**21-31 Payback methods, even and uneven cash flows** You have the opportunity to expand your business by purchasing new equipment for $159,000. The equipment has a useful life of nine years. You expect to incur cash fixed costs of $96,000 per year to use this new equipment, and you expect to incur cash variable costs in the amount of 10% of cash revenues. Your cost of capital is 12%.

**Required**

1. Calculate the payback period and the discounted payback period for this investment, assuming you will generate $140,000 in cash revenues every year.

2. Assume instead that you expect the following cash revenue stream for this investment:

Year 1 $ 90,000

Year 2 115,000

Year 3 130,000

Year 4 155,000

Year 5 170,000

Year 6 180,000

Year 7 140,000

Year 8 125,000

Year 9 110,000

Based on this estimated revenue stream, what are the payback and discounted payback periods for this investment?

**SOLUTION**

**Payback, even and uneven cash flows.**

Payback problem:

1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Payback problem: | |  |  |  |  |
| Annual revenue |  | $140,000 |  |  |  |
| Annual costs |  |  |  |  |  |
| Fixed | $96,000 |  |  |  |  |
| Variable | 14,000 | 110,000 |  |  |  |
| Net annual cash inflow | | $ 30,000 |  |  |  |
| Discounted Payback Period with even cash flows:   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | PerioYear | Cash Revenues | Fixed Costs | Variable Costs | Net Cash Inflows | Disc Factor (12%) | Discounted Cash Savings | Cumulative Disc. Cash Savings | Unrecovered Investment | | 0 |  |  |  |  |  |  |  | $159,000 | | 1 | $140,000 | $96,000 | $14,000 | $30,000 | .893 | $26,790 | $ 26,790 | $132,210 | | 2 | $140,000 | $96,000 | $14,000 | $30,000 | .797 | $23,910 | $ 50,700 | $108,300 | | 3 | $140,000 | $96,000 | $14,000 | $30,000 | .712 | $21,360 | $ 72,060 | $ 86,940 | | 4 | $140,000 | $96,000 | $14,000 | $30,000 | .636 | $19,080 | $ 91,140 | $ 67,860 | | 5 | $140,000 | $96,000 | $14,000 | $30,000 | .567 | $17,010 | $108,150 | $ 50,850 | | 6 | $140,000 | $96,000 | $14,000 | $30,000 | .507 | $15,210 | $123,360 | $ 35,640 | | 7 | $140,000 | $96,000 | $14,000 | $30,000 | .452 | $13,560 | $136,920 | $ 22,080 | | 8 | $140,000 | $96,000 | $14,000 | $30,000 | .404 | $12,120 | $149,040 | $ 9,960 | | 9 | $140,000 | $96,000 | $14,000 | $30,000 | .361 | $10,830 | $159,870 |  |   $9,960/$10,830 = .92  Discounted Payback Period = 8.92 years | | | | | |

2.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Revenue**  **(1)** | **Cash Fixed Costs**  **(2)** | **Cash**  **Variable Costs**  **(3)** | | **Net Cash Inflows**  **(4) = (1) − (2) − (3)** | **Cumulative**  **Amounts** |
| 1 | $ 90,000 | $ 96,000 | $ 9,000 |  | $(15,000) | $(15,000) |
| 2 | 115,000 | 96,000 | 11,500 |  | 7,500 | (7,500) |
| 3 | 130,000 | 96,000 | 13,000 |  | 21,000 | 13,500 |
| 4 | 155,000 | 96,000 | 15,500 |  | 43,500 | 57,000 |
| 5 | 170,000 | 96,000 | 17,000 |  | 57,000 | 114,000 |
| **6** | **180,000** | **96,000** | **18,000** |  | **66,000** | **180,000** |
| 7 | 140,000 | 96,000 | 14,000 |  | 30,000 | 210,000 |
| 8 | 125,000 | 96,000 | 12,500 |  | 16,500 | 226,500 |
| 9 | 110,000 | 96,000 | 11,000 |  | 3,000 | 229,500 |
|  |  |  |  |  |  |  |
|  | The cumulative amount exceeds the initial $159,000 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 + | | | | | |
|  |

Discounted Payback Period with uneven cash flows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | Cash Revenues | Fixed Costs | Variable Costs | Net Cash Inflows | Disc Factor (12%) | Discounted Cash Savings | Cumulative Disc. Cash Savings | Unrecovered Investment |
| 0 |  |  |  |  |  |  |  | $159,000 |
| 1 | $ 90,000 | $96,000 | $ 9,000 | $(15,000) | .893 | ($13,395) | ($13,395) | $172,395 |
| 2 | $115,000 | $96,000 | $11,500 | $ 7,500 | .797 | $ 5,978 | ($ 7,417) | $166,417 |
| 3 | $130,000 | $96,000 | $13,000 | $ 21,000 | .712 | $14,952 | $ 7,535 | $151,465 |
| 4 | $155,000 | $96,000 | $15,500 | $ 43,500 | .636 | $27,666 | $ 35,201 | $123,799 |
| 5 | $170,000 | $96,000 | $17,000 | $ 57,000 | .567 | $32,319 | $ 67,520 | $ 91,480 |
| 6 | $180,000 | $96,000 | $18,000 | $ 66,000 | .507 | $33,462 | $100,982 | $ 58,018 |
| 7 | $140,000 | $96,000 | $14,000 | $ 30,000 | .452 | $13,560 | $114,542 | $ 44,458 |
| 8 | $125,000 | $96,000 | $12,500 | $ 16,500 | .404 | $ 6,666 | $121,208 | $ 37,792 |
| 9 | $110,000 | $96,000 | $11,000 | $ 3,000 | .361 | $ 1,083 | $122,291 | $ 36,709 |

At a 12% rate of return, this project does not generate sufficient cash flows to ever recoup the investment under the discounted payback method.