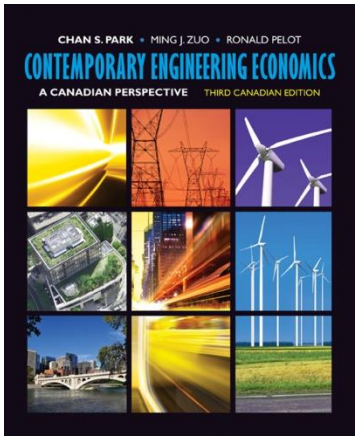
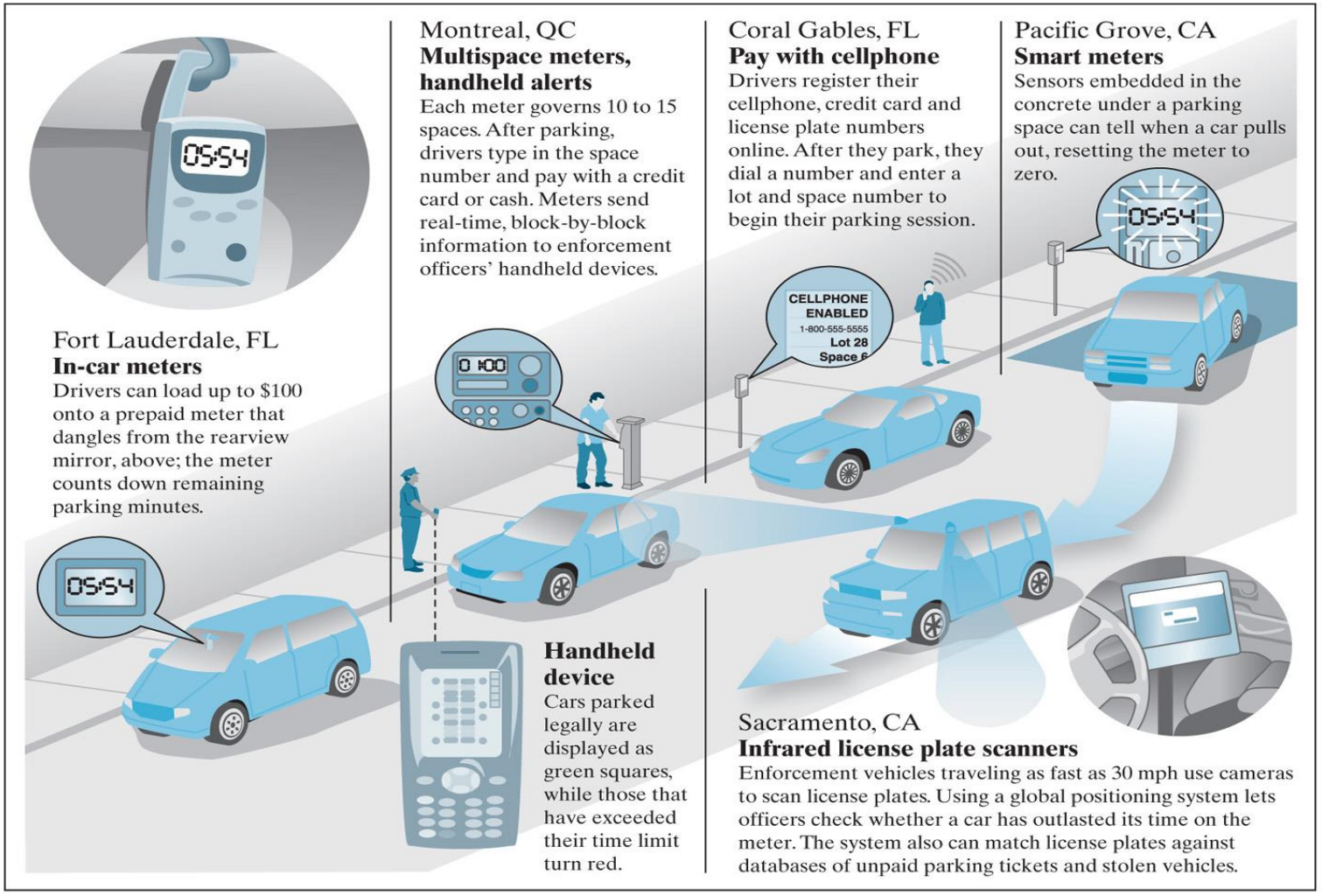
Initial Project Screening Method: Payback Period



Lecture No. 12
Chapter 5
Contemporary Engineering Economics
Third Canadian Edition

Chapter Opening Story



Ultimate Questions

- Municipalities' Point of View:
  - Would there be enough new revenues from installing the expensive parking monitoring devices?
  - How many devices could be installed to maximize the revenue streams?
- Manufacturer's Point of View:
  - Would there be enough demand for their product to justify the investment required in new facilities and marketing?
  - What would be the potential financial risk if the actual demand is far less than its forecast or adoption of technology is too slow?

Chapter 5 Objectives

- How do firms screen potential investment opportunities?
- How do firms evaluate the profitability of an investment project by considering the time value of money?
- How do you determine the net present worth (cost), net annual worth (cost), net future worth (cost), and the internal rate of return of a project?

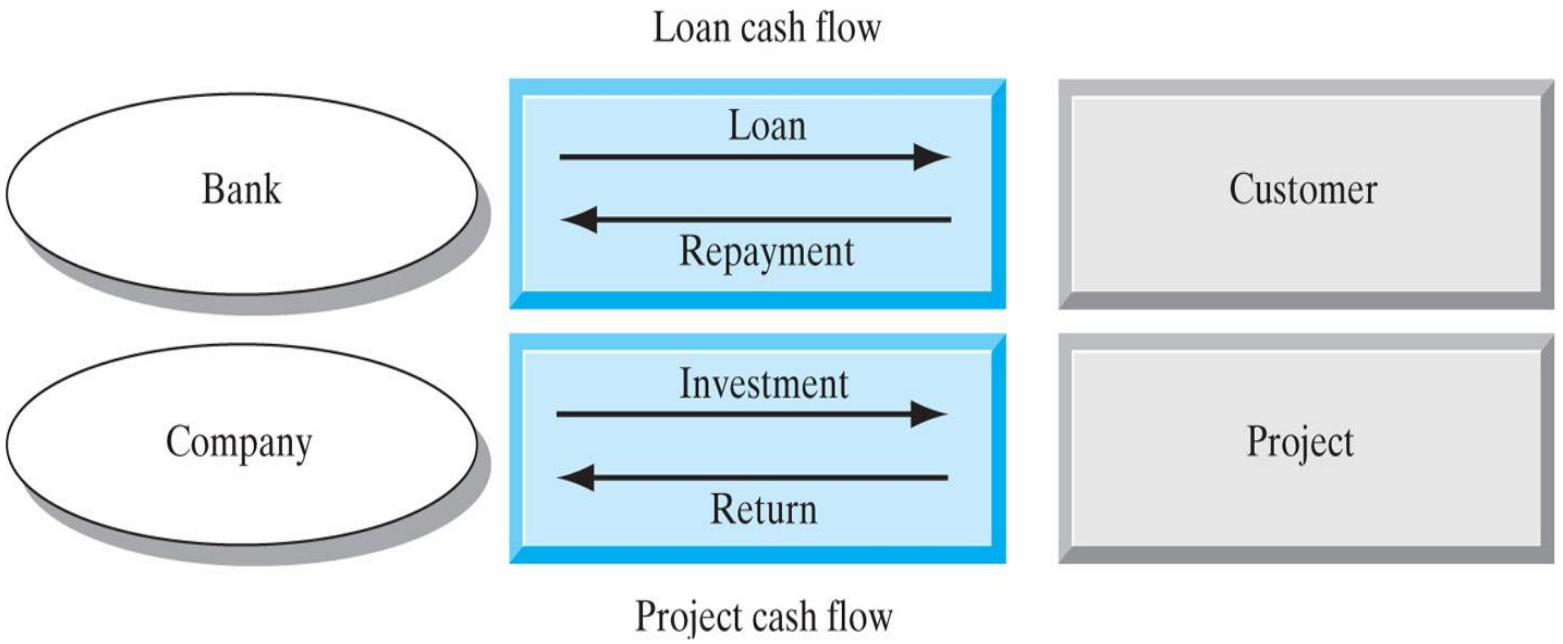
Chapter 5 Objectives (continued)

- How do you determine the capital recovery cost when you purchase an asset?
- How do you determine unit cost or unit profit?
- What is the meaning of the rate of return?
- What are some of the various methods to compute the rate of return?
- How do you resolve the multiple rates of return problem?
- How do make an accept or reject decision with each of the PW, FW, AE, and IRR criteria?

Lecture 12 Objectives

- How do firms screen potential investment opportunities?
- How do firms evaluate the profitability of an investment project by considering the time value of money?

Bank Loan vs. Investment Project



Example 5.1: Identifying Project Cash Flows

- XL Chemicals: 40% of its time is used to produce demulsification products, i.e. operating 3500 hrs per year, 30,000 kg/yr @$15/kg
- The other 60% of the time produce other specialty chemicals
- It plans to install computer control system, which costs $650,000 upfront and additional maintenance $53,000/yr with the following benefits:
  - Higher purity, then $2/kg price increase
  - Production increase of 4,000 kg/yr due to better yield at no additional costs
  - Reduced operators, leading to saving of $25/hr

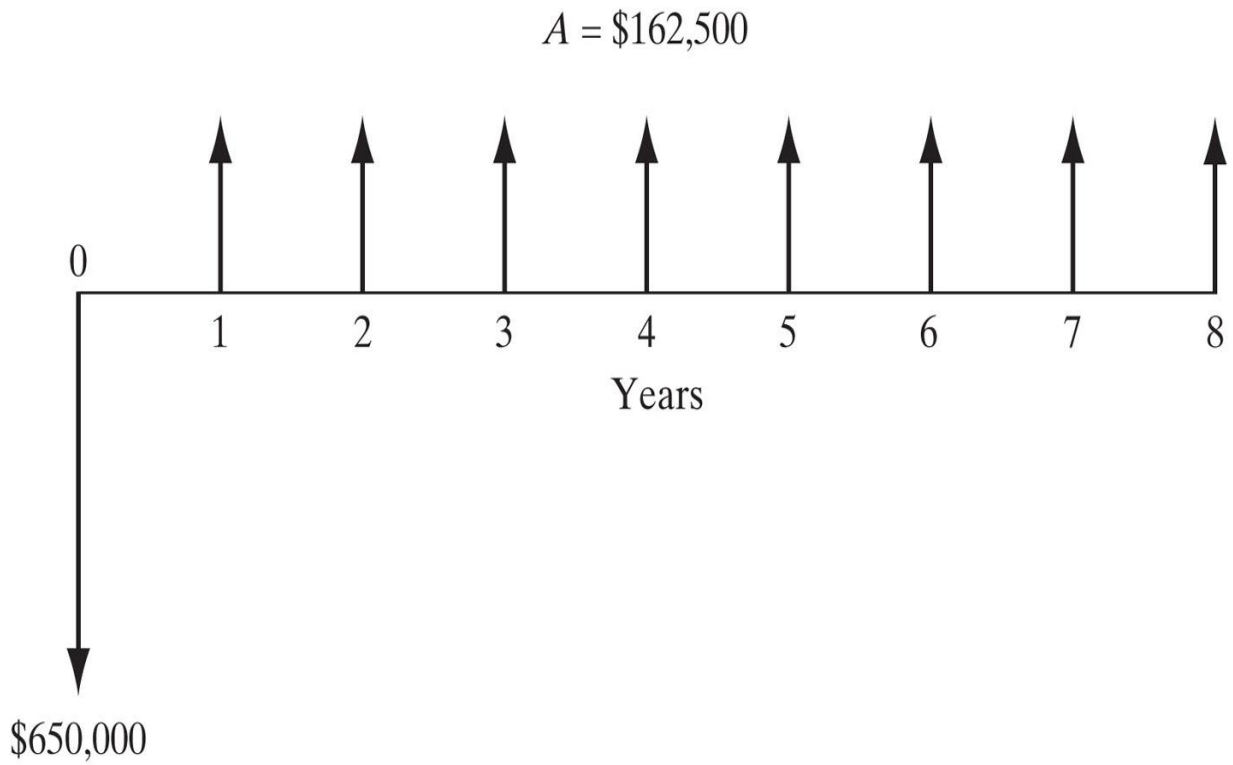
New beneficial cash flows generated:

- Revenue increase due to price increase: 30,000 kg/yr x $2/kg = $60,000/yr
- Added production volume: 4,000 kg/yr x $17/yr = $68,000/yr
- Manpower saving: $25/hr x 3500 hrs/yr = $87,500/yr
- Total benefits in cash incomes: $215,500/yr

Example 5.1: Describing Project Cash Flows

Year (*n*)	Cash Inflows (Benefits)	Cash Outflows (Costs)	Net Cash Flows
0	0	$650,000	-$650,000
1	215,500	53,000	162,500
2	215,500	53,000	162,500
…	…	…	…
8	215,500	53,000	162,500

Example 5.1: Identifying Project Cash Flows



Independent versus Mutually Exclusive Investment Projects

- Independent:
  - Costs and benefits of one project do not depend on whether another is chosen.
  - Example: Computer process control project, Waste heat recovery boiler, etc.
- Mutually Exclusive:
  - A project is excluded if another is chosen.
  - Example: a mortgage, from Bank A, Bank B, or Bank C?

Payback Period

- Principle:
  How fast can I recover my initial investment?
- Method:
  based on the cumulative cash flow (also called project balance or accounting profit)
- Screening Guideline:
  If the payback period is shorter than a maximum acceptable specified payback period, the project would be considered for further analysis.
- Weakness:
  does not consider the time value of money

Example 5.2: Conventional Payback Period

- How long does it take to recover the initial investment for the computer process control system project in Example 5.1?

$$\text{Payback Period} = \frac{\text{Initial Cost}}{\text{Uniform annual benefit}}$$

$$= \frac{\$650,000}{\$162,500}$$

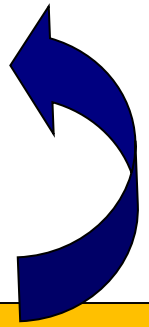
$$= 4 \text{ years}$$

Example 5.3: Conventional Payback Period With Salvage Value

- Autonumerics Company has just bought a new spindle machine at a cost of $105,000 to replace one that had a salvage value of $20,000. The projected annual after-tax savings via improved efficiency, which will exceed the investment cost, are provided in the next slide.

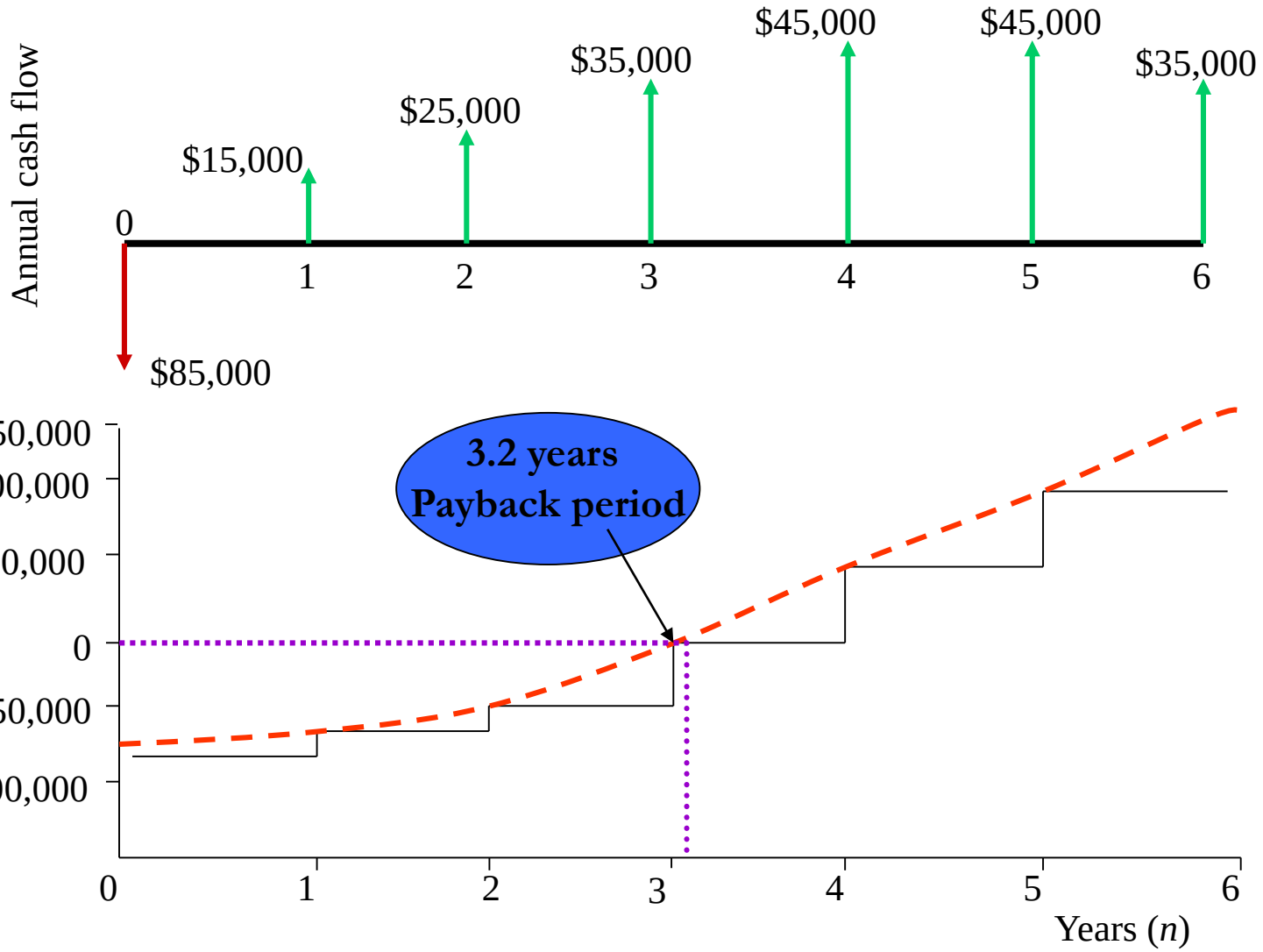
Example 5.3: Conventional Payback Period With Salvage Value

N	Cash Flow	Cum. Cash Flow
0	-$105,000+$20,000	-$85,000
1	$15,000	-$70,000
2	$25,000	-$45,000
3	$35,000	-$10,000
4	$45,000	$35,000
5	$45,000	$80,000
6	$35,000	$115,000



Payback period occurs somewhere between $N = 3$ and $N = 4$.
We say it is 4 years if the end-of-period convention is followed.

Example 5.3: Conventional Payback Period Calculation



Advantages and Disadvantages of the Payback Period Method

- **Advantages**
  - easy to understand
  - adjusts for uncertainty of later cash flows
  - reduces time spent analyzing some alternatives
- **Disadvantages**
  - fails to measure profitability
  - ignores the time value of money
  - biased against long-term projects

Discounted Payback Period

- Principle:

  How fast can I recover my initial investment plus interest?

- Method:

  Based on the cumulative discounted cash flow

- Screening Guideline:

  If the discounted payback period (DPP) is less than or equal to some specified payback period, the project would be considered for further analysis.

- Weakness:

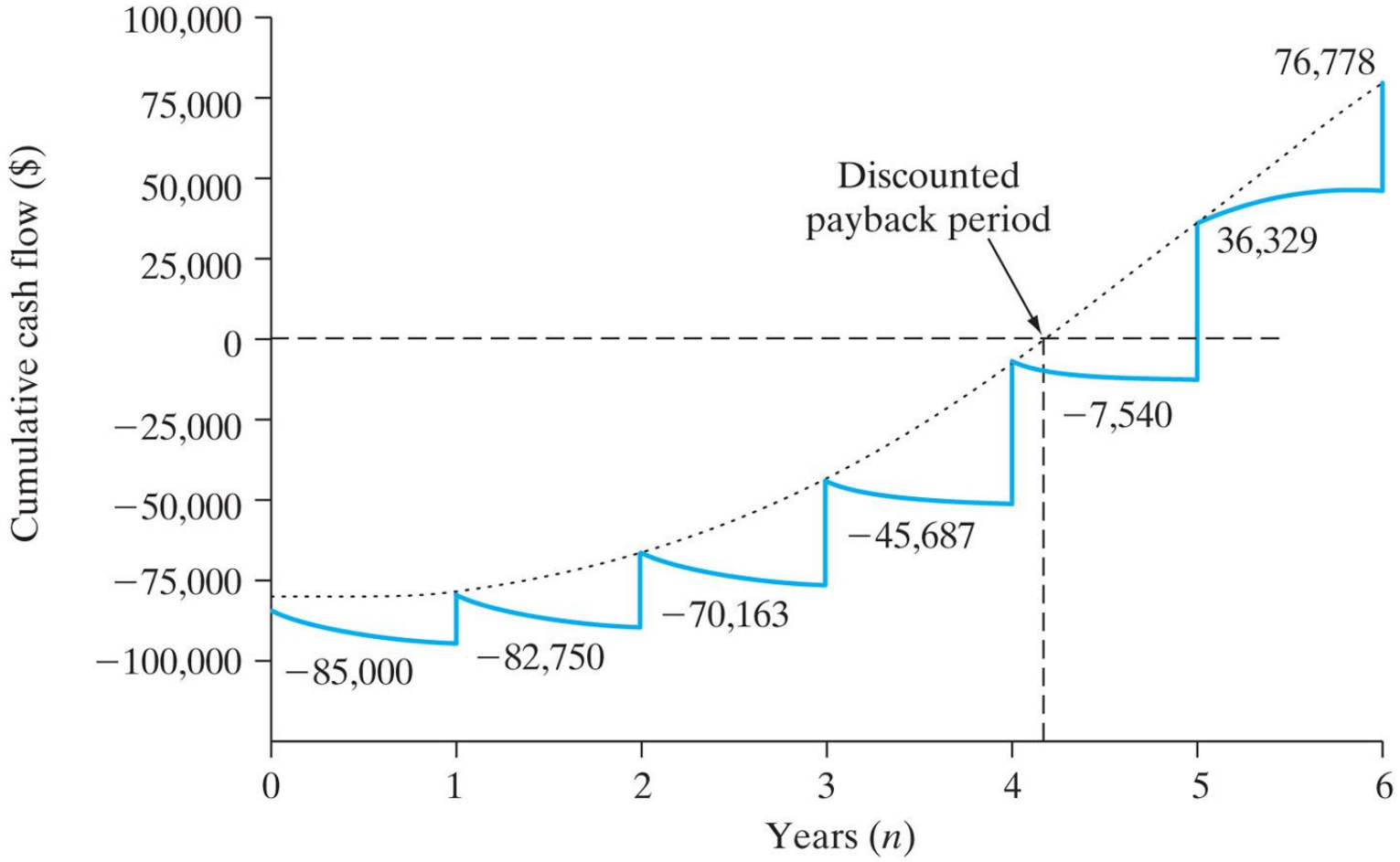
  Cash flows occurring after DPP are ignored

Example 5.3: Discounted Payback Period Calculation

Period	Cash Flow	Cost of Funds (15%)*	Cumulative Cash Flow
0	-$85,000	0	-$85,000
1	15,000	-$85,000(0.15) = -$12,750	-82,750
2	25,000	-$82,750(0.15) = -12,413	-70,163
3	35,000	-$70,163(0.15) = -10,524	-45,687
4	45,000	-$45,687(0.15) =-6,853	-7,540
5	45,000	-$7,540(0.15) = -1,131	36,329
6	35,000	$36,329(0.15) = 5,449	76,778

*** Cost of funds = (Unrecovered beginning balance) X (interest rate)**

Example 5.3: Discounted Payback Period Calculation

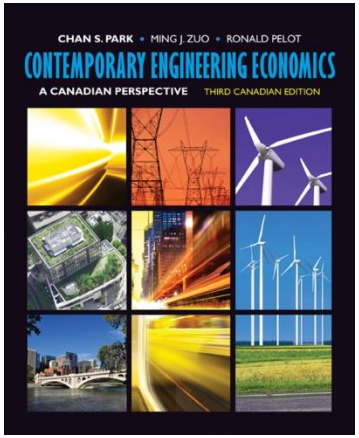


Extra Example: Problem 5.11

Period	Cash Flow	Project Balance
0	-$1,000	-$1,000
1	?	-1,100
2	?	-800
3	460	-500
4	?	0

* Find the interest rate used and the missing cash flows.

Summary



Independent projects are considered one at a time and are either accepted or rejected. Payback periods can be used as a screening tool for liquidity, but we need a measure of investment worth for profitability.