

Software project Management

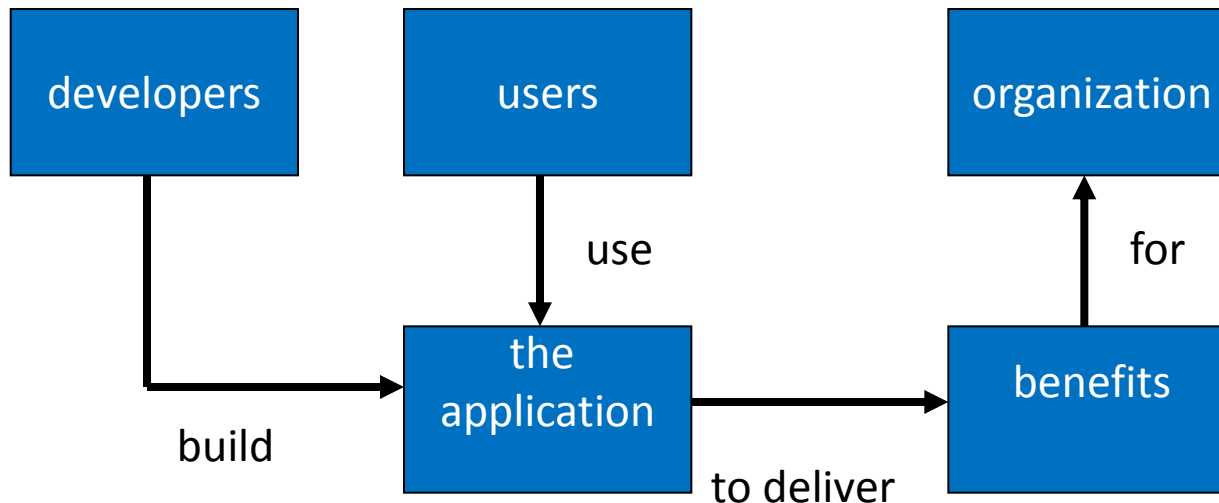
Summary

- A project is a temporary endeavor undertaken to create a unique product, service, or result
- Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements
- A program is a group of related projects managed in a coordinated way
- Project portfolio management involves organizing and managing projects and programs as a portfolio of investments
- Project managers play a key role in helping projects and organizations succeed

Summary

- Projects must be evaluated on Strategic, technical and Economic grounds.
- Many projects are not justified on their own but are a part of a broader programme of projects that implement an organization's strategy.
- Not all benefits can be precisely quantified in financial values.

Benefits management



- Providing an organization with a capability does not guarantee that this will provide benefits envisaged – need for *benefits management*
- It encompasses the identification, optimization and tracking of the expected benefits from a business change in order to ensure that they are actually achieved.

Benefits Management

- Providing a capability does not guarantee that the capability will be used to deliver the planned benefits.
- Benefits management attempts to remedy this.
- To ensure that expected benefits are actually achieved:
 - ▣ Define the expected benefits from the program
 - ▣ Analyze the balance between costs & benefits
 - ▣ Plan how the benefits will be achieved & measured
 - ▣ Allocate responsibilities for the successful delivery of the benefits
 - ▣ Monitor the realization of the benefits

Types of Possible Benefits

- ❑ Mandatory compliance
- ❑ Quality of service
- ❑ Productivity
- ❑ More motivated work force
- ❑ Internal management benefits
- ❑ Risk reduction
- ❑ Economy
- ❑ Revenue enhancement/acceleration
- ❑ Strategic fit

Benefits Management

Mandatory requirement:

Government might make certain changes mandatory.

Quality of Service:

We may make a service quicker.

Productivity:

The same or even more work can be done at less cost in staff time.

Benefits Management

- **More motivated workforce:** Because of an improved rewards system or through job enrichment.
- **Internal management benefits:** Better analysis of Insurance claims could pinpoint those categories of business which are most risky and allow the company to adjust premiums to cover this.

Benefits Management

- **Risk Reduction:** Reduction in the risk factors.
- **Economy:** Reduction of costs other than those related to staff. May be procurement costs.
- **Revenue enhancement/acceleration:** Faster the bills reach the customer faster customers can pay them.
- **Strategic fit:** Some strategic advantage for
9 the organization as a whole.

Economic Assessment (cont'd)

How?

- Cost-benefit analysis
- Cash flow forecasting
- Various cost-benefit evaluation techniques
 - NPV and IRR

Economic Assessment

- **Cost-Benefit Analysis:** Evaluates the project in terms of estimated costs and benefits.
- **Cash Flow Forecasting:** Indicates when expenditure and income will take place during the project.

Cost-benefit Analysis

- A 2 Step standard way to assess the economic benefits
- Two steps
 - Identify and estimate all the costs and benefits of carrying out the project
 - Express the costs and benefits in a common unit for easy comparison (e.g. \$)

Cost Benefit Analysis

- Cost-Benefit analysis has 2 steps:
 - ▣ Identifying all of the costs and benefits of carrying out the project and operating the delivered application
 - Development costs, operating costs, and benefits expected from the new system
 - ▣ Expressing these costs and benefits in common units
 - Expressing each costs and benefit (and the net benefit) in money
 - Most direct costs are easy to quantify in monetary terms
 - Development costs
 - Setup costs
 - Operational costs

Cost-benefit analysis

- ✿ Idea: If project requires investment, as a minimum, the project must provide a greater benefit than putting that investment in a bank account.
- ✿ Identify and estimate all costs and benefits of carrying out the project and operating the system.
- ✿ Express costs and benefits in common units.

- Costs:
 - Development costs
 - Setup costs
 - Operational costs

Relatively easy to quantify

- Benefits:
 - Direct benefits
 - Assessable indirect benefits
 - Intangible benefits

Often difficult to quantify

Cost-benefit Analysis (cont'd)

- **Costs**
 - Development costs : Includes Development staff costs.
 - Setup costs: Cost of putting the system in place
 - Operational costs : Related to operating the system after installation

Cost-benefit Analysis

- **Benefits**

- Direct benefits: Quantified and valued benefits.
- Assessable indirect benefits : Quantified but not valued.
- Intangible benefits: Identified but not easily valued.

Quantifying benefits

Benefits can be:

- Quantified and valued: A direct financial benefit is experienced. e.g. a reduction of x staff saving £ y
- Quantified but not valued e.g. a decrease in customer complaints by $x\%$
- Identified but not easily quantified – e.g. public approval for a organization in the locality where it is based

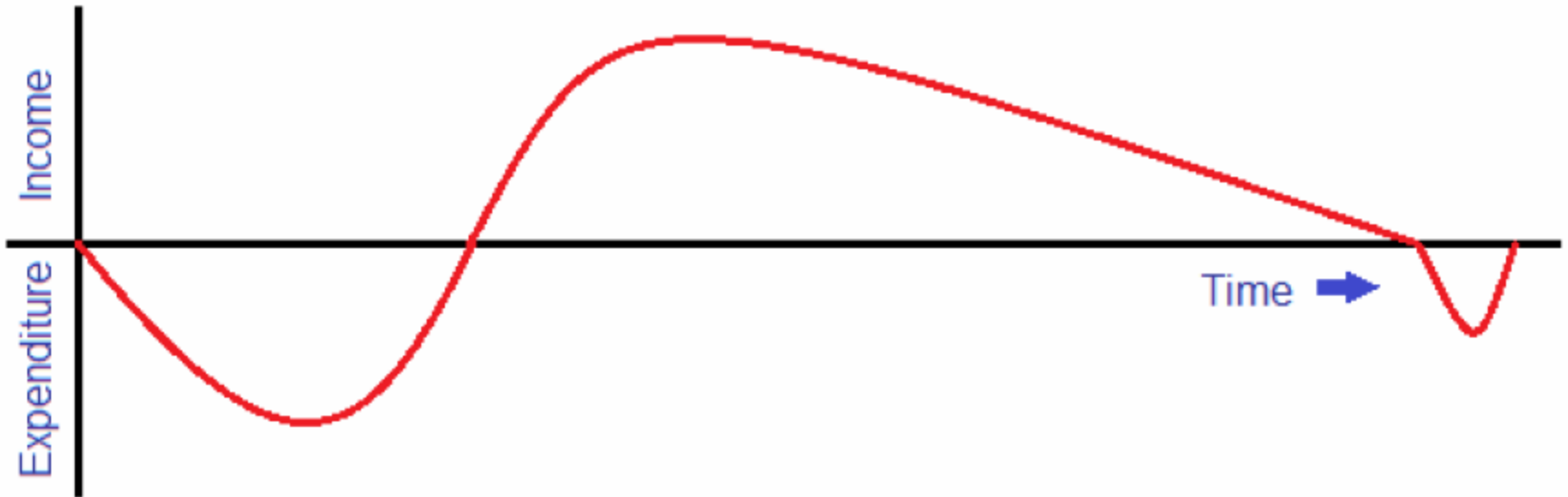
Cash Flow Forecasting

- During a project's development, money is spent for staff wages, hardware costs etc.
- We need to know that we can fund this development expenditure.
- A forecast is needed of when expenditure and income are to be expected.
- When estimating future cash flows, it is usual to ignore the effects of inflation. Forecasts of inflation rates tend to be uncertain. If expenditure is increased due to inflation, it is likely that income will increase proportionally.

Cash Flow Forecasting

- Need to forecast the expenditure and the income
- Accurate forecast is not easy
- Need to revise the forecast from time to time

Cash Flow Forecasting



Typical product life cycle cash flow.

Cost-Benefit Evaluation Techniques

- There are some methods for comparing projects based on their cash flow forecasts
 - ▣ Net Profit
 - ▣ Payback Period
 - ▣ Return on Investment – ROI
 - ▣ Net Present Value – NPV
 - ▣ Internal Rate of Return – IRR

Net Profit

Year	Cash Flow
0	- 100.000
1	10.000
2	10.000
3	10.000
4	20.000
5	100.000
Net Profit	50.000

- Year = 0: costs before the system is put into operation
- Cash Flow: timings of expenditure & income
- Net Profit: difference between the total costs and the total income over the life of the project

Net Profit

- The net profit of a project is the difference between the total costs and the total income over the life of the project.
 - Project 2 shows the greatest net profit but this is at the expense of a large investment. Indeed, if we had £1M to invest, we might undertake all of the other three projects and obtain an even greater net profit.
 - Project 1 & 3 each have a net profit of £50K, and according to this selection criterion, would be equally preferable. The bulk of the income occurs late in the life of Project 1, whereas Project 3 returns a steady income throughout its life.

Cash Flow Forecasts for 4 Projects

Year	Project 1	Project 2	Project 3	Project 4
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000

Cost-benefit Evaluation Techniques

- Net profit
= Total income – Total costs

Calculate Net Profit

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	?	?	?	?

Calculate Net Profit

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
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2	10,000	200,000	30,000	30,000
3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	60,000	150,000	30,000	45,000

Payback Period

- The payback period is the time taken to break even or pay back the initial investment.
 - ▣ The project with the shortest payback period will be chosen on the basis that an organization will wish to minimize the time that a project is “in debt”.
 - ▣ The advantage of the payback period is that it is simple to calculate and is not particularly sensitive to small forecasting errors.
 - ▣ Its disadvantage as a selection technique is that it ignores the overall profitability of the project.
 - Projects 2 & 4 are ignored although they are more profitable than Project 3.

Pay back period

This is the time it takes to start generating a surplus of income over outgoings. What would it be below?

Year	Cash-flow	Accumulated
0	-100,000	-100,000
1	10,000	-90,000
2	10,000	-80,000
3	10,000	-70,000
4	20,000	-50,000
5	100,000	50,000

Cost-benefit Evaluation Techniques

- Payback period
= Time taken to break even

Cash Flow Forecasts for 4 Projects

Year	Project 1	Project 2	Project 3	Project 4
0	-100,000	-1,000,000	-100,000	-120,000
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Cash Flow Forecasts for 4 Projects

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3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000
Pay Back Period	5	5	4	4 (End)

Calculate Payback Period

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
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3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	60,000	150,000	30,000	45,000
Payback	?	?	?	?

Calculate Payback Period

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
0	-100,000	-1,000,000	-100,000	-120,000
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3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	60,000	150,000	30,000	45,000
Payback	5	5	4	5

Return on Investment – ROI

- Also known as the Accounting Rate of Return (ARR), ROI provides a way of comparing the net profitability to the investment required.
- Common formula of ROI is:

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

Return on Investment – ROI

Year	Cash Flow
0	- 100.000
1	10.000
2	10.000
3	10.000
4	20.000
5	100.000
Net Profit	50.000

- Calculation of ROI for Project 1
- Net Profit = £50,000
- Total Investment = £100,000

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

$$\text{average annual profit} = \frac{50,000}{5} = 10,000$$

$$ROI = \frac{10,000}{100,000} \times 100 = 10\%$$

Cost-benefit Evaluation Techniques

- Return on Investment (ROI)

$$= \frac{\text{average annual profit}}{\text{total investment}} \times 100\%$$

Cash Flow Forecasts for 4 Projects

Year	Project 1	Project 2	Project 3	Project 4
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
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Net profit	50,000	100,000	50,000	75,000

ROI

Cash Flow Forecasts for 4 Projects

Year	Project 1	Project 2	Project 3	Project 4
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	10,000	200,000	30,000	30,000
4	20,000	200,000	30,000	30,000
5	100,000	300,000	30,000	75,000
Net profit	50,000	100,000	50,000	75,000
ROI	10%	2%	10%	12.5%

Return on Investment – ROI

- Using the cash flow table, we can calculate ROIs of other projects:
 - ▣ ROI of Project 2 = 2%
 - ▣ ROI of Project 3 = 10%
 - ▣ ROI of Project 4 = 12.5%
- ROI provides a simple, easy-to-calculate measure of return on capital. But, it suffers from two severe disadvantages:
 - ▣ Like the net profit, it takes no account of the timing of the cash flows.
 - ▣ It has no relationship to the interest rates offered or charged by banks, so it is very misleading.

Calculate Rate of Interest

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	60,000	150,000	30,000	45,000
Payback	5	5	4	4
ROI	?	?	?	?

Calculate Rate of Interest

<i>Year</i>	<i>Project 1</i>	<i>Project 2</i>	<i>Project 3</i>	<i>Project 4</i>
0	-100,000	-1,000,000	-100,000	-120,000
1	10,000	200,000	30,000	30,000
2	10,000	200,000	30,000	30,000
3	20,000	200,000	30,000	30,000
4	20,000	200,000	20,000	25,000
5	100,000	350,000	20,000	50,000
Net Profit	60,000	150,000	30,000	45,000
Payback	5	5	4	4
ROI	12%	4%	10%	11%

Net Present Value

- A company is planning to invest Rs.9000 in a project today.
- The project is expected to have a life of four years.
- The expected cash flows at the end of each of the next four years are Rs 2000, Rs 3000, Rs 3000 and Rs 4000

Net Present Value – NPV

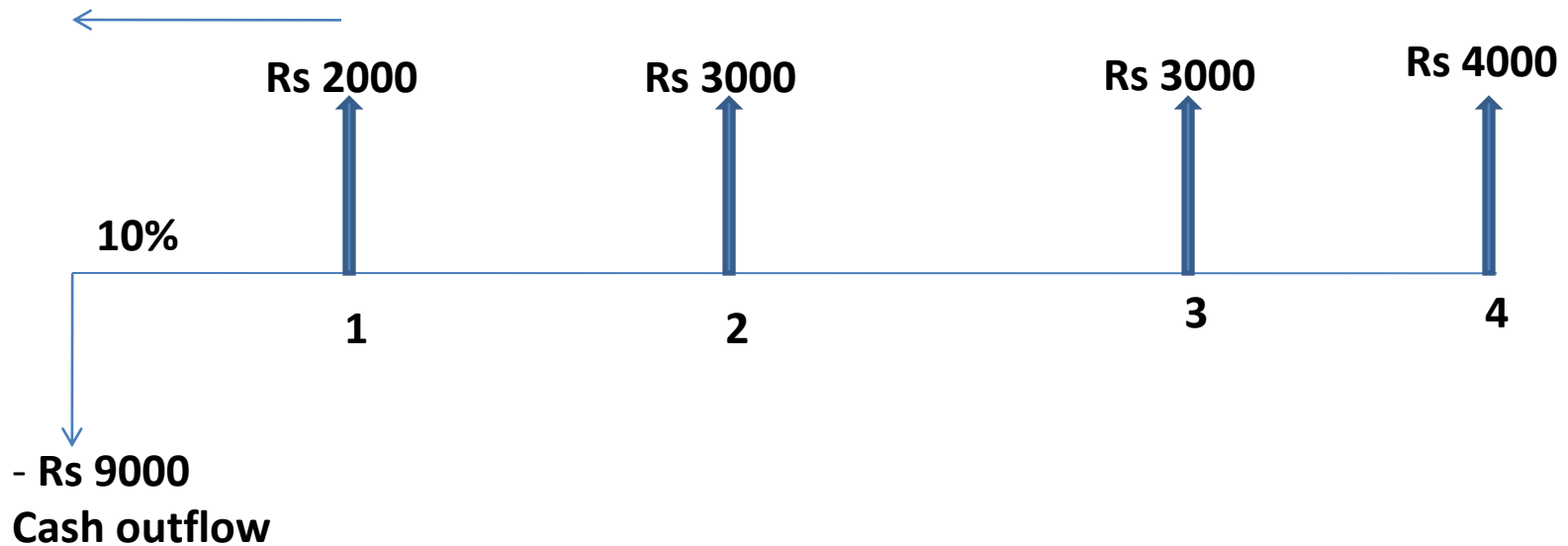
- The net present value technique takes into account the profitability of a project and the timing of the cash flows that are produced.
 - ▣ Receiving £100 today is better than having to wait until next year to receive it.
 - ▣ We could invest £100 in a bank today and have £100 plus the interest in a year's time.
 - ▣ If we say that the present value of £100 in a year's time is £91, we mean that £100 in a a year's time is the equivalent of £91 now.
 - ▣ Here, **discount rate** is 10%

Calculate Present Value

- *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

Net Present Value (NPV)

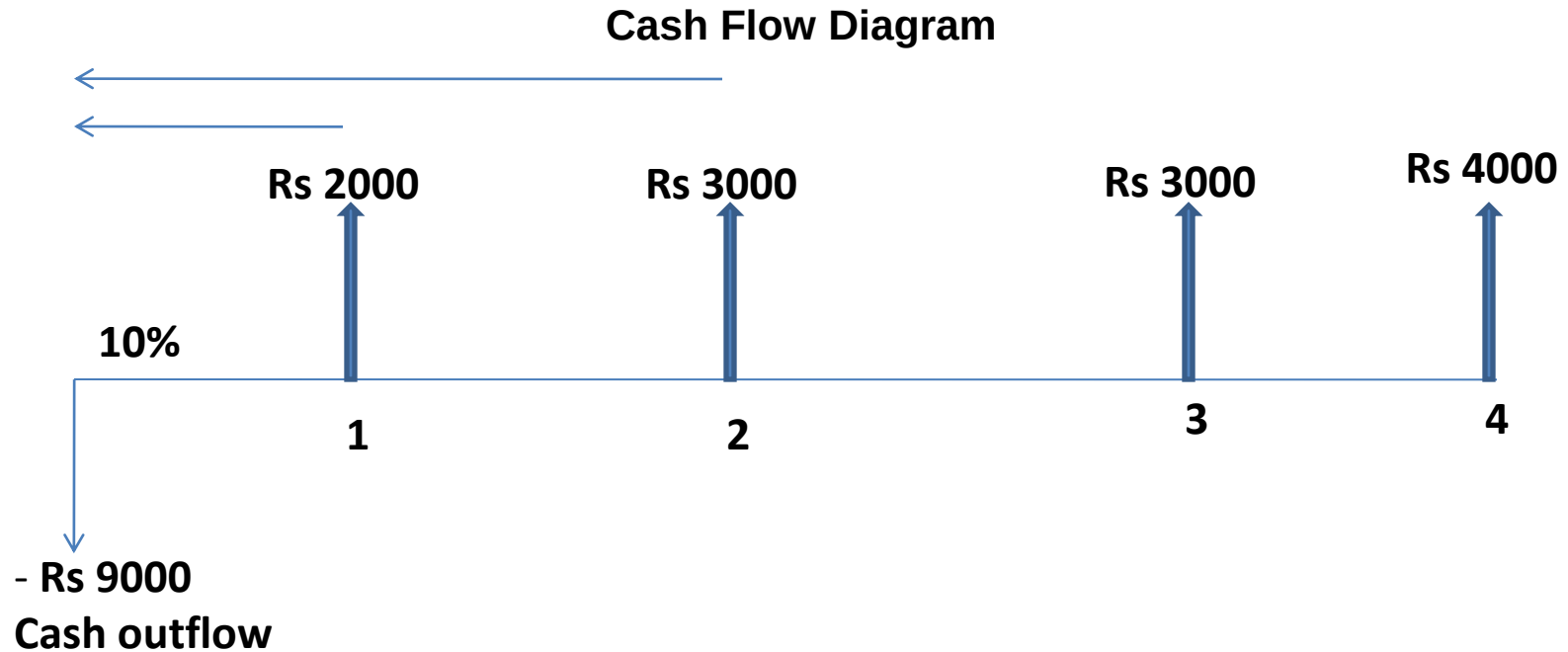
Cash Flow Diagram



Assume we are Borrowing Rs 9000 from Bank.

We calculate the present value of First cash Inflow

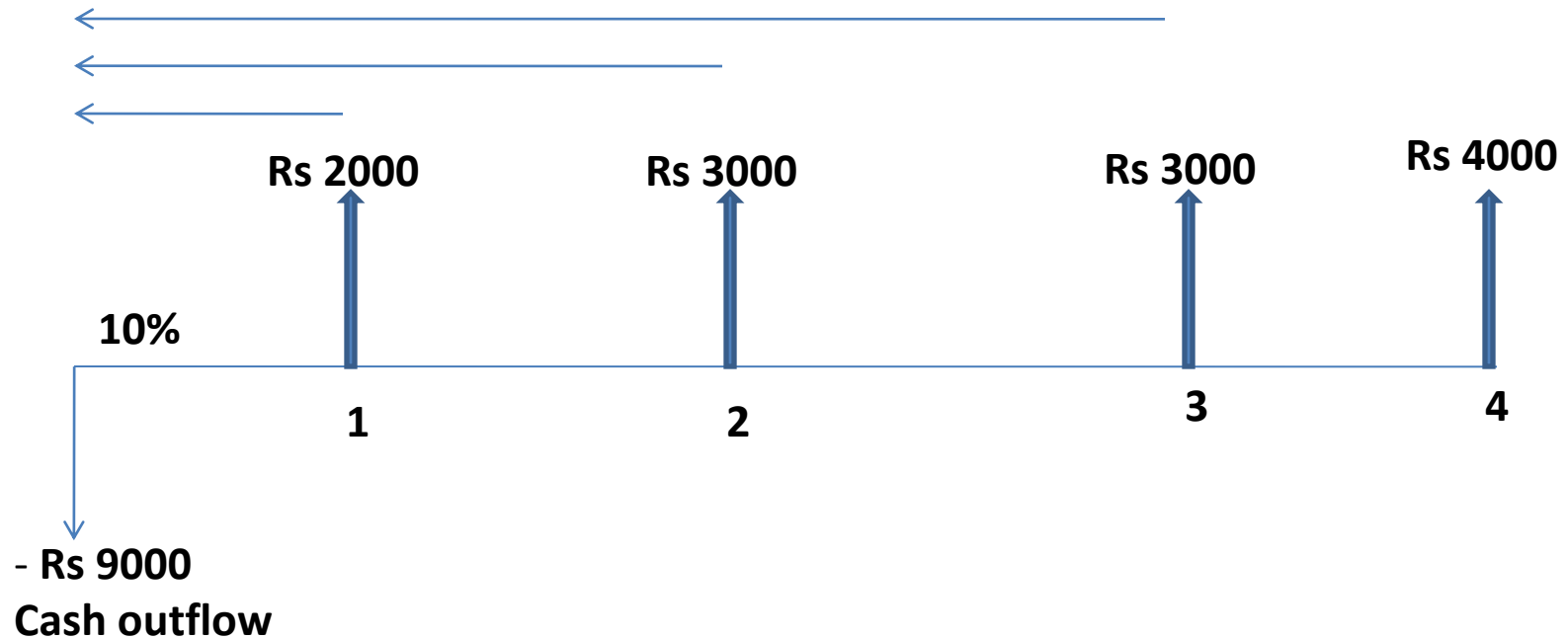
Net Present Value (NPV)



We calculate the present value of Second cash Inflow

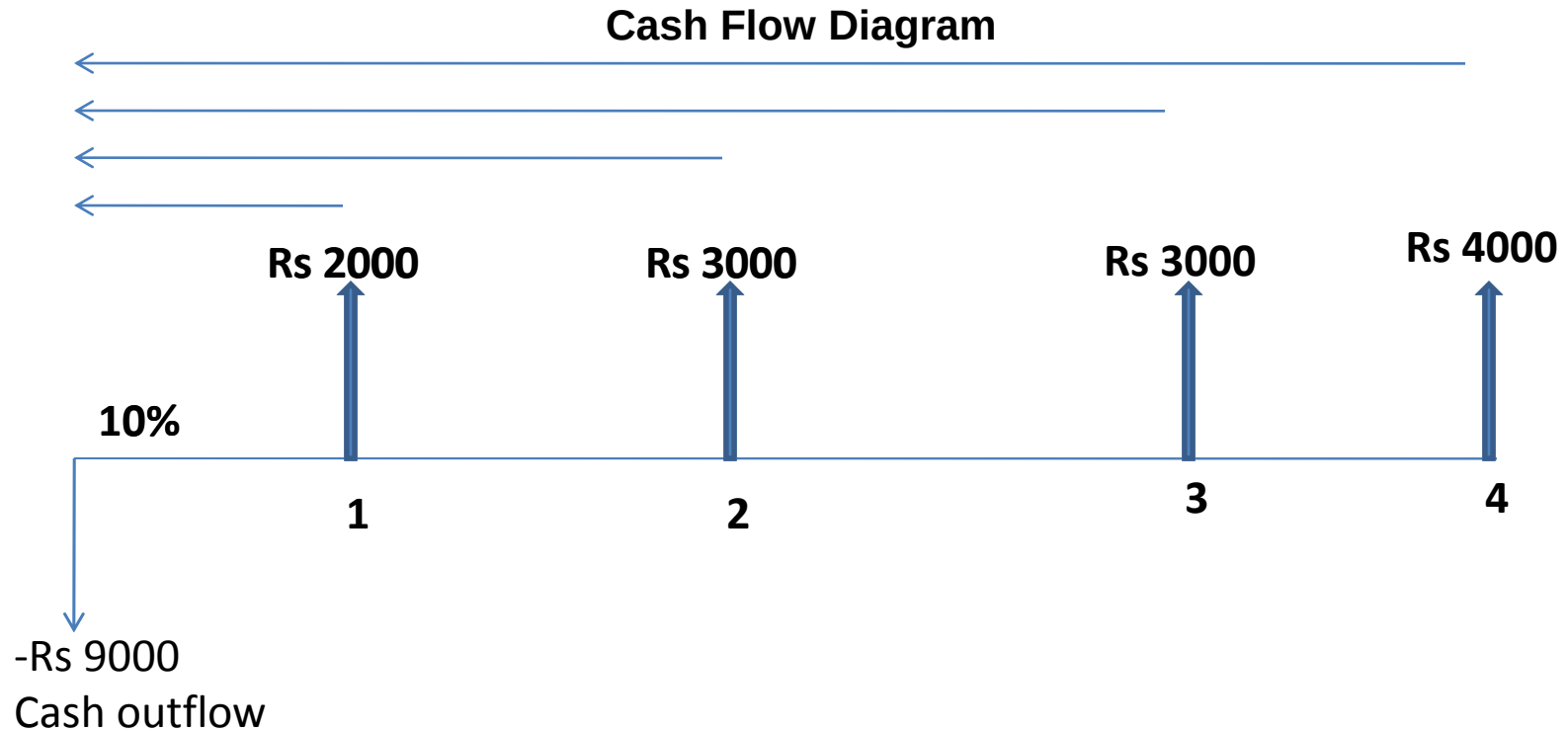
Net Present Value (NPV)

Cash Flow Diagram



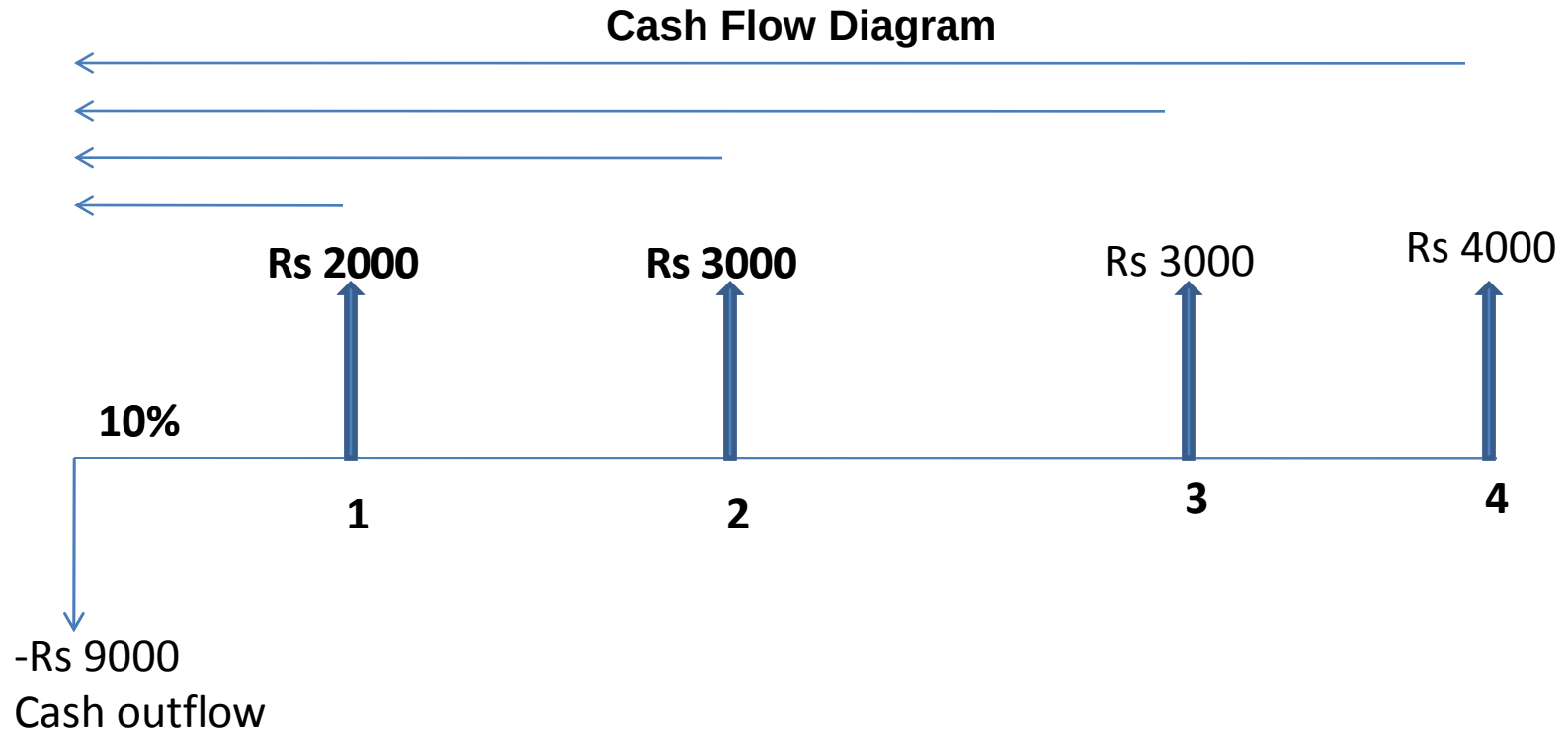
We calculate the present value of third cash Inflow

Net Present Value (NPV)



We calculate the present value of fourth cash Inflow

Net Present Value (NPV)



Net Present Value

$$FV = PV(1+r)^n \text{ ----- 1}$$

Where FV=Future Value
PV=Present Value

Re-arranging

$$PV = FV / (1+r)^n \text{ ----- 2}$$

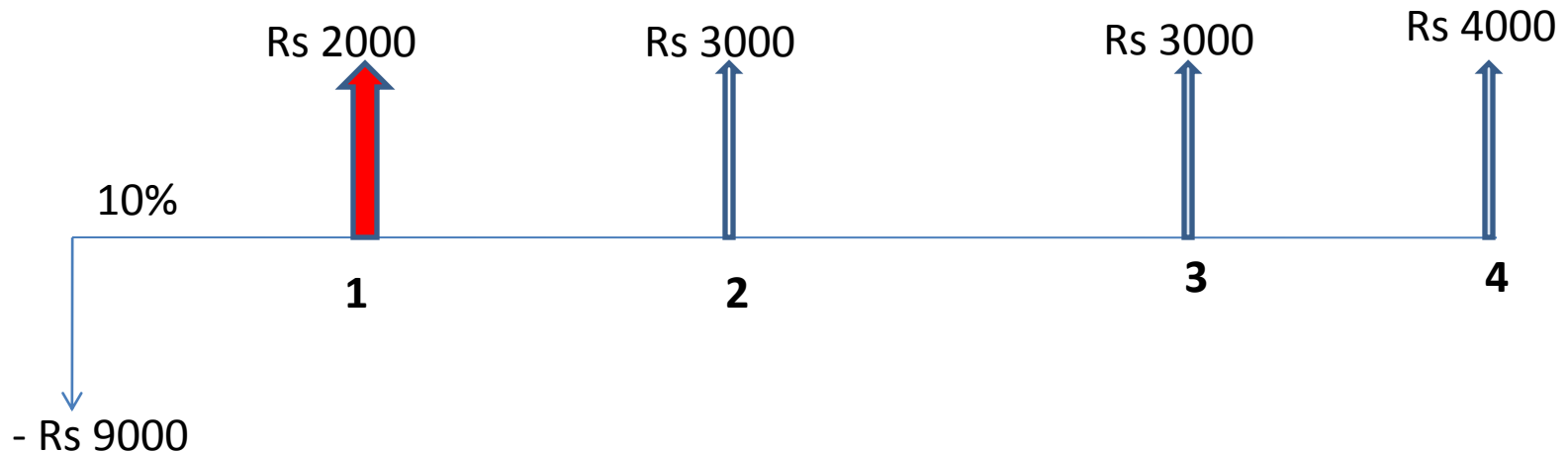
Net Present Value – NPV

- The present value of any future cash flow can be obtained by applying the following formula:
 - ▣ t: number of years
 - ▣ r: discount rate (expressed as a decimal value)

$$\text{Present Value} = \frac{\text{value in year } t}{(1 + r)^t}$$

PV of Rs 2000 cash Flow (t=1)

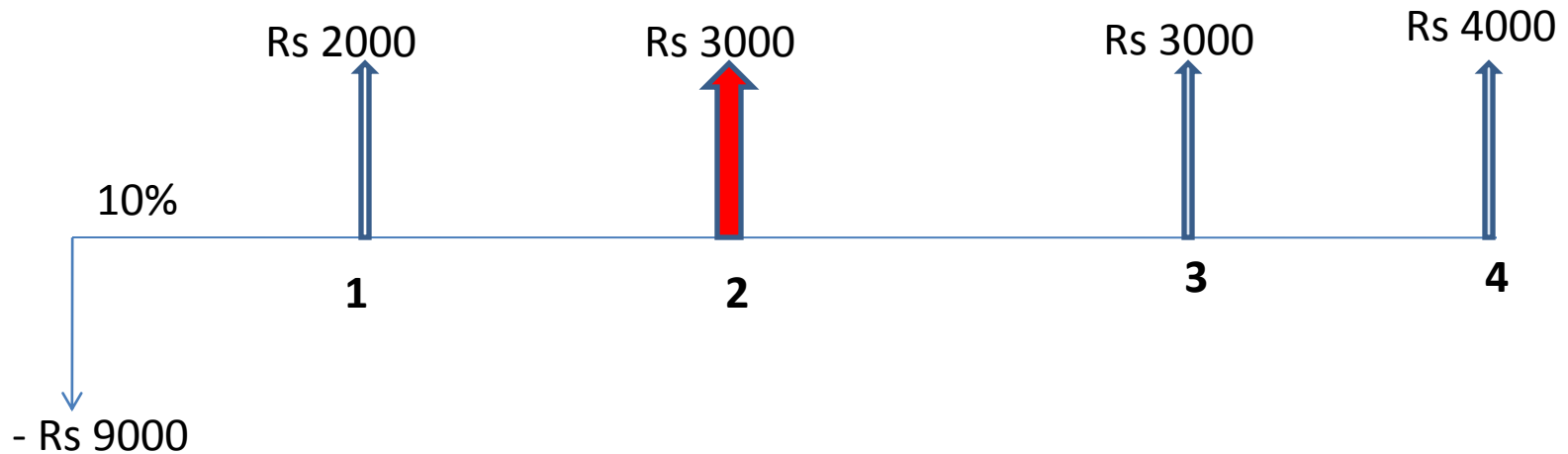
$$FV = PV(1+r)^n \quad \text{or} \quad PV = FV / (1+r)^n$$



$$PV \text{ of 1}^{\text{st}} \text{ Cash inflow} = Rs 2000 / (1+.10)^1 = 1818.18$$

PV of Rs 3000 cash Flow (t=2)

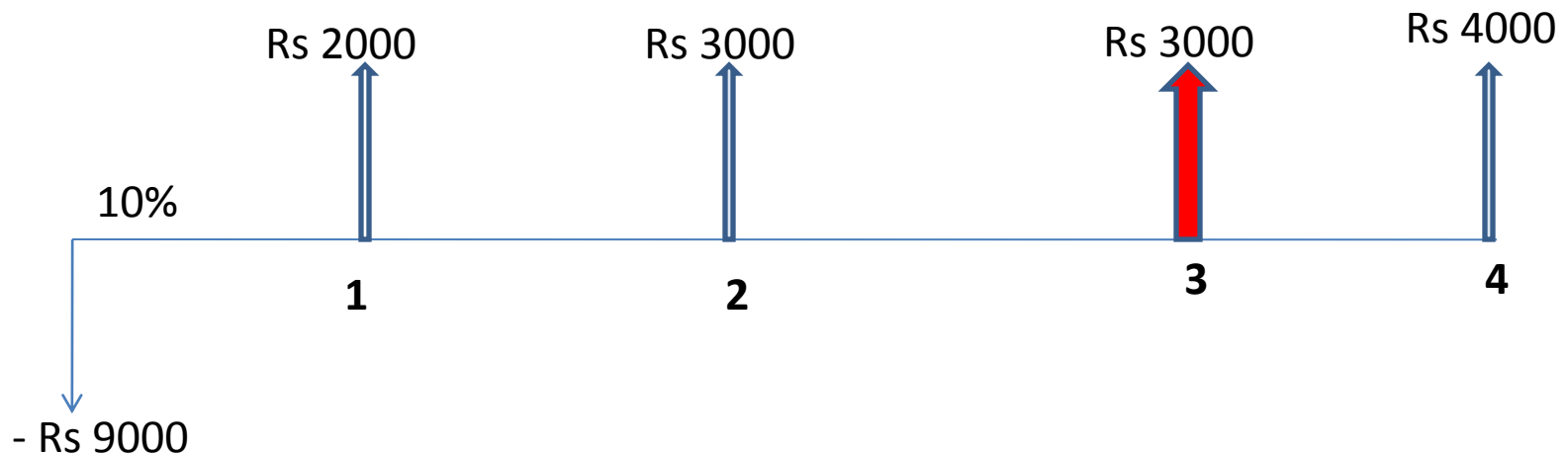
$$FV = PV(1+r)^n \quad \text{or} \quad PV = FV / (1+r)^n$$



$$PV \text{ of 2}^{\text{nd}} \text{ Cash inflow} = Rs 3000 / (1+.10)^2 = 2479.34$$

PV of Rs 3000 cash Flow (t=3)

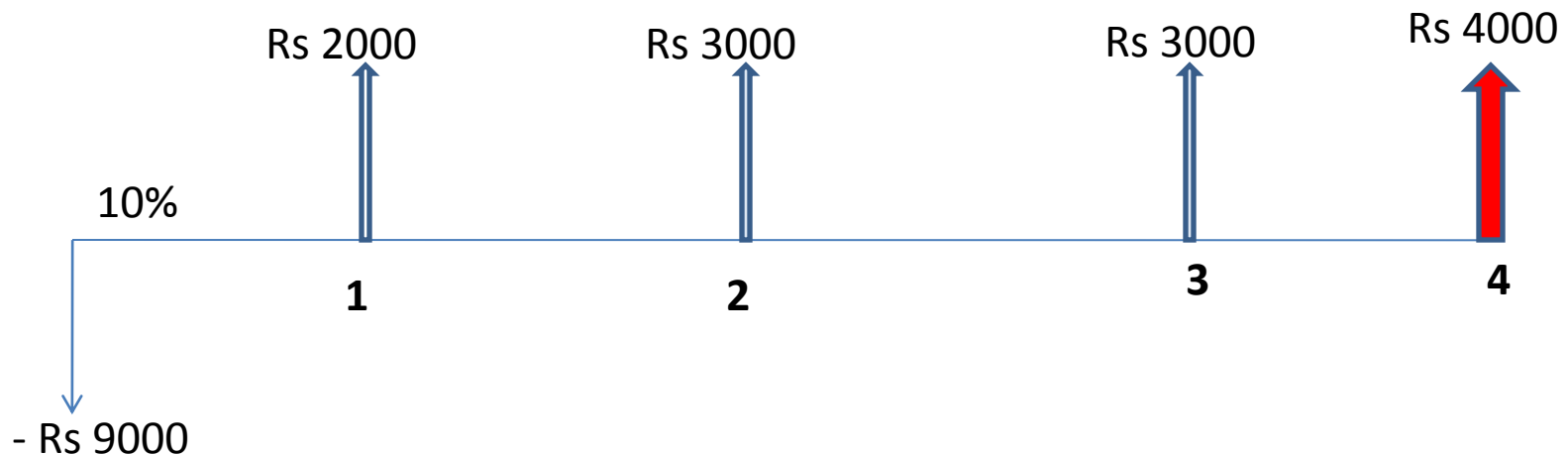
$$FV = PV(1+r)^n \text{ or } PV = FV/(1+r)^n$$



$$PV \text{ of 3}^{\text{rd}} \text{ Cash inflow} = Rs 3000/(1+.10)^3 = 2253.94$$

PV of Rs 4000 cash Flow (t=4)

$$FV = PV(1+r)^n \text{ or } PV = FV/(1+r)^n$$



$$PV \text{ of } 4^{\text{th}} \text{ Cash inflow} = Rs 4000/(1+.10)^3 = 2732.05$$

The process of finding of present value based on future values is called Discounting

Determine the NPV

$$PV_0 = -9000$$

$$PV_1 = 1818.18$$

$$PV_2 = 2479.34$$

$$PV_3 = 2253.94$$

$$PV_4 = 2732.05$$

$$NPV = 283.51$$

$$\text{NPV@10\%} = 283.51$$

We have discounted all future values at 10%

Net Present Value = The net result of adding the PV of cash inflows to the PV of cash outflows

Conclusion

A positive NPV means the combined PV of all cash inflows exceeds the PV of cash outflows.

Combined PV of all cash inflows exceeds the PV of cash outflows by Rs 283.51

This is a good investment as it adds Rs283.51 to the value of the company.

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

Internal Rate of Return

Let us compare NPVs at different discount rates

Discount Rate	NPV
8%	Rs 745.48
10%	Rs 283.51
?	\$0
12%	Rs 145.29

As discount rate rises NPV drops

At some discount rate NPV equals 0

Goal is to determine the Discount rate where NPV which is 0. That NPV is Internal rate of return

Internal Rate of Return

The internal rate of return (IRR) is the discount rate where NPV of a given set of cash flows =0.

The IRR is also known as the break even discount rate

The present value of the cash inflows equals the present value of cash outflows at IRR

Internal Rate of Return

Let us compare NPVs at different discount rates

Discount Rate	NPV
8%	Rs 745.48
10%	Rs 283.51
11.31%	\$0
12%	Rs 145.29

The Significance of the IRR

As the borrowing cost (cost of capital) rises , NPV declines.

IRR is the limit of cost of capital for a project

If the borrowing cost > the IRR the NPV will turn negative and the project would be rejected.

IRR is related to NPV in the sense that a project with a positive NPV will have $COC < IRR$

Net Present Value – NPV

- Alternatively, the present value of a cash flow may be calculated by multiplying the cash flow by the appropriate discount factor.
- Discount factor = $1/(1+r)^t$
- For discount rate of 10% in a year:
 - ▣ Discount factor = $1/(1 + 0.1)^1 = 0.9091$
- For discount rate of 10% in 2 years:
 - ▣ Discount factor = $1/(1 + 0.1)^2 = 0.8264$
- Net Present Value (NPV) for a project is obtained by discounting each cash flow and summing the discounted values. It is normally assumed that any initial investment takes place immediately and is not discounted (year 0).

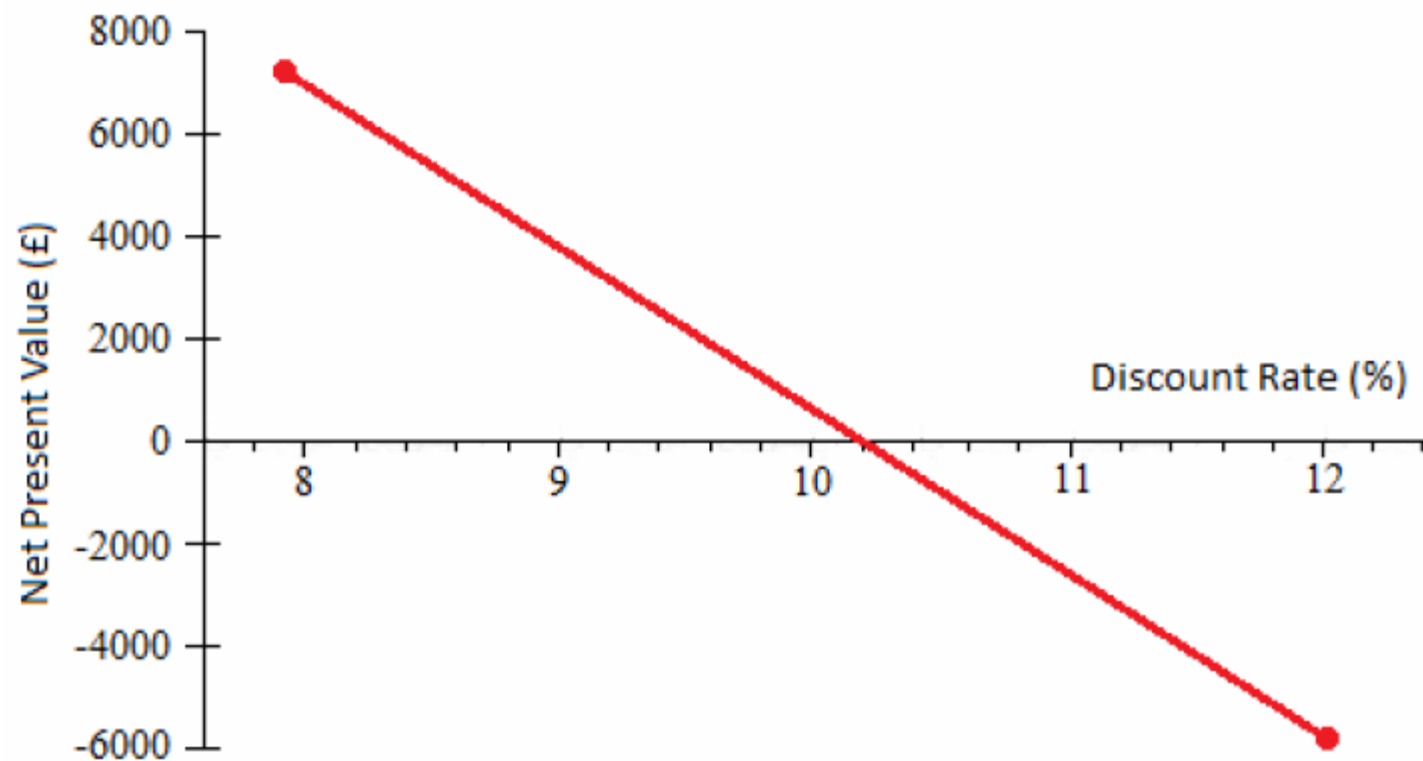
Internal Rate of Return – IRR

- IRR attempts to provide a profitability measure as a percentage return that is directly comparable with interest rates.
- A project with an estimated IRR of 10% is worthwhile if the capital cannot be invested elsewhere for a return greater than 10%.

Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project.

Supported by MS Excel and Lotus 1-2-3

Internal Rate of Return – IRR



Graph of the Internal Rate of Return calculated for Project 1.