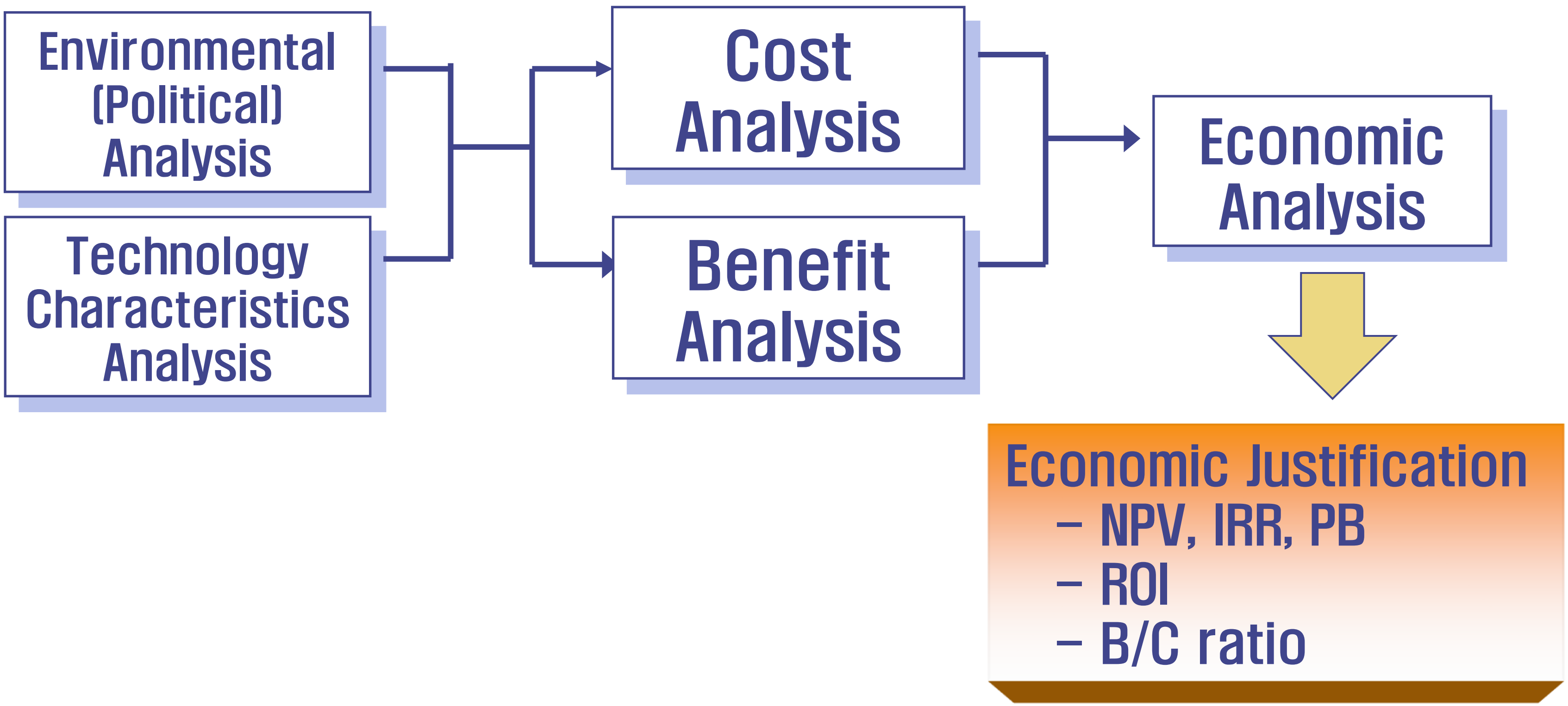
Fundamentals of Financial Method

서울과학기술대학교
SEOUL NATIONAL UNIVERSITY OF SCIENCE & TECHNOLOGY

Procedures for Economic Analysis



Time Value of Money

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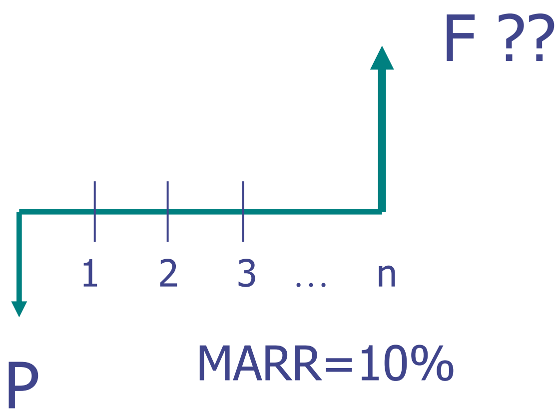
- Value of money changes over time
- Economic equivalence should be introduced to determine the different amount of money at different points in time
- Present Worth: To determine the present worth P of a given future amount F at discount rate i
- Discount rate: financing cost + risk + earning rate + …
  - Minimum Attractive Rate of Return (MARR)
    - A project is not economically viable unless it is expected to return at least the MARR
    - Hurdle rate, Cut-off rate
  - Weighted Average Cost of Capital (WACC)
    - Weighted average cost of equity financing and debt financing
  - Risk Premium : evaluation on the risks involved in the investment

Equivalence of Present & Future Value



$$F_1 = P \times (1+0.1)$$

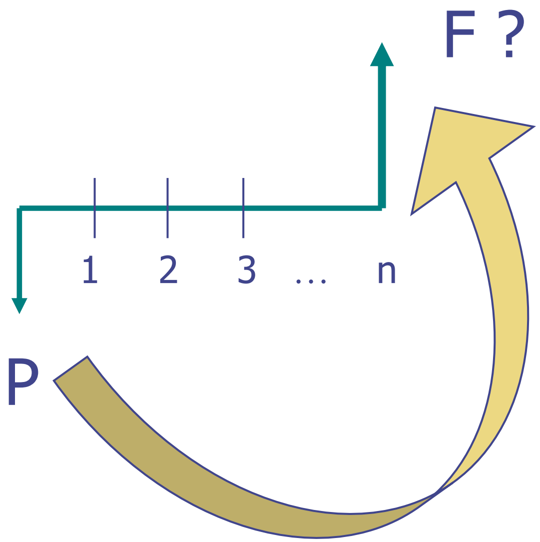
$$F_2 = F_1 \times (1+0.1) = P \times (1+0.1)^2$$

$$\vdots$$

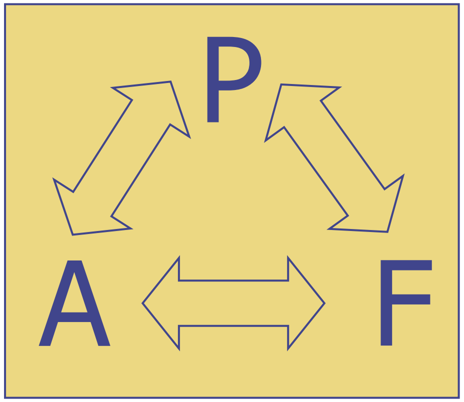
$$F_n = F_{n-1} \times (1+0.1) = P \times (1+0.1)^n$$

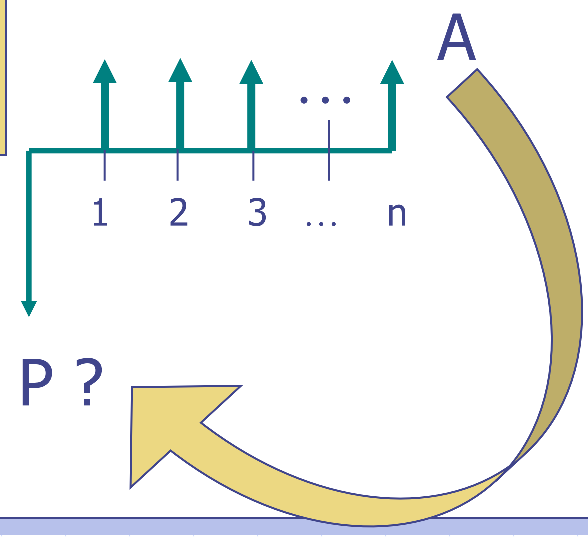
$$P = \frac{F}{(1+0.1)^n}$$

Present Value, Future Value, Annual Value



$$F = P \times (1+i)^n$$





$$P = \sum_{t=1}^{n} \frac{A}{(1+i)^t}$$

Financial Evaluation Methods

- **Financial Evaluation**
  - Profitability
    - **NPV** (Net Present Value)
    - **IRR** (Internal Rate Of Return)
    - **PI** (Profitability Index)
  - Public Benefit
    - **B/C Ratio** (Cost-Benefit Analysis)
  - Stability
    - **PP** (Payback Period Method)

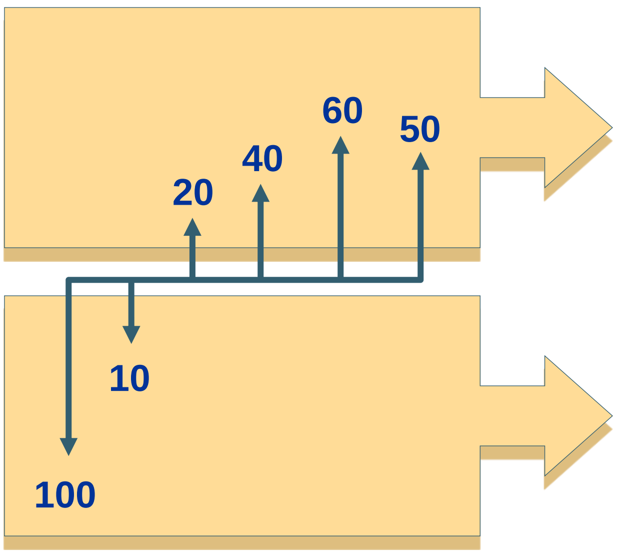
Profitability

Net Present Value : (NPV)

NPV (Net Present Value)	All future costs and revenues are transformed to equivalent monetary units NOW ⇒ **IF NPV ≥ 0, then it is economically viable**

MARR 10%

Present Value



118.61

-

109.09

-

NPV = 9.52

Decision Guideline

NPV = PV $_{in}$ – PV $_{out}$

NPV ≥ 0 → Go

NPV < 0 → No Go

☜ Accepted !!

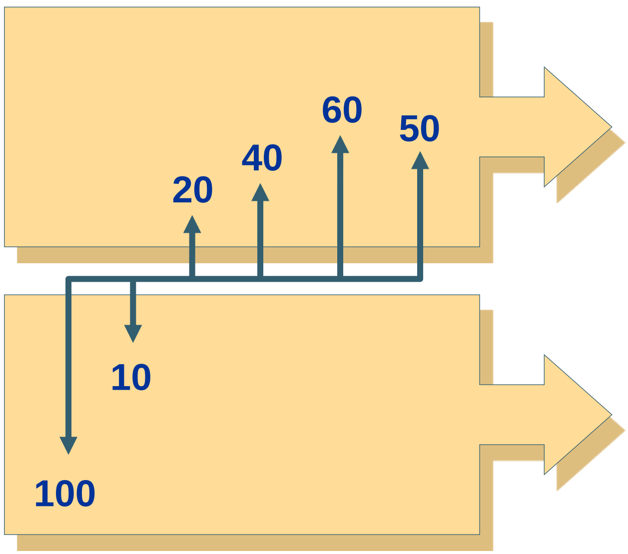
WARNING !

- The comparison must be made for equal-service periods
- NPV does not show earned rate of capital invested

Internal Rate of Return (IRR)

IRR (Internal Rate of Return)	Rate of return that makes NPV zero ⇒ IF IRR ≥ MARR, then it is economically viable

MARR 10%



IRR

$$
\begin{aligned}
0 = & -100 \\
& -10 \div (1+i) \\
& +20 \div (1+i)^2 \\
& +40 \div (1+i)^3 \\
& +60 \div (1+i)^4 \\
& +50 \div (1+i)^5
\end{aligned}
$$

IRR = 12.56%

Decision Guideline

$$\sum \{ NCF_t \div (1+i)^t \} = 0$$

i ≥ MARR → Go

i < MARR → No Go

☜ Accepted!!

WARNING !

- There may exist none or multiple values
- Higher IRR does not guarantee better alternative among the mutually exclusive alt.s

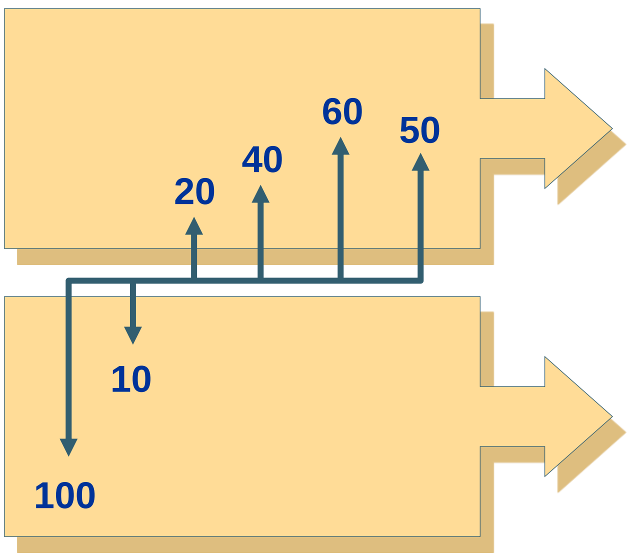
Profitability

Profitability Index(PI)

PI (Profitability Index)	Divide NPV(PW of NCF_t, t=1,2,…,n) by initial invested capital

MARR 10%

NPV of NCF_t



109.52

/

100

PI = 1.10

Decision Guideline

PI = NPV÷IC×100(%)

PI ≥ 1 → Go

PI < 1 → No Go

WARNING !

- **NCF** = **Market size to be created** x **Operating Profit rate** x **Success Rate** x **Project Contribution rate** x **R&D Contribution rate (KISTEP, 2011)**
- Estimation of NCF is rather complex

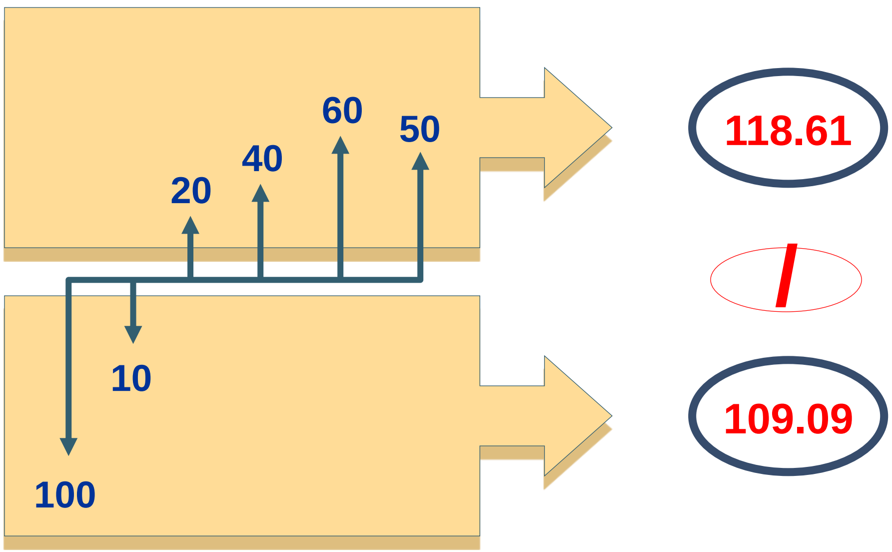
Public Benefit

B/C Ratio Analysis

B/C Ratio (Cost Benefit Analysis)	All costs and benefit estimates will be converted to a common equivalent monetary unit ⇒ **If B/C Ratio ≥ 1, then it is economically viable**

Public discount rate 10%

NPV



B/C Ratio = 1.09

Decision Guideline

$\text{B/C Ratio} = \text{P(A)V}_{\text{benefit}} / \text{P(A)V}_{\text{cost}}$

B/C Ratio ≥ 1 → Go
B/C Ratio < 1 → No Go

☜ Accepted !!

WARNING !

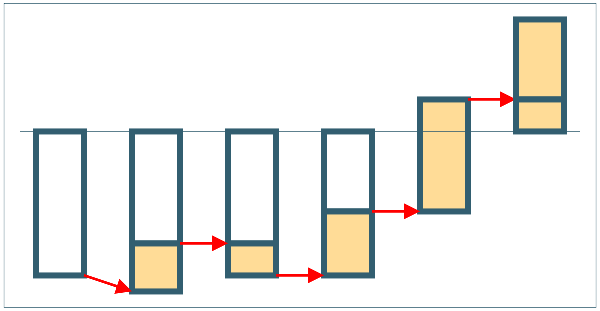
- How to determine public discount rate ?
- How to quantify Intangible cost and benefit ?
- How to consider technology risk premium ?

Payback Period (PP)

Payback Period Method	Estimate time for the revenues to completely recover the initial investment ⇒ A project with shorter PP will be selected

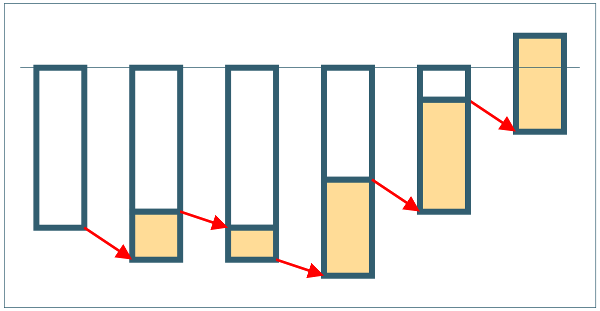
Simple Payback Period

Time	0	1	2	3	4	5
(1) Cash Flow	-100	-10	20	40	60	50
(2) Accumulated CF	-100	-110	-90	-50	10	60



Discounted Payback Period(i= 10%)

Time	0	1	2	3	4	5
(1) Cash Flow	-100	-10	20	40	60	50
(2) Cost of Capital	0	-10	-12	-11	-8	-3
(3) **Accumulated CF**	-100	-120	-108	-80	-28	19



WARNING !

- Supplemental analysis technique used primarily for initial screening prior to a full evaluation by other methods

Spreadsheet Functions

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(1) Present Value, P:	= PV(i%,n,A,F)
(2) Future Value, F:	= FV(i%,n,A,P)
(3) Equal, periodic value, A:	= PMT(i%,n,P,F)
(4) Number of periods, n:	= NPER(i%,A,P,F)
(5) Compound interest rate, i:	= RATE(n,A,P,F)
(6) Compound interest rate, i:	= IRR(first_cell:last_cell)
(7) Present value, any series, P:	= NPV(i%, 2nd_cell:last_cell) + first_cell