PROJECT MANAGEMENT

Topic 9

Project Selection

Contents

Project Selection

- Evaluate needs, costs, benefits
- Select project
  - Develop criteria
  - List assumptions
  - Gather data
  - Evaluate each opportunity
- Combine “gut” feelings and quantitative information to make decision.

Project Selection

Project evaluation and selection			
Evaluation criteria	Project A	Project B	Project C
Investment ($)	700.000$	2.100.000$	1.200.000$
Return in Investment	9.1%	18.3%	11.5%
Time to Market	10 months	16 months	12 months
Increase in Market share	2%	5%	3%
Risk	Low	High	Medium
Chance of Success	High	Medium	High

Comments

Project A: Major competior already has similar product and may reduce price

Project B: New technology may not work as expected.

Project C: Product features may not be accepted in some international markets.

Non-financial methods

A set of Criteria in Project Selection

For example

- Alignment with company goals
- Anticipated sales volume
- Increase in market share
- Establishment of new markets
- Anticipated retail price
- Investment required
- Estimated manufacturing cost per unit
- ….

Non-financial methods

Non-financial: projects of strategic importance to the firm.

- Checklist model
- Simplified scoring models
- Analytic hierarchy process
- Profile models.

Non-financial methods

Checklist Model

List of criteria applied to possible projects.

- ✓ Requires agreement on *criteria*
- ✓ Assumes all criteria are *equally important*

☞ *Checklists are valuable for recording opinions and encouraging discussion.*

Non-financial methods

Checklist Model

Performance on Criteria				
Project	Criteria	High	Medium	Low
Project α	Cost	X		
	Profit potential			X
	Time to market		X	
	Development risks			X
Project β	Cost		X	
	Profit potential		X	
	Time to market	X		
	Development risks		X	
Project γ	Cost			X
	Profit potential			X
	Time to market	X		
	Development risks		X	

Non-financial methods

Scoring Models

- Each project receives a score that is the weighted sum of its grade on a list of criteria.
- Scoring models require:
  - Agreement on *criteria*
  - Agreement on *weights* for criteria
  - *A score* assigned for each criteria

$$Score = \sum (Weight \times Score)$$

Relative scores can be misleading!

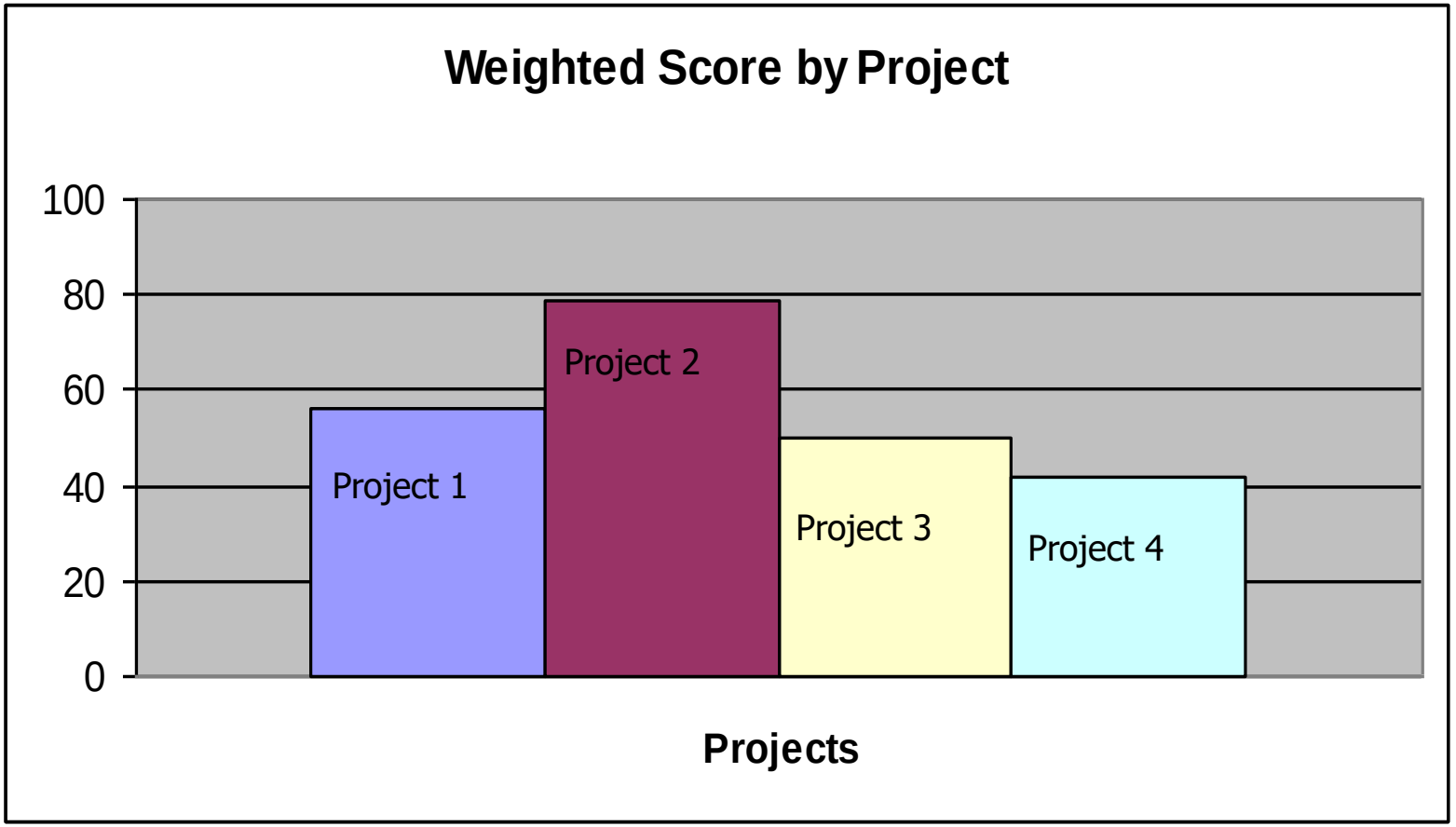
Non-financial methods

Scoring Models

Criteria	weight	Project 1	Project 2	Project 3	Project 4
Support key business objectives	25%	90	90	50	20
Has strong internal sponsor	15%	70	90	50	20
Has strong customer support	15%	50	90	50	20
Uses realistic level of technology	10%	25	90	50	70
Can be implemented in one year or less	5%	20	20	50	90
Provides positive NPV	20%	50	70	50	50
Has low risk in meeting scope, time, and cost go	10%	20	50	50	90
Weighted Project Scores	100%	56	78.5	50	41.5

Non-financial methods

Scoring Models



Non-financial methods

Analytic Hierarchy Process

The AHP is a four step process:

1. Construct a hierarchy of *criteria and subcriteria*
2. *Allocate weights* to criteria
3. Assign *numerical values* to evaluation dimensions
4. *Scores determined* by summing the products of numeric evaluations and weights.

Contents..

1. Project selection
2. Non-financial methods
3. Financial methods

Financial Models

Based on the time value of money principal

- Payback period (PP) – Thời gian hoàn vốn
- Net present value (NPV) - Hiện giá lợi ích ròng
- Internal rate of return (IRR) – Nội suất thu hồi vốn

☞ *All of these models use discounted (chiết khấu) cash flows*

Financial Models

Payback Period

- Determines *how long* it takes for a project to reach a breakeven point.
- The pay-out period measures the number of years it will take for the positive net cashflows to repay the investment.

$$Payback\ Period = \frac{Investment}{Annual\ Cash\ Savings}$$

  - Cash flows should be discounted
  - Lower numbers are better ***(faster payback)***

Financial Models

Payback Period

Example: A project requires an initial investment of $200.000 and will generate cash savings of $75.000 each year for the next three years; what is the payback period?

Solution

Year	Cash Flow	Cumulative
0	($200.000)	($200.000)
1	$75.000	($125.000)
2	$75.000	($50.000)
3	$75.000	$25.000

$$PP = \frac{200.000}{75.000} = 2.67 \; years$$

$$^{(*)} rate\ of\ \ return = \frac{1}{2.67} = 37\%$$

(*) the reciprocal of payback yields the average rate of return

Financial Models

Pay-out or Pay-back period

- The pay-out period measures the number of years it will take for the undiscounted net benefits (positive net cashflows) to repay the investment.
- A more sophisticated version of this rule compares the discounted benefits over a given number of years from the beginning of the project with the discounted investment costs.
- An arbitrary limit is set on the maximum number of years allowed and only those investments having enough benefits to offset all investment costs within this period will be acceptable.

Financial Models

Advance

- Simple
- Usefull with the high risk project, need a fast payback.

Disadvance

Do not care the cash flow after the payback period.

Financial Models

Payback Period

Project A	Year	Cash Flow	Cum. Cash Flow
	0	($500.000)	($500.000)
	1	50.000	(450.000)
	2	150.000	(300.000)
	3	350.000	50.000
	4	600.000	650.000
	5	500.000	1.150.000

Payback = 2.857 years

Rate of Return = 35%.

Financial Models

Payback Period

Project B	Year	Cash Flow	Cum. Cash Flow
	0	($500.000)	($500.000)
	1	75.000	(425.000)
	2	100.000	(325.000)
	3	150.000	(175.000)
	4	150.000	(25.000)
	5	900.000	875.000

Payback = 4.028 years

Rate of Return = 24.8%.

Financial Models

Example: r = 10%

Cash flow

	0	**1**	**2**	**3**	**4**	**5**	**pp** (yr)
PV[NCF(A)]	-1000	500	300	200	100	60	3
PV[NCF(B)]	-1000	200	300	300	400	300	3.5
$1/(1+0.1)^t$	1	0.909	0.826	0.751	0.683	0.621	
PV_A	-1000	454.5	247.8	150.2	68.3	37.26	-41.94
PV_B	-1000	181.8	247.8	225.3	273.2	186.3	114.4

☞ pp(A) < pp(B) but NPV(B) > NPV(A).

Financial Models

Net Present Value (NPV)

Projects the change in the firm's stock value if a project is undertaken.

$$NPV = I_o + \sum \frac{F_t}{(1 + r + p_t)^t}$$

Higher NPV values are better!

where

F_t = *net cash flow for period* t

r = *required rate of return*

I_0 = *initial cash investment*

p_t = *inflation rate during period* t

Financial Models

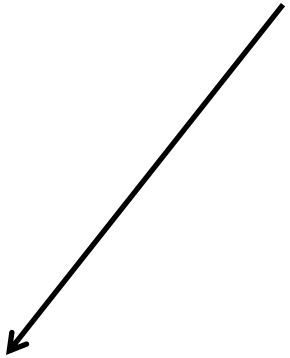
Net Present Value

Should you invest $60.000 in a project that will return $15.000 per year for five years? You have a minimum return of 8% and expect inflation to hold steady at 3% over the next five years.

Solution

Year	Net flow	Discount	NPV
0	-$60.000	1.0000	-$60.000
1	$15.000	0.9009	$13.514
2	$15.000	0.8116	$12.174
3	$15.000	0.7312	$10.968
4	$15.000	0.6587	$9.881
5	$15.000	0.5935	$8.902
			-$4.562

The NPV column total is negative, so don't invest!



Financial Models

1. The NPV is the algebraic sum of the discounted values of the incremental expected positive and negative net cashflows over a project's anticipated lifetime.

2. What does net present value mean?

- Measures the change in wealth created by the project.
- If this sum is equal to zero, then investors can expect to recover their incremental investment and to earn a rate of return on their capital equal to the private cost of funds used to compute the present values.
- Investors would be no further ahead with a zero-NPV project than they would have been if they had left the funds in the capital market.

Financial Models

r ≠ constant

Year	0	1	2	3	4
Net Cash Flow	-1000	200	300	350	1440
r	18%	16%	14%	12%	10%

$$NPV^0 = -1000 + \frac{200}{1.18} + \frac{300}{(1.18)(1.16)} + \frac{350}{(1.18)(1.16)(1.14)} + \frac{1440}{(1.18)(1.16)(1.14)(1.12)} = 436.91$$

$$NPV^1 = -1000(1.18) + 200 + \frac{300}{1.16} + \frac{350}{(1.16)(1.14)} + \frac{1440}{(1.16)(1.14)(1.12)} = 515.55$$

$$NPV^2 = -1000(1.18)(1.16) + 200(1.16) + 300 + \frac{350}{(1.14)} + \frac{1440}{(1.14)(1.12)} = 598.04$$

Note: All of the transactions are done at the beginning of the year.

Financial Models

r = 10%; NPV?

Cash flow

Year	0	1	2	3	4	5
B_t		900	1500	1500	1500	1700
C_t	2000	500	800	800	800	800
$B_t - C_t$	-2000	400	700	700	700	900
$1/(1+0.1)^t$	1	0.909	0.826	0.751	0.683	0.621
PV(NCF) NPV =	-2000 459$	363.6	587.2	525.7	478.1	558.9

☞ NPV in EXCEL = NPV(r%,CF_1:CF_n)

Financial Models

Net Present Value (NPV): Use as a decision criterion to answer following.

a. To reject projects?

b. Select project(s) under a budget constraint?

c. Compare mutually exclusive projects?

Financial Models

a. Reject a projects?

Rule: *"Do not accept any project unless it generates a positive net present value"*

Examples

Project A: Present Value Costs $1 million, NPV + $70,000

Project B: Present Value Costs $5 million, NPV - $50,000

Project C: Present Value Costs $2 million, NPV + $100,000

Project D: Present Value Costs $3 million, NPV - $25,000

Result

Only projects A and C are acceptable.

Financial Models

b. When You Have a Budget Constraint?

Rule: *"Within the limit of a fixed budget, choose that subset of the available projects which maximizes the net present value"*

Example: If budget constraint is $4 million and 4 projects with positive NPV.

Project E:	Costs $1 million, NPV + $60,000
Project F:	Costs $3 million, NPV + $400,000
Project G:	Costs $2 million, NPV + $150,000
Project H:	Costs $2 million, NPV + $225,000

Result

- FG and FH are impossible, as they cost too much.
- EG and EH are within the budget.
- Combination EF, which has a total NPV of $460,000. GH is also possible, but its NPV of $375,000 is not as high as EF.

Financial Models

c. When You Need to Compare Mutually Exclusive Projects?

Rule: *"In a situation where there is no budget constraint but a project must be chosen from mutually exclusive alternatives, we should always choose the alternative that generates the largest net present value"*

Example

Assume that we must make a choice between the following three mutually exclusive projects.

Project I: PV costs $1.0 million, NPV $300,000

Project J: PV costs $4.0 million, NPV $700,000

Projects K: PV costs $1.5 million, NPV $600,000

Result

Projects J should be chosen because it has the largest NPV.

Financial Models

Internal Rate of Return (IRR)

A project must meet a *minimum rate of return* before it is worthy of consideration.

$$IO = \sum_{t=1}^{n} \frac{ACF_t}{(1+IRR)^t}$$

Higher IRR values are better!

where

ACF_t = *annual after tax cash flow for time period t*

IO = *initial cash outlay*

n = *project's expected life*

IRR = *the project's internal rate of return*

Financial Models

Internal Rate of Return

A project that costs $40.000 will generate cash flows of $14.000 for the next four years. You have a rate of return requirement of 15%; does this project meet the threshold?

Year	Net flow	Discount	PV
0	-$40.000	1.0000	-$40.000
1	$14.000	0.8696	$12.174
2	$14.000	0.7561	$10.586
3	$14.000	0.6575	$9.205
4	$14.000	0.5718	$8.005
			-$30.30

This table has been calculated using a discount rate of 15%

[1] IRR_A: $-40.000 + PV_i/(1 + K_A)^5 = 0$ which implies that K_A = …..

☞ The project doesn't meet our 15% requirement and *should not be considered further*.

Financial Models

Internal Rate of Return (nội suất thu hồi vốn k)

Còn được gọi suất sinh lợi nội tại là suất chiết khấu làm cho hiện giá lợi ích ròng của dự án bằng không.

$$IRR = k \Rightarrow NPV = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+k)^t} = 0$$

Note: IRR là tỷ số toán học, not finance.

Calculate IRR

Net flowcash (dòng lưu ròng) NCF :

$(B_0 - C_0), (B_1 - C_1), (B_2 - C_2), \ldots\ldots\ldots, (B_n - C_n)$

Hay viết ngắn gọn: $CF_0, CF_1, CF_2, \ldots\ldots\ldots, CF_n$

IRR in EXCEL =IRR(CF_0:CF_n)

Financial Models

Sử dụng IRR

(a) Nếu IRR > MARR(Minimum acceptable rate of return), dự án nên được tiến hành.

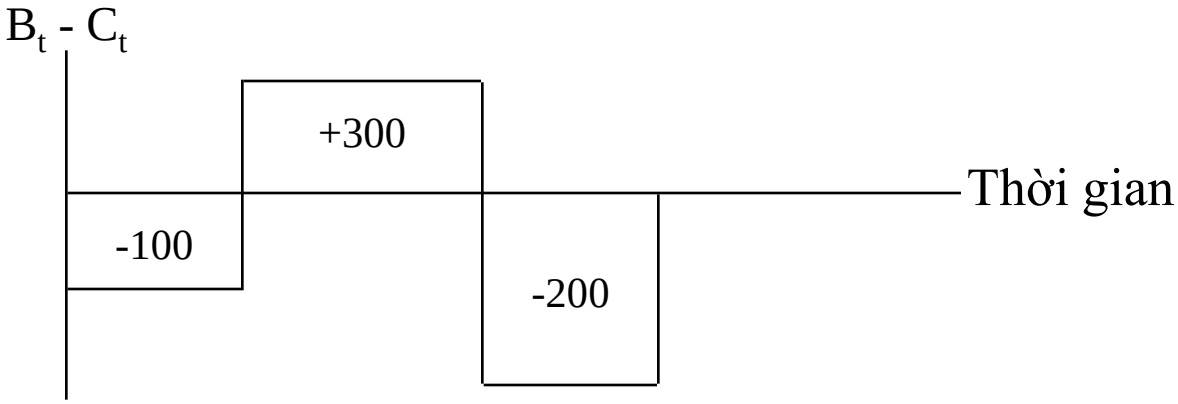
(b) Sử dụng IRR để phân hạng dự án. Dự án có chỉ số IRR lớn nên được chọn.

(c) Lợi thế của IRR là không chỉ sử dụng dữ liệu từ dự án.

Financial Models

Lưu ý khi sử dụng IRR

Vấn đề 1: Một dự án có thể có nhiều tỷ số IRR.



Solution 1

$K = 100\%; \quad NPV = -100 + 300/(1+1) - 200/(1+1)^2 = 0$

Solution 2

$K = 0\%; \quad NPV = -100 + 300/(1+0) - 200/(1+0)^2 = 0$

Financial Models

Vấn đề 2: NPV và IRR đưa ra các kết luận khác nhau

Năm	0	1	2	3	…	…	∞
Dự án A	-2000	600	600	600	600	600	600
Dự án B	-20000	4000	4000	4000	4000	4000	4000

Chi phí cơ hội của quỹ = 10%

NPV_A^0: 600/0.1 – 2000 = 6000 – 2000 = 4.000

NPV_B^0: 4000/0.1 – 20000 = 40000 – 20000 = 20.000

Vậy $NPV_B^0 > NPV_A^0$

IRR_A: $600/K_A - 2000 = 0$ hay $K_A = 0.3$

IRR_B: $4000/K_B - 20000 = 0$ hay $K_B = 0.2$

Vậy $IRR_A > IRR_B$

☞NPV và IRR đưa ra kết luận khác nhau khi so sánh 2 dự án có kích thước khác nhau.

Financial Models

Vấn đề 3: Dự án có thời gian sống khác nhau và loại trừ lẫn nhau.

Chi phí cơ hội của quỹ đầu tư: 8%.

Dự án A: Chi phí đầu tư: 1000 $ ở năm 0

Lợi nhuận: 3200$ ở năm thứ 5.

Dự án B: Chi phí đầu tư: 1000 ở năm 0.

Lợi nhuận: 5200$ ở năm thứ 10

NPV_A^0: $-1000 + 3200/(1.08)^5 = 1177.86$

NPV_B^0: $-1000 + 5200/(1.08)^{10} = 1408.60$

Vậy $NPV_B^0 > NPV_A^0$

IRR_A: $-1000 + 3200/(1 + K_A)^5 = 0$ tức $K_A = 0.262$

IRR_B: $-1000 + 5200/(1 + K_B)^{10} = 0$ tức $K_B = 0.179$

Vậy $K_A > K_B$

☞NPV và IRR đưa ra kết luận khác nhau khi so sánh 2 dự án có thời gian sống khác nhau.

Financial Models

Vấn đề 4: Cùng dự án nhưng bắt đầu ở các thời điểm khác nhau.

Dự án A: Chi phí đầu tư = 1000$ ở năm 0

Lợi nhuận = 1500$ ở năm 1

Dự án B: Chi phí đầu tư = 1000$ ở năm 5

Lợi nhuận = 1600$ ở năm 6

NPV_A^0: -1000 + 1500/(1.08) = 388.88

NPV_B^0: -1000 + 1600/$(1.08)^6$ = 327.68

Vậy $NPV_A^0 > NPV_B^0$

IRR_A: -1000 + 1500/(1 + K_A) = 0 tức K_A = 0.5

IRR_B: -1000 /$(1 + K_B)^5$ + 1600/$(1 + K_B)^6$ = 0 tức K_B = 0.6

Vậy $K_B > K_A$

☞NPV và IRR đưa ra kết luận khác nhau khi thời điểm bắt đầu của một dự án là khác nhau.

Home work

r = 12%

Cash flow

Year	0	1	2	3	4	5
NCF(A)	-1000	500	300	200	100	60
NCF(B)	-1000	200	300	300	400	300
NCF(C)	-1000	100	200	300	400	500

a. NPV

b. PP

c. IRR (year 1, year 5)

d. Chose project (A, B or C?)