

Project Analysis

Unit 2

By

Deep Raj Bhujel

Introduction

- a systematic method for collecting, analyzing, and using information to answer questions about projects, policies and programs, particularly about their effectiveness and efficiency.
- important for answering the following questions
 - what progress has been made?
 - were the desired outcomes achieved? Why?
 - whether the project can be refined to achieve better outcomes?
 - do the project results justify the project inputs?

- done by
 - Senior management
 - Project manager/coordinator
 - Team leader
- e.g.
 - Strategic assessment
 - Technical assessment
 - Economic assessment

Strategic Assessment

- Strategic planning is defined as an organization's process of defining its strategy , or direction and making decisions on allocating its resources to pursue this strategy, including its capital and people
- it deals with:
 - what do we do?
 - for whom do we do it?
 - how do we excel?
- Strategic assessment is the first criteria for project evaluation
 - For evaluating and managing the projects, the individual projects should be seen as components of a programme. Hence need to do programme management

- **Programme management:**

- A programme in this context is a “collection of projects that all contribute to the same overall organization goals”.

- Evaluating of project depends on:

- How it contributes to programme goal.
- It is viability [capability of developing or useful].
- Timing.
- Resourcing.

- For successful strategic assessment, there should be a strategic plan which defines:

- Organization's objectives.
- Provides context for defining programme.
- Provides context for defining programme goals.
- Provides context for accessing individual project.

- **Typical issues and questions to be considered during strategic assessment:**

1. Objectives
2. IS plan
3. organization structure
4. MIS
5. Personnel
6. image

- **Portfolio management**

- Project Portfolio management provides an overview of all the projects that an organization is undertaking or is considering.
- It prioritizes the allocation of resources to projects and decides which projects should be accepted and which existing ones should be dropped.

- The three key aspects of Project Portfolio management are:

1. Portfolio definition
2. Portfolio management
3. Portfolio optimization

Technical Assessment

- the second criteria for evaluating the project.
- evaluates functionality against available:
 - Hardware
 - Software
- Limitations
 - Nature of solutions produced by strategic information systems plan
 - Cost of solution. Hence undergoes cost-benefit analysis.
- also referred as Technology Evaluation. Include: equipment, tools, products, processes, raw materials, skills, and ways of organizing production.

- **Why it is important:**

- It's a tool to Identify the Problem
- It's a tool to Identify the Best Solution
- It's a tool for Communication

- **Purpose:**

- Technology assessment provides an organization with information about the profitability of current technology as well as the benefits of implementing new technology.
- Ineffective technology needs to be upgraded or replaced for businesses to produce quality products or services.

- **Types of Assessments:**

- Flexibility/Longevity
- Upgrade/Scale Assessments

- **Evaluate the technology options on the following factors:**
 - Fixed capital costs
 - Source of equipment
 - Operation, maintenance, and replacement costs
 - Scale of production and expected capacity use rate
 - Reliability
 - Labor intensiveness (labor costs, productivity, and employment generation)
 - Types and amounts of inputs required
 - Raw material availability, sustainability, and cost
 - Effects on product quality, cost and marketability
 - Foreign exchange requirements and availability
 - Natural resource requirements and sustainability
 - Compatibility with existing technology in use
 - Human resource requirement (training and technical assistance costs, management and supervision costs, etc)

Economic Analysis

- **Economic Assessment:**

- Consider whether the project is the best among other options
- Prioritise the projects so that the resources can be allocated effectively if several projects are underway
- The economic assessment can be done by the following ways:
 - ✓ Cash flow forecasting
 - ✓ Various cost-benefit evaluation techniques
 - ✓ Cost-benefit analysis

Cash flow forecasting

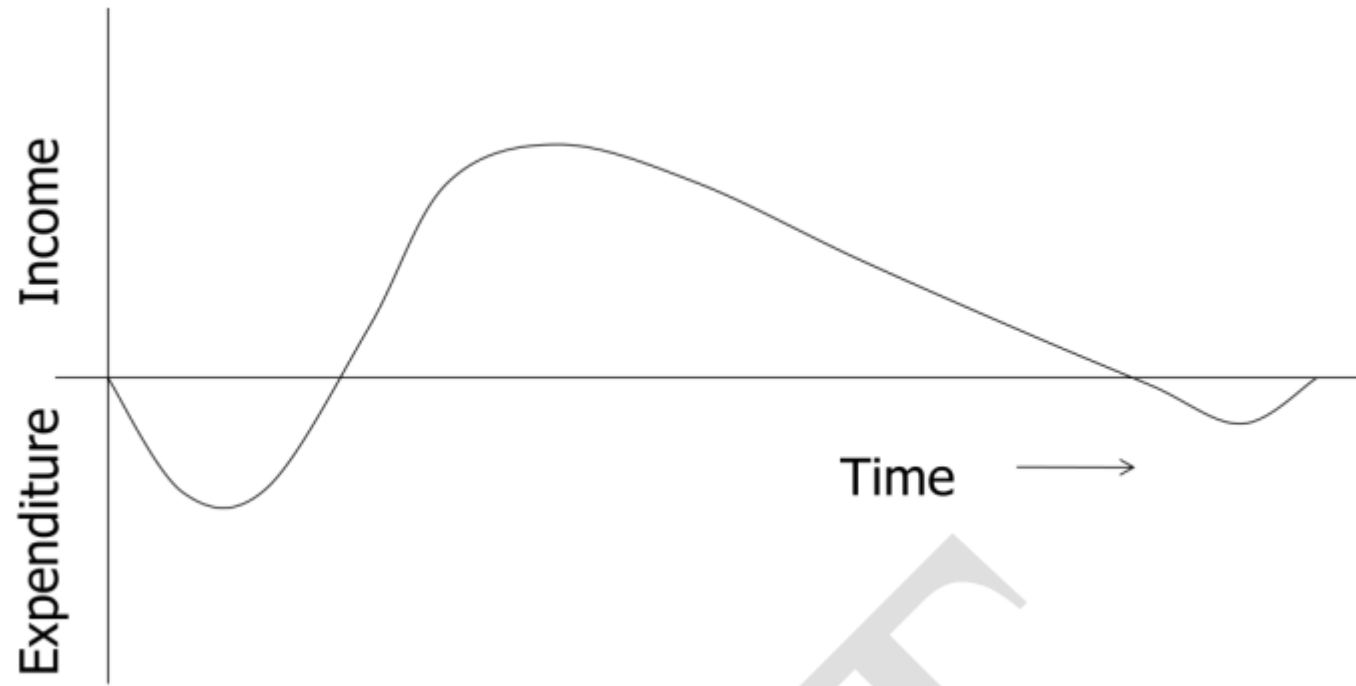
- As important as estimating the overall costs and benefits of a project is producing a cash flow forecast which indicates when expenditure and income will take place. It estimate overall cost and benefits of a product with respect to time.
 - Negative cash flow during development stage.
 - Positive cash flow during operating life.

- **During development stage**

- Staff wages
- Borrowing money from bank
- Paying interest to bank
- Payment of salaries
- Amount spent for installation, buying hardware and software

- **Income is expected by 2 ways.**

- Payment on completion
- Stage payment



When estimating future cash flows, it is usual to ignore the effects of inflation. Forecasts of inflation rates tend to be uncertain. Moreover, if expenditure is increased due to inflation it is likely that income will increase proportionately.

Example:

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000
3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

Cash flow forecasting or cash flow management is a key aspect of financial management of a business, planning its future cash requirements to avoid a crisis of liquidity.

Here are the key reasons why a cash flow forecast is so important:

- Identify potential shortfalls in cash balances in advance—think of the cash flow forecast as an "early warning system". This is, by far, the most important reason for a cash flow forecast.
- Make sure that the business can afford to pay suppliers and employees. Suppliers who don't get paid will soon stop supplying the business; it is even worse if employees are not paid on time.
- Spot problems with customer payments—preparing the forecast encourages the business to look at how quickly customers are paying their debts. Note—this is not really a problem for businesses (like retailers) that take most of their sales in cash/credit cards at the point of sale.
- As an important discipline of financial planning—the cash flow forecast is an important management process, similar to preparing business budgets.
- External stakeholders such as banks may require a regular forecast. Certainly, if the business has a bank loan, the bank will want to look at the cash flow forecast at regular intervals.

Cost-Benefit evaluation techniques

- It considers:
 - the timing of the costs and benefits
 - the benefits relative to the size of the investment
- Common method for comparing projects on the basis of their cash flow forecasting.
 - 1) **Net Profit**
 - 2) **Payback Period**
 - 3) **Return on Investment (RoI)**
 - 4) **Net Present Value (NPV)**
 - 5) **Internal Rate of Return (IRR)**

Net Profit

- Net profit is calculated by subtracting a company's total expenses from total income.
- Showing what the company has earned (or lost) in a given period of time (usually one year). also called net income or net earnings.

Net Profit= total incomes - total costs

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000
3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

- For project1,
 - Total income = $10,000+10,000+10,000+20,000+1,00,000=150,000$
 - Total cost = 100,000
 - Net profit = $150,000-100,000=\text{Rs.}50,000$
- For project2,
 - Total income = $2,00,000+2,00,000+2,00,000+2,00,000+3,00,000=1,100,000$
 - Total cost = 1,000,000
 - Net profit = $1,100,000-1,000,000=\text{Rs.}100,000$
- For project2,
 - Total income = $30,000+30,000+30,000+30,000+30,000+75,000=195,000$
 - Total cost = 120,000
 - Net profit = $195,000-120,000=\text{Rs.}75,000$

Payback Period

- The payback period is the time taken to recover the initial investment or it is the length of time required for cumulative incoming returns to equal the cumulative costs of an investment
- **Advantages**
 - simple and easy to calculate.
 - It is also a seriously flawed method of evaluating investments
- **Disadvantages**
 - It attaches no value to cash flows after the end of the payback period.
 - It makes no adjustments for risk.
 - It is not directly related to wealth maximisation as NPV is.
 - It ignores the time value of money.
 - The "cut off" period is arbitrary.

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000
3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

- Calculate Payback Period
 - Project1 = $10,000 + 10,000 + 10,000 + 20,000 + 1,00,000 = 150,000$
 - Project 2 = $2,00,000 + 2,00,000 + 2,00,000 + 2,00,000 + 3,00,000 = 1,100,000$
 - Project 3 = $30,000 + 30,000 + 30,000 + 30,000 + 75,000 = 195,000$
- It ignores any benefits that occur after the payback period and, therefore, does not measure profitability. And it ignores the time value of money.

Return on Investment or Accounting Rate Of Return

- It provides a way of comparing the net profitability to the investment required.
- Or, A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments.
- **Disadvantages**
 - It takes no account of the timing of the cash flows.
 - Rate of returns bears no relationship to the interest rates offered or changed by bank.

$$\text{ROI} = \frac{\text{average annual profit}}{\text{total investment}} * 100$$

$$\text{Average annual profit} = \frac{\text{net profit}}{\text{total no. of years}}$$

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000
3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

- Calculate ROI for project 1.
 - Total investment = 1,00,000
 - Net profit = 50,000
 - Total no. of year = 5
 - Average annual profit = $50,000/5 = 10,000\text{rs}$
 - $\text{ROI} = (10,000/1,00,000) * 100 = 10\%$
- Calculate ROI for project 2.
 - Total investment = 1,00,000
 - Net profit = 1,00,000
 - Total no. of year = 5
 - Average annual profit = $1,00,000/5 = 20,000\text{rs}$
 - $\text{ROI} = (20,000/1,00,000) * 100 = 2\%$

- Calculate ROI for project 3.
 - Total investment = 1,20,000
 - Net profit = 75,000
 - Total no. of year = 5
 - Average annual profit = $75,000/5 = 15,000\text{rs}$
 - $\text{ROI} = (15,000/1,20,000) * 100 = 12.5\%$

Net Present Value (NPV)

- Sum of the present values of all future amounts.
- Present value is the value which a future amount is worth at present
- It takes into account the profitability of a project and the timing of the cash flows
- **Discounted Cash Flow (DCF)** is a cash flow summary adjusted to reflect the time value of money. DCF can be an important factor when evaluating or comparing investments, proposed actions, or purchases. Other things being equal, the action or investment with the larger DCF is the better decision. When discounted cash flow events in a cash flow stream are added together, the result is called the Net Present Value (NPV).

- When the analysis concerns a series of cash inflows or outflows coming at different future times, the series is called a cash flow stream. Each future cash flow has its own value today (its own present value). The sum of these present values is the Net Present Value for the cash flow stream.
- The size of the discounting effect depends on two things: the amount of time between now and each future payment (the number of discounting periods) and an interest rate called the Discount Rate. Discount rate is the annual rate by which we discount future earnings.

$$\text{Discount Factor} = \frac{1}{(1 + \text{Discount Rate})^{\text{Period Number}}}$$

- Discount Factor = $1/(1+r)^t$

- The example shows that:
- As the number of discounting periods between now and the cash arrival increases, the present value decreases.
- As the discount rate (interest rate) in the present value calculations increases, the present value decreases.

Discount Factor table

Present Value
Definition Formula

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

PV = Present Value

FV = Future Value

i = Interest (discount) rate

n = Period number

Present Value of \$1 in the Future at Discount Rate r%

Year	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
0	1	1	1	1	1	1	1	1	1	1	1	1	1
1	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696
2	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561
3	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575
4	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718
5	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972
6	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323
7	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759
8	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269
9	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843
10	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472
11	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149
12	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869
13	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625
14	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413
15	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229
16	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069

- **Issues in NPV**

- Choosing an appropriate discount rate is difficult
- Ensuring that the rankings of projects are not sensitive to small changes in discount rate

- **Guidelines:**

- Use the standard rate prescribed by the organization
- Use interest rate + premium rate
- Use a target rate of return
- Rank the projects using various discount rates

- **Applying discount factors**

- NPV is the sum of the discounted cash flows for all the years of the 'project' (note that in NPV terms the lifetime of the completed application is included in the 'project')

Discounted Cash Flow (DCF) Formula

$$= \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_n}{(1+r)^n}$$

CF = Cash Flow

r = Discount Rate (WACC)

n = Time in Years

Year	Cash-flow	Discount factor(discount rate 10%)	Discounted cash flow
0	-100,000	1.0000	-100,000
1	10,000	0.9091	9,091
2	10,000	0.8264	8,264
3	10,000	0.7513	7,513
4	20,000	0.6830	13,660
5	100,000	0.6209	62,090
		NPV	618

Example:

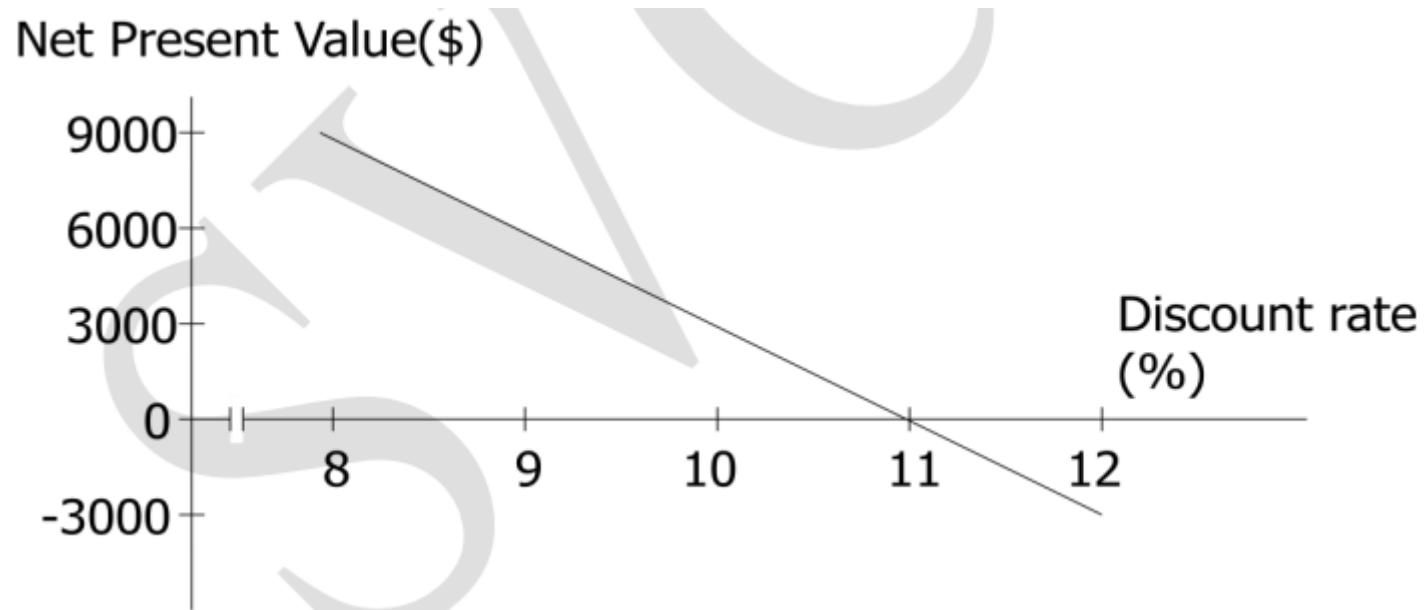
- Comparing Competing Investments with NPV. Consider two competing investments in computer equipment. Each calls for an initial cash outlay of \$100, and each returns a total a \$200 over the next 5 years making net gain of \$100. But the timing of the returns is different, as shown in the table below (Case A and Case B), and therefore the present value of each years return is different. The sum of each investments present values is called the Discounted Cash flow (DCF) or Net Present Value (NPV). Using a 10% discount rate

Timing	Discount Rate(10%)	CASE A		CASE B	
		Net Cash Flow	Present Value	Net Cash Flow	Present Value
Now 0	1	– \$100.00	– \$100.00	– \$100.00	– \$100.00
Year 1	0.9091	\$60.00	\$54.54	\$20.00	\$18.18
Year 2	0.8264	\$60.00	\$49.59	\$20.00	\$16.52
Year 3	0.7513	\$40.00	\$30.05	\$40.00	\$30.05
Year 4	0.6830	\$20.00	\$13.70	\$60.00	\$41.10
Year 5	0.6209	\$20.00	\$12.42	\$60.00	\$37.27
Total		Net CF _A = \$100.00	NPV _A = \$60.30	Net CF _B = \$100.00	NPV _B = \$43.12

Disadvantage: May not be directly comparable with earnings from other investments or the costs of borrowing capital

Internal Rate of Return (IRR)

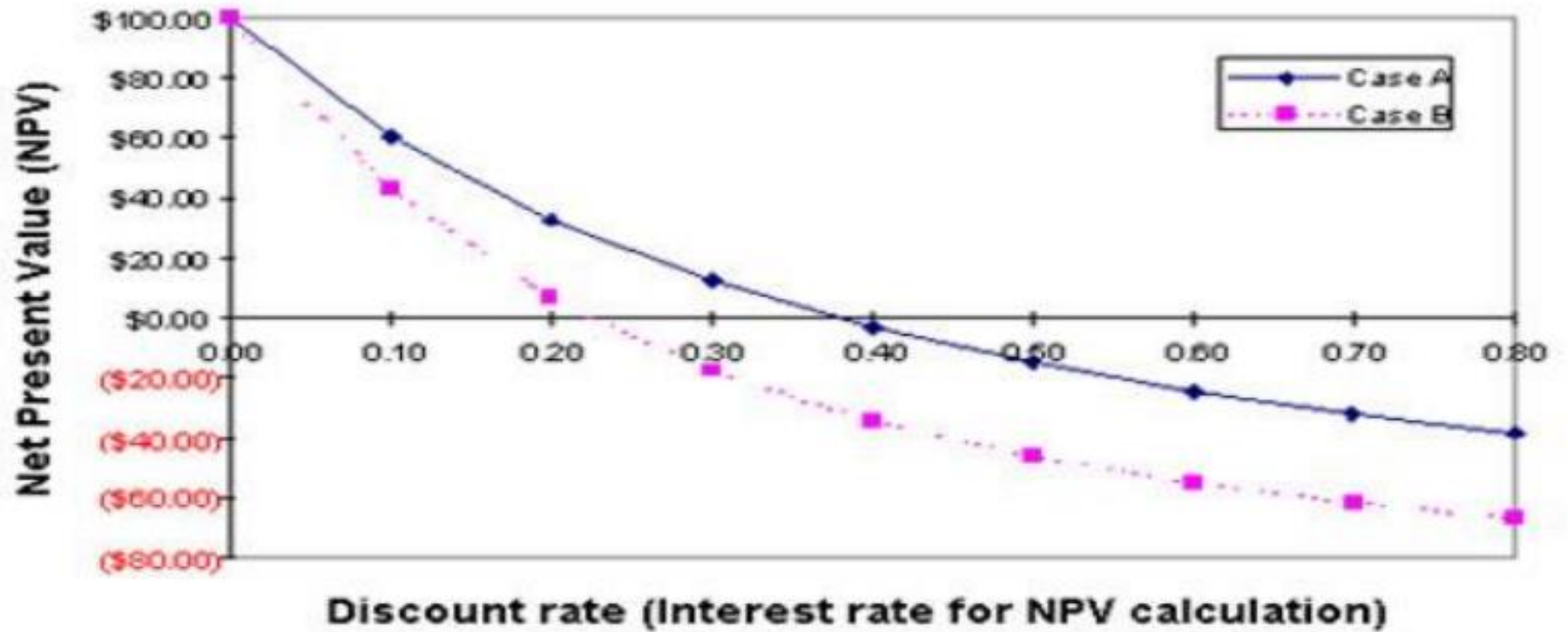
- The percentage discount rate that would produce a NPV of zero
- A relative measure. Use Excel to demonstrate the calculation of NPV and IRR
- The IRR being a relative measure does not indicate the absolute size of the return.



The IRR compares returns to costs by asking: **"What is the discount rate that would give the cash flow stream a net present value of 0?"**

Timing	Discount Rate(10%)	CASE A		CASE B	
		Net Cash Flow	Present Value	Net Cash Flow	Present Value
Now 0	1	– \$100.00	– \$100.00	– \$100.00	– \$100.00
Year 1	0.9091	\$60.00	\$54.54	\$20.00	\$18.18
Year 2	0.8264	\$60.00	\$49.59	\$20.00	\$16.52
Year 3	0.7513	\$40.00	\$30.05	\$40.00	\$30.05
Year 4	0.6830	\$20.00	\$13.70	\$60.00	\$41.10
Year 5	0.6209	\$20.00	\$12.42	\$60.00	\$37.27
Total		Net CF _A = \$100.00	NPV _A = \$60.30	Net CF _B = \$100.00	NPV _B = \$43.12

- IRR asks a different question of the same two cash flow streams. Instead of proposing a discount rate and finding the NPV of each stream (as with NPV), IRR starts with the net cash flow streams and **finds** the interest rate (discount rate) that produces an NPV of zero for each. The easiest way to see how this solution is found is with a graphical summary:



- These curves are based on the Case A and Case B cash flow figures in the table above. Here, however, we have used nine different interest rates, including 0.0 and 0.10, on up through 0.80.
- As you would expect, as the interest rate used for calculating NPV of the cash flow stream increases, the resulting NPV decreases.
- For Case A, an interest rate of 0.38 produces $NPV = 0$, whereas
- Case B NPV arrives at 0 with an interest rate of 0.22.
- **Case A therefore has an IRR of 38%, Case B an IRR of 22%.**
- IRR as the decision criterion, the one with the **higher IRR is the better choice.**

Cost-Benefit analysis

- One of the important and common way of carrying “economic assessment” of a proposed information system.
- Done by comparing the expected costs of development and operation of the system with its benefits.
- Any project aiming at return on investment must provide a greater benefit than putting that investment in a bank.
- So it takes an account:
 - Expected cost of development of system
 - Expected cost of operation of system
 - Benefits obtained
- Assessment is based on:
 - Whether the estimated costs are executed by the estimated income.
 - And by other benefits

- For achieving benefit where there is a scarce resource, projects will be prioritized and resources are allocated effectively.
- The standard way of evaluating economic benefits of any project is done by “cost benefit analysis”
- Cost-Benefit analysis comprises of two steps:
 - Step-1: identifying and estimating all of the costs and benefits of carrying out the project.
 - Step-2: expressing these costs and benefits in common units.

- **Step-1:**
- It includes
 - Development cost of system.
 - Operating cost of system.
 - Benefits obtained by system.
- When new system is developed by the proposed system, then new system should reflect the above three as same as proposed system.
- **Example:** sales order processing system which gives benefit due to use of new system.
- **Step-2:**
- Calculates net benefit.
- $\text{Net benefit} = \text{total benefit} - \text{total cost}$.
- cost should be expressed in monetary terms.

- **Three types of cost**

1. **Development costs:** includes salary and other employment cost of staff involved.
2. **Setup costs:** includes the cost of implementation of system such as hardware, and also file conversion, recruitment and staff training.
3. **Operational cost:** cost require to operate system, after it is installed.

- **Three categories of benefits:**

1. **Direct benefits:** directly obtained benefit by making use of/operating the system. Example: reduction of salary bills, through the introduction of a new , computerized system.
2. **Assessable indirect benefits:** these benefits are obtained due to updation / upgrading the performance of current system. It is also referred as “secondary benefits”. Example: “use of user – friendly screen”, which promotes reduction in errors, thus increases the benefit
3. **Intangible benefits:** these benefits are longer term, difficult to quantify. It is also referred as “indirect benefits”. Example: enhanced job interest leads reduction of staff turnover, inturn leads lower recruitment costs.

- **Determining Project Benefits**

- Tangible benefits, Intangible benefits

- **Determining Project Costs**

- Tangible costs, Intangible costs
- Underestimating costs, overestimating costs
- One-time costs, Recurring costs
- Fixed costs, Variable costs

Break-Even Analysis

	A	B	C	D	E	F	G	H
1	Pine Valley Furniture							
2	Economic Feasibility Analysis							
3	WebStore Project							
4								
5		Year of Project						
6		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	TOTALS
7	Net economic benefit	\$0	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	
8	Discount Rate (12%)	1.0000	0.8929	0.7972	0.7118	0.6355	0.5674	
9	PV of Benefits	\$0	\$44,643	\$39,860	\$35,589	\$31,776	\$28,371	
10								
11	NPV of all BENEFITS	\$0	\$44,643	\$84,503	\$120,092	\$151,867	\$180,239	\$180,239
12								
13	One-time COSTS	(\$42,500)						
14								
15	Recurring Costs	\$0	(\$28,500)	(\$28,500)	(\$28,500)	(\$28,500)	(\$28,500)	
16	Discount Rate (12%)	1.0000	0.8929	0.7972	0.7118	0.6355	0.5674	
17	PV of Recurring Costs	\$0	(\$25,446)	(\$22,720)	(\$20,286)	(\$18,112)	(\$16,172)	
18								
19	NPV of All COSTS	(\$42,500)	(\$67,946)	(\$90,666)	(\$110,952)	(\$129,064)	(\$145,236)	(\$145,236)
20								
21								
22	Overall NPV							\$35,003
23								
24								
25	Overall ROI - (Overall NPV / NPV of All COSTS)							0.24
26								
27								
28	Break-Even Analysis							
29	Yearly NPV Cash Flow	(\$42,500)	\$19,196	\$17,140	\$15,303	\$13,664	\$12,200	
30	Overall NPV Cash Flow	(\$42,500)	(\$23,304)	(\$6,164)	\$9,139	\$22,803	\$35,003	
31								
32	Project break-even occurs between years 2 and 3							
33	Use first year of positive cash flow to calculate break-even fraction - $((15303 - 9139) / 15303) = .403$							
34	Actual break-even occurred at 2.4 years							
35								

$$\text{Break-Even Ratio} = \frac{\text{Yearly NPV Cash Flow} - \text{Overall NPV Cash Flow}}{\text{Yearly NPV Cash Flow}}$$

Using data from Figure 5-6,

$$\text{Break-Even Ratio} = \frac{15,303 - 9139}{15,303} = .403$$

