --- | --- |
| a. Net initial investment  Jan. 1, 2015 $(58,690,000) × 1.000 | | | $(58,690,000) |
| b. Annual after-tax cash flow from operations (excluding depreciation) | | |  |
| Dec. 31, | 2015 | $15,515,000 × 0.70 × 0.909 | $ 9,872,195 |
|  | 2016 | 17,400,000 × 0.70 × 0.826 | 10,060,680 |
|  | 2017 | 19,285,000 × 0.70 × 0.751 | 10,138,125 |
|  | 2018 | 21,170,000 × 0.70 × 0.683 | 10,121,377 |
|  | 2019 | 23,055,000 × 0.70 × 0.621 | 10,022,009 |
|  | 2020 | 24,940,000 × 0.70 × 0.564 | 9,846,312 |
|  | 2021 | 26,825,000 × 0.70 × 0.513 | 9,632,858 |
|  |  |  |  |
| c. Income tax cash savings from annual depreciation deductions  ($2,644,286 each year for 7 years) $2,644,286 × 4.868 | | | 12,872,384 |
|  | | |  |
| d. After-tax cash flow from terminal sale of equipment, $11,900,000 × 0.513 | | | 6,104,700 |
|  | | |  |
| Net present value of replace alternative | | | $29,980,640 |

On the basis of NPV, Clean Chips should replace rather than modernize the equipment.

3. Clean Chips would prefer to:

1. have lower tax rates,
2. have revenue exempt from taxation,
3. recognize taxable revenues in later years rather than earlier years,
4. recognize taxable cost deductions greater than actual outlay costs, and
5. recognize cost deductions in earlier years rather than later years (including accelerated amounts in earlier years).

**21-31** (20 min.) **DCF, sensitivity analysis, no income taxes.**

The present value of an annuity of $1 per year for 8 years discounted at 12% = 4.968.

1. Revenues, $50 × 1,200,000 $60,000,000

Variable cash costs, $20 × 1,200,000 24,000,000

Cash contribution margin 36,000,000

Fixed cash costs 8,000,000

Cash inflow from operations $28,000,000

Net present value:

Cash inflow from operations: $28,000,000 × 4.968 $139,104,000

Cash outflow for initial investment (70,000,000)

Net present value $ 69,104,000

2a. 10% reduction in selling prices:

Revenues, $45 × 1,200,000 $54,000,000

Variable cash costs, $20 × 1,200,000 24,000,000

Cash contribution margin 30,000,000

Fixed cash costs 8,000,000

Cash inflow from operation $22,000,000

Net present value:

Cash inflow from operations: $22,000,000 × 4.968 $109,296,000

Cash outflow for initial investment (70,000,000)

Net present value $ 39,296,000

b. 10% increase in the variable cost per unit:

Revenues, $50 × 1,200,000 $60,000,000

Variable cash costs, $22 × 1,200,000 26,400,000

Cash contribution margin 33,600,000

Fixed cash costs 8,000,000

Cash inflow from operations $25,600,000

Net present value:

Cash inflow from operations: $25,600,000 × 4.968 $127,180,800

Cash outflow for initial investment (70,000,000)

Net present value $ 57,180,800

3. Sensitivity analysis enables management to see those assumptions for which input variations have sizable impact on NPV. Extra resources could be devoted to getting more informed estimates of those inputs with the greatest impact on NPV, in this case the potential reduction in selling prices.

Sensitivity analysis also enables management to have contingency plans in place if assumptions are not met.

**21-32** (30–35 min.) **NPV and AARR, goal-congruence issues.**

1.

|  |  |
| --- | --- |
| Annual cash flow from operations | $110,000 |
| Income tax payments (30%) | 33,000 |
| Annual after-tax cash flow from operations (excl. deprn.) | $ 77,000 |

Depreciation: $430,000 ÷ 8 = $53,750 per year

Income-tax cash savings from depreciation deduction: $53,750 × 0.30 = $16,125 per year

The present value of an annuity of $1 per year for 8 years discounted at 12% = 4.968.

So, present value of annual cash flows = ($77,000 + $16,125) × 4.968 = $462,645

Net initial investment = $(430,000) + $(7,500) = $(437,500)

Present value of working capital recovery = $7,500 × 0.404 = $3,030

Net present value of project = $(437,500) + $462,645 + $3,030 = $28,175

2. Accrual accounting rate of return (AARR): The accrual accounting rate of return takes the annual accrual net income after tax and divides by the initial investment to get a return.

Incremental net operating income excluding depreciation $110,000

Less: Depreciation expense ($430,000 ÷ 8) 53,750

Income before tax 56,250

Income tax expense (at 30%) 16,875

Net income per period $ 39,375

AARR = $39,375 ÷ $437,500 = 9.00%.

3. Eric will not accept the project if he is being evaluated on the basis of accrual accounting rate of return because the project does not meet the 12% threshold above which Eric earns a bonus. Eric should accept the project if he wants to act in the firm’s best interest because the NPV is positive, implying that, based on the cash flows generated, the project exceeds the firm’s required 12% rate of return. Thus, Eric will turn down an acceptable long-run project to avoid a poor evaluation based on the measure used to evaluate his performance. To remedy this, the firm could evaluate Eric instead on a project-by-project basis and by looking at how well he achieves the cash flows forecasted when he chose to accept a given project.

**21-33** (30 min.) **Payback methods, even and uneven cash flows.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Payback problem: | |  |  |  | | |  |
|  |  |  |  |  |  | | |  |
|  |  | |  |  |  | | |  |
| 1. | Annual revenue |  | $180,000 |  |  | | |  |
|  | Annual costs |  |  |  |  | | |  |
|  | Fixed | $82,000 |  |  |  | | |  |
|  | Variable | 9,000 | 91,000 |  |  | | |  |
|  | Net annual cash inflow | | $ 89,000 |  |  | | |  |
|  |  |  |  |  |  | | |  |
|  | Payback period = Investment / Net cash inflows = $186,000 / $89,000 = 2.09 years  Discounted Payback Period with even cash flows: | | | | | | | |
|  |  |  |  |  | |  |  | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Period Year** | **Cash Revenues** | **Fixed Costs** | **Variable Costs** | **Net Cash Inflows** | **Disc Factor (6%)** | **Discounted Cash Savings** | **Cumulative Disc. Cash Savings** | **Unrecovered Investment** |
| 0 |  |  |  |  |  |  |  | $186,000 |
| 1 | $180,000 | $82,000 | $9,000 | $89,000 | 0.943 | $83,927 | $ 83,927 | $102,073 |
| 2 | $180,000 | $82,000 | $9,000 | $89,000 | 0.890 | $79,210 | $163,137 | $ 22,863 |
| 3 | $180,000 | $82,000 | $9,000 | $89,000 | 0.840 | $74,760 | $237,897 | $ 0 |
| 4 | $180,000 | $82,000 | $9,000 | $89,000 | 0.792 | $70,488 |  |  |
| 5 | $180,000 | $82,000 | $9,000 | $89,000 | 0.747 | $66,483 |  |  |
| 6 | $180,000 | $82,000 | $9,000 | $89,000 | 0.705 | $62,745 |  |  |
| 7 | $180,000 | $82,000 | $9,000 | $89,000 | 0.665 | $59,185 |  |  |
| 8 | $180,000 | $82,000 | $9,000 | $89,000 | 0.627 | $55,803 |  |  |
| 9 | $180,000 | $82,000 | $9,000 | $89,000 | 0.592 | $52,688 |  |  |

$22,863/$74,760 = 0.31

Discounted Payback Period = 2.31 years

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 2. |  | |  |  |  |  |
| **Year** | **Revenue**  **(1)** | **Cash Fixed Costs**  **(2)** | **Cash**  **Variable Costs**  **(3)** | | **Net Cash Inflows**  **(4) = (1) − (2) − (3)** | **Cumulative**  **Amounts** |
| 1 | $110,000 | $ 82,000 | $ 5,500 |  | $ 22,500 | $ 22,500 |
| 2 | 100,000 | 82,000 | 5,000 |  | 13,000 | 35,500 |
| 3 | 150,000 | 82,000 | 7,500 |  | 60,500 | 96,000 |
| 4 | 95,000 | 82,000 | 4,750 |  | 8,250 | 104,250 |
| 5 | 165,000 | 82,000 | 8,250 |  | 74,750 | 179,000 |
| **6** | **205,000** | **82,000** | **10,250** |  | **112,750** | **291,750** |
| 7 | 150,000 | 82,000 | 7,500 |  | 60,500 | 352,250 |
| 8 | 165,000 | 82,000 | 8,250 |  | 74,750 | 427,000 |
| 9 | 170,000 | 82,000 | 8,500 |  | 79,500 | 506,500 |
|  |  |  |  |  |  |  |
|  | The cumulative amount exceeds the initial $186,000 investment for the first time at the end of year 6. So, payback happens in year 6.  Using linear interpolation, a more precise measure is that payback happens at:    5 years + ($186,000 – $179,000)/$112,750 = 5.06 years | | | | | |
|  |

Discounted Payback Period with uneven cash flows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Cash Revenues** | **Fixed Costs** | **Variable Costs** | **Net Cash Inflows** | **Disc Factor (6%)** | **Discounted Cash Savings** | **Cumulative Disc. Cash Savings** | **Unrecovered Investment** |
| 0 |  |  |  |  |  |  |  | $186,000 |
| 1 | $110,000 | $82,000 | $ 5,500 | $ 22,500 | 0.943 | $21,218 | $ 21,218 | $164,782 |
| 2 | $100,000 | $82,000 | $ 5,000 | $ 13,000 | 0.890 | $11,570 | $ 32,788 | $153,212 |
| 3 | $150,000 | $82,000 | $ 7,500 | $ 60,500 | 0.840 | $50,820 | $ 83,608 | $102,392 |
| 4 | $ 95,000 | $82,000 | $ 4,750 | $ 8,250 | 0.792 | $ 6,534 | $ 90,142 | $ 95,858 |
| 5 | $165,000 | $82,000 | $ 8,250 | $ 74,750 | 0.747 | $55,838 | $145,980 | $ 40,020 |
| 6 | $205,000 | $82,000 | $10,250 | $112,750 | 0.705 | $79,489 | $225,469 | $ 0 |
| 7 | $150,000 | $82,000 | $ 7,500 | $ 60,500 | 0.665 | $40,233 | $265,702 |  |
| 8 | $165,000 | $82,000 | $ 8,250 | $ 74,750 | 0.627 | $46,868 | $312,570 |  |
| 9 | $170,000 | $82,000 | $ 8,500 | $ 79,500 | 0.592 | $47,064 | $359,634 |  |

Discounted payback period = 5 years + ($186,000 – $145,980)/$79,489 = 5.50 years

**21-34** (40 min.) **Replacement of a machine, income taxes, sensitivity**.

1a. Original cost of old machine: $150,000

Depreciation taken during the first 3 years

{[($150,000 – $20,000) ÷ 8] × 3} 48,750

Book value 101,250

Current disposal price: 68,000

Loss on disposal $ 33,250

Tax rate × 0.34

Tax savings from loss on current disposal of old machine $ 11,305

Total after-tax cash effect of disposal = $68,000 + $11,305 = $79,305

1b. Difference in recurring after-tax variable cash-operating savings, with 34% tax rate:

($0.25 – $0.19) × (475,000) × (1– 0.34) = $18,810 (in favor of new machine)

Difference in after-tax fixed cost savings, with 34% tax rate:

($25,000 – $24,000) × (1 – 0.34) = $660 (in favor of new machine)

1c.

|  |  |  |
| --- | --- | --- |
|  | **Old Machine** | **New Machine** |

Initial machine investment $150,000 $190,000

Terminal disposal price at end of useful life 20,000 25,000

Depreciable base $130,000 $165,000

Annual depreciation using

straight-line (8-year life) $ 16,250

Annual depreciation using straight-line (5-year life): $ 33,000

Annual income tax cash savings from difference in depreciation deduction:

($33,000 – $16,250) × 0.34 = $5,695 (in favor of new machine)

1d.

|  |  |  |
| --- | --- | --- |
|  | **Old Machine** | **New Machine** |

Original cost $150,000 $190,000

Total depreciation 130,000 165,000

Book value of machines on Dec. 31, 2018 20,000 25,000

Terminal disposal price of machines on Dec. 31, 2018 12,000 22,000

Loss on disposal of machines 8,000 3,000

Add tax savings on loss (34% of $8,000; 34% of $3,000) 2,720 1,020

After-tax cash flow from terminal disposal of

machines ($12,000 + $2,720; $22,000 + $1,020) $ 14,720 $ 23,020

Difference in after-tax cash flow from terminal disposal of machines:

$23,020 – $14,720 = $8,300 (in favor of new machine)

2. The Frooty Company should retain the old equipment because the net present value of the incremental cash flows from the new machine is negative. The computations, using the results of requirement 1, 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** | | | | |
|  | **2013**a | **2014** | **2015** | **2016** | **2017** | **2018** |
| Initial machine investment | $(190,000) |  |  |  |  |  |
| Current disposal price of old machine | 68,000 |  |  |  |  |  |
| Tax savings from loss on disposal of  old machine | 11,305 |  |  |  |  |  |
| Recurring after-tax cash-operating savings |  |  |  |  |  |  |
| Variable |  | $18,810 | $18,810 | $18,810 | $18,810 | $18,810 |
| Fixed |  | 660 | 660 | 660 | 660 | 660 |
| Income tax cash savings from difference in  depreciation deductions |  | 5,695 | 5,695 | 5,695 | 5,695 | 5,695 |
| Additional after-tax cash flow from  terminal disposal of new machine  over old machine | \_\_\_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_\_\_\_\_\_\_ | \_ 8,300 |
| Net after-tax cash flows | $(110,695) | $25,165 | $25,165 | $25,165 | $25,165 | $33,465 |
| Present value discount factors (at 12%) | \_ 1.000 | 0.893 | 0.797 | 0.712 | 0.636 | 0.567 |
| Present value | $(110,695) | $22,472 | $20,057 | $17,917 | $16,005 | $18,975 |
| Net present value | $ (15,269) |  |  |  |  |  |

a More precisely, January 1, 2014

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

The present value of an annuity of $1 per year for 5 years discounted at 12% = 3.605.

To make NPV = 0, Frooty needs to generate cash savings with NPV of $15,269.

That is $X × (3.605) = $15,269

X = $15,269 ÷ 3.605 = $4,235.51

Frooty must generate *additional* annual after-tax cash operating savings of $4,235.51.

**21-35** (35 min.) **Recognizing cash flows for capital investment projects.**

1. Partitioning relevant cash flows into categories:

(1) **Net initial investment cash flows**

— The $49,000 cost of the new Rock Band Pro

—The disposal value of Guitar Hero, $2,700, is a cash inflow.

—The book value of Guitar Hero $2,200 ($25,200 − $23,000), relative to the disposal value of $2,700, yields a taxable gain of $500 ($2,700 − $2,200) that leads to a cash outflow for taxes of $500 × Tax Rate.

(2) **Cash flow savings from operations**

-—The 30% savings in utilities cost per year of $2,160 (30% × $600 per month × 12 months) results in cash inflow from operations after tax of $2,160 × (1 − Tax Rate).

-—The savings of half the maintenance costs per year of $2,500 (50% × $5,000) results in a cash inflow from operations after tax of $2,500 × (1 − Tax Rate).

—Annual depreciation of ($49,000 − $5,000) ÷ 11 years = $4,000 on Rock Band Pro, relative to the ($2,200 − $0) ÷ 11 years = $200 depreciation on current Guitar Hero leads to additional tax savings of $3,800 × Tax Rate.

(3) **Cash flows from terminal disposal of investment**

—The $5,000 salvage value of Rock Band Pro minus the $0 salvage value of the old Guitar Hero equipment is a terminal cash flow at the end of Year 11. There are no tax effects because both systems are planned to be disposed of at book value.

(4) **Data not relevant to the capital budgeting decision**

—The $5 per hour charge for customers, since it would not change whether or not Johnny got the new machine

—The $25,200 original cost of the Guitar Hero setup

2. Net present value of the investment:

|  |  |
| --- | --- |
| Net initial investment |  |
| Initial investment in Rock Band Pro | $(49,000) |
| Current disposal value of Guitar Hero | 2,700 |
| Tax on gain on sale of Guitar Hero, 40% × $500 | (200) |
| Net initial investment | $(46,500) |

|  |  |
| --- | --- |
| Annual after-tax cash flow from operations (excl. deprn. effects) |  |
| After-tax savings in utilities costs, $2,160 × (1−0.40) | $ 1,296 |
| After-tax savings in maintenance costs, $2,500 × (1−0.40) | 1,500 |
| Annual after-tax cash flow from operations | $ 2,796 |
| Income-tax cash savings from annual additional depreciation deductions ($4,000 − $200) × 40% | $ 1,520 |

|  |  |
| --- | --- |
| After-tax cash flow from terminal disposal of machines | $ 5,000 |

These four amounts can be combined to determine the NPV at an 8% discount rate.

|  |  |
| --- | --- |
| Present value of net initial investment, $(46,500) × 1.000 | $(46,500) |
| Present value of 11-year annuity of annual after-tax cash flow from operations (excl. deprcn. effects), $2,796 × 7.139 | 19,961 |
| Present value of 11-year annuity of income-tax cash savings from annual depreciation deductions, $1,520 × 7.139 | 10,851 |
| Present value of after-tax cash flow from terminal disposal of machines, $5,000 × 0.429 | 2,145 |
| Net present value | $(13,543) |

At the required rate of return of 8%, the net present value of the investment in the Rock Band Pro machine is substantially negative. Johnny should therefore not make the investment.

**21-36** (25 min.) **NPV, inflation and taxes.**

1. Without inflation or taxes, this is a simple net present value problem using an 8% discount rate

|  |  |
| --- | --- |
| Present value of initial investment, $(899,640) × 1.000 | $(899,640) |
| Present value of 7-year annuity of annual cash savings:  $192,000 × 5.206 | 999,552 |
| Net present value | $ 99,912 |
|  |  |

2. With inflation, we adjust each year’s cash flow for the inflation rate to get nominal cash flows and then discount each cash flow separately using the nominal discount rate.

Nominal rate = (1 + real rate) × (1 + inflation rate) − 1

Nominal rate = (1.08) × (1.055) − 1 = 1.1394 – 1 = 0.1394 or 14% (approx.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Cash Flow** | **Cumulative** | **Cash Inflows** | **Present Value** |  |
| **Period** | **(Real Dollars)** | **Inflation Rate** | **(Nominal Dollars)** | **Factor, 14%** | **Present Value** |
|  | **(1)** | **(2)** | **(3) = (1) × (2)** | **(4)** | **(5) = (3) × (4)** |
| 1 | $192,000 | 1.055 | $202,560 | 0.877 | $177,645 |
| 2 | 192,000 | 1.1131 | 213,696 | 0.769 | 164,332 |
| 3 | 192,000 | 1.174 | 225,408 | 0.675 | 152,150 |
| 4 | 192,000 | 1.239 | 237,888 | 0.592 | 140,830 |
| 5 | 192,000 | 1.307 | 250,944 | 0.519 | 130,240 |
| 6 | 192,000 | 1.379 | 264,768 | 0.456 | 120,734 |
| 7 | 192,000 | 1.455 | 279,360 | 0.400 | 111,744 |
| Total present value of annual net cash inflows in nominal dollars | | | |  | 997,675 |
| Present value of initial investment, $(899,640) × 1.000 | | | |  | (899,640) |
| Net present value | | | |  | $ 98,035 |

11.113 = (1.055)2

3. Both the unadjusted and adjusted NPV are positive. Based on financial considerations alone, Cheap-O Foods should buy the new cash registers. However, the effect of taxes should also be considered, as well as any pertinent nonfinancial issues, such as potential improvements in customer response time from moving to the new cash registers.

|  |  |  |  |
| --- | --- | --- | --- |
| 4. | Initial equipment investment |  | $(899,640) |
|  |  |  |  |
|  | Annual cash flow from operations (excl. deprn. effects) | $192,000 |  |
|  | Deduct income tax payments (0.30 × $192,000) | 57,600 |  |
|  | Annual after-tax cash flow from operations (excl. deprn. effects) |  | $ 134,400 |
|  |  |  |  |
|  | Income tax cash savings from annual depreciation deductions  (0.30 × $128,520)1 |  | $ 38,556 |

1 Depreciation deductions = ($899,640 – $0) / 7 = $128,520

The terminal disposal price of the equipment is equal to the book value at disposal = $0, so the above three amounts suffice to determine the NPV at a 8% discount rate.

|  |  |
| --- | --- |
| Present value of net initial investment, $(899,640) × 1.000 | $(899,640) |
| Present value of 7-year annuity annual after-tax cash flow from operations,  $134,400 × 5.206 | 699,686 |
| Present value of 7-year annuity of income tax cash savings from  annual depreciation deductions, $38,556 × 5.206 | 200,723 |
| Net present value | $ 769 |

5. As in the previous section, with inflation, we adjust each year’s cash flow for the inflation rate to get nominal cash flows and then discount each cash flow separately using the nominal discount rate.

Nominal rate = (1 + real rate) × (1 + inflation rate) −1

Nominal rate = (1.08)(1.055) −1 = 1.1394 – 1 = .1394 or 14% (approx.)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Cash Flow** | **Cumulative** | **Cash Inflows** | **After Tax Cash** | **Present Value** |  |
| **Period** | **(Real Dollars)** | **Inflation Rate** | **(Nominal Dollars)** | **Flows** | **Factor, 14%** | **Present Value** |
|  | **(1)** | **(2)** | **(3) = (1) × (2)** | **(4) = 0.7 × (3)** | **(5)** | **(6) = (4) × (5)** |
| 1 | $192,000 | 1.055 | $202,560 | $141,792 | 0.877 | $124,352 |
| 2 | 192,000 | 1.113 | 213,696 | 149,587 | 0.769 | 115,033 |
| 3 | 192,000 | 1.174 | 225,408 | 157,786 | 0.675 | 106,505 |
| 4 | 192,000 | 1.239 | 237,888 | 166,522 | 0.592 | 98,581 |
| 5 | 192,000 | 1.307 | 250,944 | 175,661 | 0.519 | 91,168 |
| 6 | 192,000 | 1.379 | 264,768 | 185,338 | 0.456 | 84,514 |
| 7 | 192,000 | 1.455 | 279,360 | 195,552 | 0.400 | 78,221 |
| Total present value of annual net cash inflows (excl. depreciation. effects) | | | | |  | $698,374 |
| Present value of 7-year annuity of income-tax cash savings from | | | | |  |  |
| annual depreciation deductions, $38,556 × 5.206 | | | |  |  | 200,723 |
| Present value of initial investment $(899,640) × 1.000 | | | |  |  | (899,640) |
| Net present value | |  |  |  |  | $ (543) |

6.Without inflation, we obtain a positive NPV; however, with inflation NPV is negative, and Cheap-O Foods would be better off not purchasing the new registers. Negative NPV is obtained with an inflation estimate of 5.5%. If a careful review of this forecasted inflation rate results in a lower rate of inflation, Cheap-O Foods should recalculate the NPV to determine whether the purchase of the registers is in its best interest.

**21-37** (60 min.) **NPV of information system, income taxes.**

1. Initial investment (Year 0): $750,000

Working-capital investment:

Reduced working capital of $100,000 at end of Year 0.

Increased working capital of $100,000 at end of Year 5.

Depreciation on initial investment: $750,000 ÷ 5 years = $150,000 per year

Income tax cash savings from annual depreciation deductions: $150,000 × 0.30 = $45,000

After-tax cash flow from disposal of JIT system at end of Year 5: $50,000 × (1– 0.30) = $35,000

Annual after-tax cash flow from operations:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Incremental revenues  (5% annual growth) | $500,000 | $525,000 | $551,250 | $578,813 | $607,753 |
| Incremental contribution margin  (60%  incremental revenues) | $300,000 | $315,000 | $330,750 | $347,288 | $364,652 |
| Rent savings | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Deduct increase in software upgrades and tech support costs | (75,000) | (75,000) | (75,000) | (75,000) | (75,000) |
| Annual pre-tax incremental  cash inflow from operations | 265,000 | 280,000 | 295,750 | 312,288 | 329,652 |
| Deduct income tax payments  (30%) | 79,500 | 84,000 | 88,725 | 93,686 | 98,896 |
| Annual after-tax incremental  cash inflow from operations | $185,500 | $196,000 | $207,025 | $218,602 | $230,756 |
|  |  |  |  |  |  |

2. Solution Exhibit 21-37 reports the net present value to be $214,506.

3. Saina will have a NPV of $214,506 with the new data warehousing and analytics system. Based on financial quantitative factors, this is an attractive investment. Qualitative factors could make the system even more attractive. For example, if a competitor adopts the new information system but Saina does not, Saina could be at a sizable competitive disadvantage. Not adopting the information system does not mean the status quo will remain. Saina’s workers can also gain additional expertise when using the data warehousing and analytics system that can be beneficially employed on other projects.

**SOLUTION EXHIBIT 21-37**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Total Present Value** | **Present Value Discount Factors**  **at 12%** |  |  |  | |  | |  |  |  |
| **Sketch of Relevant After-Tax Cash Flows** | | | | | | | |
| **Year 0** | **Year 1** | | **Year 2** | | **Year 3** | **Year 4** | **Year 5** |
|  |  |  |  |  |  |  | |  | |  |  |
| 1a. Net initial investment | $(750,000) | 1.000 |  | $(750,000) |  |  | |  | |  |  |
| 1b. Working capital decrease | 100,000 | 1.000 |  |  | $100,000 | | |  | |  |  |
| 2a. Annual after-tax cash flow from operations |  |  |  |  |  |  | |  | |  |  |
| Year 1 | 165,652 | 0.893 |  |  | $185,500 | | |  | |  |  |
| Year 2 | 156,212 | 0.797 |  |  |  | $196,000 | |  | |  |  |
| Year 3 | 147,402 | 0.712 |  |  |  |  | | $207,025 | |  |  |
| Year 4 | 139,031 | 0.636 |  |  |  |  | |  | | $218,602 |  |
| Year 5 | 130,839 | 0.567 |  |  |  |  | |  | |  | $230,756 |
| 2b. Income tax cash  savings from annual  depreciation charges | |  |  |  |  |  | |  | |  |  |
| Year 1 | 40,185 | 0.893 |  |  | $45,000 | | |  | |  |  |
| Year 2 | 35,865 | 0.797 |  |  |  | $45,000 | |  | |  |  |
| Year 3 | 32,040 | 0.712 |  |  |  |  | | $45,000 | |  |  |
| Year 4 | 28,620 | 0.636 |  |  |  |  | |  | | $45,000 |  |
| Year 5 | 25,515 | 0.567 |  |  |  |  | |  | |  | $45,000 |
| 3. After-tax cash flow from: | |  |  |  |  |  | |  | |  |  |
| a. Terminal disposal of machine | 19,845 | 0.567 |  |  |  |  | |  | |  | $35,000 |
| b. Increase in working capital | (56,700) | 0.567 |  |  |  |  | |  | |  | $(100,000) |
| Net  present value | $214,506 |  |  |  |  |  | |  | |  |  |