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Project Management Seminars

Financial Management of Projects

Reminding Question

- .....in project management and systems engineering, is a deliverable-oriented decomposition of a project into smaller components. (source: Wikipedia)
  a. CPM
  b. PERT
  c. Slacks
  d. WBS
  e. Deliverables planning

Reminding Question

- Relationships in an AON diagram are
  a. events.
  b. slack.
  c. nodes.
  d. dummy.
  e. arcs.

Reminding Question

- Which of the following are the activities with the least slack through the project diagram?
  a. PERT
  b. Slack
  c. Critical Path
  d. CPM
  e. None of the above

Reminding Question

- Significant events in the project lifecycle that have zero duration and that do not consume resources are called _____.

a) Deliverables

b) Tasks

c) Components

d) Milestones

Net Present Value

Opportunity Cost of Capital - *Expected rate of return given up by investing in a project*

Net Present Value - *Present value of cash flows minus initial investments*

Future Value

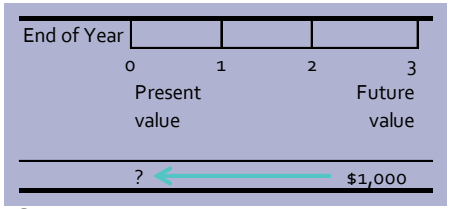
- Formula for computing the FV of S dollars in n years at interest rate i

$$FV = S(1+i)^n$$

- Calculating future values and compound interest is time consuming—Tables help
  - Table values, future value of $1 (n=3; i = 10%) = 1.331
    - 1.331 × $10,000 = $13,310

Present Value

- Value today of a future cash inflow or outflow



- Formula for computing the PV

$$PV = \frac{FV}{(1+i)^n}$$

Present Value

- **Discounted values**: Another name for present value
- **Discount rates**: Interest rates used to compute present values
- **Discounting**: Process of finding present value
- Table Value - Present value of $1 (n=3; i = 10%) = 0.7513; Present value of $13,310
- $13, 310 × 0.7513 = $10,000

Present Value of an Ordinary Annuity

- **Ordinary annuity**: Series of equal cash flows that take place at the end of successive periods of equal length
  - Formula for computing the PV_A

$$PV_A = \frac{1}{i}\left[1 - \frac{1}{(1+i)^n}\right]$$

Present Value of an Ordinary Annuity

- $1,000 paid/received at the end of each year for next 3 years at 6% discount rate

Time 0			Year 1	Year 2	Year 3
$839.60	=	0.8396 x	←		1,000
$890.00	=	0.8900 x	←	1,000	
$943.40	=	0.9434 x	← 1,000		
$2,673.00		$2.6730			

Table 9A-3 (Present Value of an Ordinary Annuity) (n=3; I = 6%)

Net Present Value

Terminology

C_0 = Initial Cash Flow (often negative)

C_1 = Cash Flow at time 1

C_2 = Cash Flow at time 2

C_t = Cash Flow at time t

t = Time period of the investment

r = Opportunity cost of capital

$$NPV = C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_t}{(1+r)^t}$$

Net Present Value: Example 1

Assume you plan to invest $1,000 today and will receive $600 each year for two years (assume the cash is received at the end of the year). What is the net present value if there is a 10% opportunity cost of capital?

$C_0 = \$1{,}000$
$C_1 = \$600$
$C_2 = \$600$
$r = 0.10$

$$NPV = -\$1{,}000 + \frac{\$600}{(1+.10)^1} + \frac{\$600}{(1+.10)^2} = \$41.32$$

Net Present Value: Example 2

Assume you invest $1,000 today and will receive $1,200 in two years (assume the cash is received at the end of the 2nd year). What is the net present value if there is a 10% opportunity cost of capital?

$C_0 = ?$
$C_1 = ?$
$C_2 = ?$
$r = ?$

$$NPV = -\$1{,}000 + \frac{\$0}{(1+.10)^1} + \frac{\$1{,}200}{(1+.10)^2} = -\$8.26$$

Net Present Value Rule

Managers increase shareholders' wealth by accepting all projects that are worth more than they cost. Therefore, managers should only accept projects with a positive net present value.

NPV.wpl

Choosing among Projects

When choosing among mutually exclusive projects, calculate the NPV of each alternative and choose the highest positive-NPV project. Example: Consider two projects, assuming a 10% opportunity cost of capital. Which project should be selected?

	Cash Flows			
Project	C_0	C_1	C_2	NPV
Project 1	- $1,000	$700	$500	$49.59
Project 2	- $1,000	$500	$700	$33.06

Equivalent Annual Annuity

The Choice between Long- and Short-lived Equipment:

Equivalent Annual Annuity:

$$EAA = \frac{\text{present value of cash flows}}{\text{annuity factor}} = \frac{PV_{Cash\ Flows}}{\left[\frac{1}{r} - \frac{1}{r \times (1+r)^t}\right]}$$

Equivalent Annual Annuity: Example

Given the following costs of operating two machines and an 8% cost of capital, select the lower-cost machine using the equivalent annual annuity method.

Project	Cash Flows C_0	C_1	C_2	C_3	NPV	Annuity Factor	EAA
Machine 1	- $3,000	-$800	-$800	-$800	-$5,062	2.577	-$1,964
Machine 2	- $2,000	-$1,300	-$1,300		-$4,318	1.783	-$2,422

Select Machine 1 because its EAA is less negative.
But be careful: Payment periods are not the same!

Payback Method

Payback Period – Time until cash flows recover the initial investment of the project.

Says a project should be accepted if its payback period is less than a specified cutoff period.

Payback Method: Example

The three projects below are available. The company accepts all projects with a 2 year or less payback period. Show how this will impact your decision.

Project	Cash Flows C_0	C_1	C_2	C_3	Payback Period	NPV (@ 10%)
Project 1	- $1,000	$700	$500		1.6 years	$49.59
Project 2	- $1,000	$500	$700		1.7 years	$33.06
Project 3	- $1,000	$500	$700	$700	1.7 years	$558.98

Drawback of Payback Rule

1. Though Projects 1, 2 and 3 have payback periods less than 2 years, notice the differences in NPV.

2. The Payback Rule ignores the time value of money.

Other Investment Criteria: IRR

Internal Rate of Return (IRR) –

Terminology

C_0 = Initial Cash Flow (typically negative)

C_l = Cash Flow at time 1

C_2 = Cash Flow at time 2

C_t = Cash Flow at time t

t = Time period of the investment

IRR = Internal Rate of Return

$$0 = C_0 + \frac{C_1}{(1+IRR)^1} + \frac{C_2}{(1+IRR)^2} + \ldots + \frac{C_t}{(1+IRR)^t}$$

Internal Rate of Return: Example

Project	Cash Flows C_0	C_1	C_2	NPV (@ 10%)	IRR
Project 1	- $1,000	$700	$500	$49.59	13.90%
Project 2	- $1,000	$500	$700	$33.06	12.32%

Project 1

$$0 = -1{,}000 + \frac{700}{(1+IRR)^1} + \frac{500}{(1+IRR)^2}$$

$$IRR = 13.90\%$$

Project 2

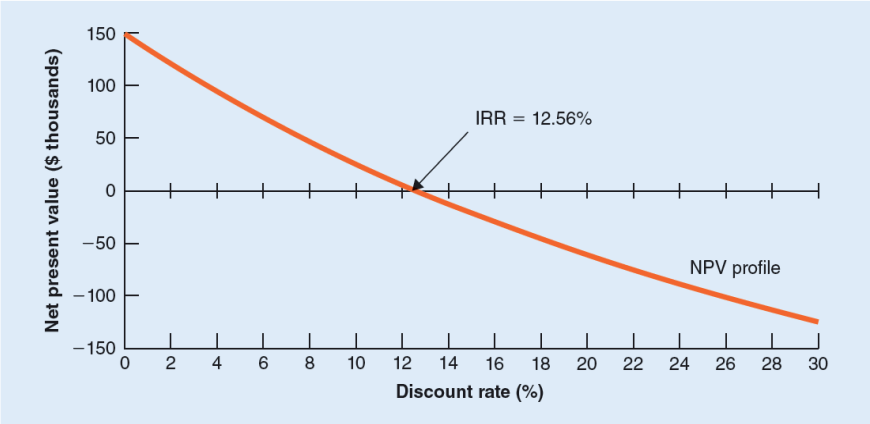
$$0 = -1{,}000 + \frac{500}{(1+IRR)^1} + \frac{700}{(1+IRR)^2}$$

$$IRR = 12.32\%$$

Internal Rate of Return Rule

Managers increase shareholders' wealth by accepting all projects which offer a rate of return that is higher than the opportunity cost of capital.

NPV & Internal Rate of Return



IRR vs. NPV: Mutually Exclusive Projects

Pitfall – Mutually Exclusive Projects

Project	C_0	C_1	C_2	C_3	IRR	NPV@7%
Initial Proposal	-350,000	400,000			14.29%	$ 23,832
Revised Proposal	-350,000	16,000	16,000	466,000	12.96%	$ 59,323

Other Criteria: Profitability Index

$$\text{Profitability Index} = \frac{\text{NPV}}{\text{Initial Investment}}$$

Project	Cash Flows C_0	C_1	C_2	NPV (@ 10%)	Profitability Index
Project 1	- $1,000	$700	$500	$49.59	.0496
Project 2	- $1,000	$500	$700	$33.06	.0331

What-if Testing

- Sensitivity Analysis – *Analysis of the effects on project profitability of changes in sales, costs, etc.*
- Scenario Analysis – *Analysis given a particular combination of assumptions.*
- Simulation Analysis – *Estimation of the probabilities of different possible outcomes.*
- Break-Even Analysis – *Analysis of the level of sales at which the company breaks even.*

Sensitivity & Scenario Analysis

Sensitivity Analysis: Investigate the effects of the parameter changes on project profitability, costs, etc. Do the optimal solution(s) change?

Scenario Analysis – Project analysis given a particular combination of assumptions/scenarios.

Scenario Analysis – Example

Base Case: Expected cash flows from a new project (with 8% Opportunity Cost of Capital; 40% average tax rate; variable costs are a constant 80% of sales; all numbers in $000s)

	Year 0	Years 1-12
Investment	-5,400	
Sales		16,000
Variable Costs		(12,800)
Fixed Costs		(2,000)
Depreciation		(450)
Pretax profit		750
Taxes		(300)
Profit after tax		450
Operating cash flow		900
Net Cash Flow	-5,400	900

Calculate:

NPV = $1,382.47

IRR = 12.7%

Payback Period = 6 years

Profitability Index = .256

Scenarios

Possible Range of Variables

	Range		
Variable	Pessimistic	Expected	Optimistic
Sales	14,000	16,000	18,000
Fixed Costs	2,500	2,000	1,500

Scenario Analysis: Changing Sales

NPV = -$426

NPV = $3,191

Pessimistic Case—**Sales = $14,000**

Pessimistic Case	Year 0	Years 1-12
Investment	-5,400	
Sales		14,000
Variable Costs		11,200)
Fixed Costs		(2,000)
Depreciation		(450)
Pretax profit		350
Taxes		(140)
Profit after tax		210
Operating cash flow		660
Net Cash Flow	-5,400	660

Optimistic Case—**Sales = $18,000**

Optimistic Case	Year 0	Years 1-12
Investment	-5,400	
Sales		18,000
Variable Costs		(14,400)
Fixed Costs		(2,000)
Depreciation		(450)
Pretax profit		1,150
Taxes		(460)
Profit after tax		690
Operating cash flow		1,140
Net Cash Flow	-5,400	1,140

Scenario: Changing Fixed Costs

Pessimistic—**Fixed Costs = $2,500**

NPV = -$878

Pessimistic Case	Year 0	Years 1-12
Investment	-5,400	
Sales		16,000
Variable Costs		(12,800)
Fixed Costs		(2,500
Depreciation		(450)
Pretax profit		250
Taxes		(100)
Profit after tax		150
Operating cash flow		600
Net Cash Flow	-5,400	600

Optimistic—**Fixed Costs = $1,500**

NPV = $3,643

Optimistic Case	Year 0	Years 1-12
Investment	-5,400	
Sales		16,000
Variable Costs		(12,800)
Fixed Costs		(1,500)
Depreciation		(450)
Pretax profit		1,250
Taxes		(500)
Profit after tax		750
Operating cash flow		1,200
Net Cash Flow	-5,400	1,200

Break-Even Analysis

Break-Even Analysis – *Analysis of the level of sales at which the project breaks even.*

Why is this useful?

Break-Even Analysis – Example

X = Number of Units Sold

-Determine the number of units that must be sold in order to break even, on an NPV basis.

-Suppose each unit has a price point of $45,000

-All other variables are at their base case levels

	Year 0	Years 1-12
Investment	$5,400	
Sales		$45\times X$
Var. Cost		$(36\times X)$
Fixed Costs		$(2,000)$
Depreciation		(450)
Pretax Profit		$9\times X-2,450$
Taxes (40%)		$3.6\times X-980$
Net Profit		$5.4\times X-1,470$
Net Cash Flow	-5,400	$5.4\times X-1,020$

Break-Even Point: Accounting

Break-Even Point – The break-even point is the number of units sold where net profits = $0.

$$0 = 5.4\times X - 1,470$$

$$X = \frac{1,470}{5.4} = 273 \text{ Units}$$

What does the accounting break-even point not account for?

Break-Even Point: Finance

NPV Break-Even Point (Finance):

How can we find the present value of future cash flows? As long as cash flows are equal each year, we can use the Annuity Factor.

Step 1: PV (Cash Flows) = Annuity Factor × Yearly Cash Flows

$$\text{where Annuity Factor} = \frac{1-(1+r)^{-t}}{r}$$

$$\text{Example: PV(Cash Flows)} = \frac{1-(1+.08)^{-12}}{.08} \times [5.4 \times X - 1{,}020]$$

Break-Even Analysis

Recall: the break-even point is the number of units sold where NPV = $0.

Step 2: PV (Cash Flows) = Initial Investment

$$\text{Example-} \quad \frac{1-(1+.08)^{-12}}{.08} \times [5.4 \times X - 1{,}020] = 5{,}400$$

$$X = 322 \text{ units}$$

Real Options

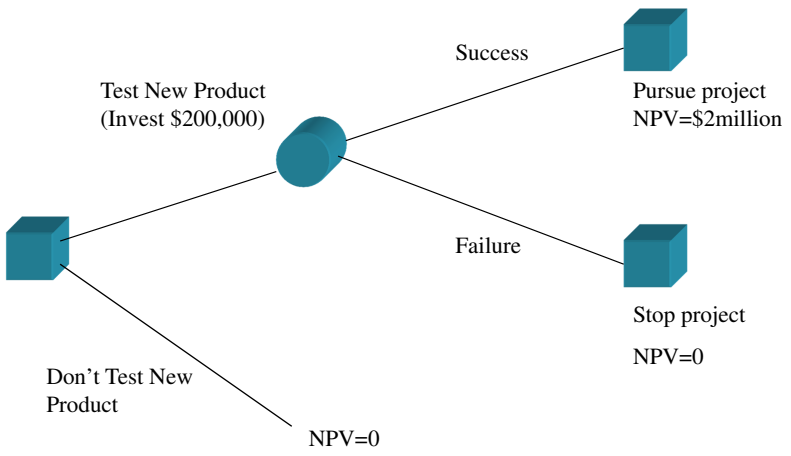
1. Option to expand
2. Option to abandon
3. Timing option
4. Flexible production facilities

Real Options & Value of Flexibility

Decision Trees – Diagram of sequential decisions and possible outcomes.

- Decision trees help companies determine their options by showing various choices and outcomes.
- The option to avoid a loss or produce extra profit has value.
- The ability to create an option has value that can be bought or sold.

Decision Trees: Example



Brealey, Principles of Corporate Finance

Project Budgets

A budget is a quantitative expression of a plan of action that imposes the formal structure of an organization.

Managers use budgeting as an effective cost-management tool.

Budgets facilitate planning and coordination.

Benefits of Budgets

Compel managers to think ahead

Provide an opportunity to reevaluate existing activities and evaluate new ones.

Aid managers in communicating objectives and coordinating actions across the organization.

Provide benchmarks to evaluate subsequent performance.

Types of Budgets

Strategic plan

Long-range planning

Master budget

Capital budget

Continuous budget

Strategic Plan

The most forward-looking budget is the strategic plan, which sets the overall goals and objectives of the organization.

The strategic plan leads to long-range planning, which produces forecasted financial statements for five- to ten-year periods.

Long-Range Plans

Long-range plans…

are coordinated with capital budgets, which detail the planned expenditures for facilities, equipment, new products, and other long-term investments.

Master budgets link to both long-range plans and short-term budgets.

Master Budget

The master budget is a detailed and comprehensive analysis of the first year of the long-range plan. It summarizes the planned activities of all subunits of an organization.

- Sales
- Purchases
- Production
- Distribution

Steps in Preparing the Master Budget

The principal steps in preparing the master budget:

1. Basic data
   a. Sales budget
   b. Cash collections from customers
   c. Purchases and cost-of-goods sold budget
   d. Cash disbursements for purchases
   e. Operating expense budget
   f. Cash disbursements for operating expenses

Steps in Preparing the Master Budget

2. Operating Budget: Prepare budgeted income statement using basic data in step 1.

3. Financial Budget: Prepare forecasted financial statements:
a. Capital budget
b. Cash budget
c. Budgeted balance sheet

Continuous Budget

Rolling budgets…

are a common form of master budgets that add a month in the future as the month just ended is dropped.

Bankruptcy

- Declared by companies that lose too much cash
- Companies seek court protection from its creditors under federal law
  - Allows a firm to delay paying certain obligations while it negotiates with its creditors to reorganize its business and settle its debts

Expected Cash Balance

If expected cash is **greater** than minimum needed → Invest excess

If expected cash is **less** than minimum needed → Consider borrowing

Cash Budget
Beginning cash balance
Budgeted cash receipts:
Collections from customers
Dividends from investments
Sale of plant and equipment
Budgeted cash payments:
Purchases of inventory
Operating expenses
Purchase of long-term assets
Payment of dividends
Payment of long-term debt
Cash available (needed)
Budgeted cash balance, end of period
Cash available for investing or (new financing needed)

Reminding Question

- The project's budget should _____.

a) Associate resource use with the achievement of organizational goals
b) Allow funds to be spent without linkage to achievement
c) Not reflect the timing of expenses associated with the use of resources
d) Never be changed during project execution

Reminding Question

- In order to develop a budget, the PM must forecast _____.

a) The type and quantities of resources required
b) The labor rates and prices of resources required
c) The type, quantities, prices/rates of resources and contingency funds
d) The expected monetary value and relevant uncertainty

Reminding Question

- If projects include repetitive tasks with significant human input, the _____ rate should be factored into the cost estimate.

a) Inflation
b) Hurdle
c) Interest
d) Learning

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