

Week 5

Project Appraisal

Recap from last week...

- Assignment 1 (Questions)
- Ratios – Queries / Concerns

At the end of this session you will be able to:

- **explain the nature and importance of investment decision making**
- **identify three main investment appraisal methods used in practice**
- **use each method to reach a decision on a particular practical investment opportunity**
- **discuss the attributes of each of the methods**

Project Appraisals

Financial Appraisals Tools

Payback
Period

Internal Rate
of Return (IRR)

Financial
Appraisal Tools

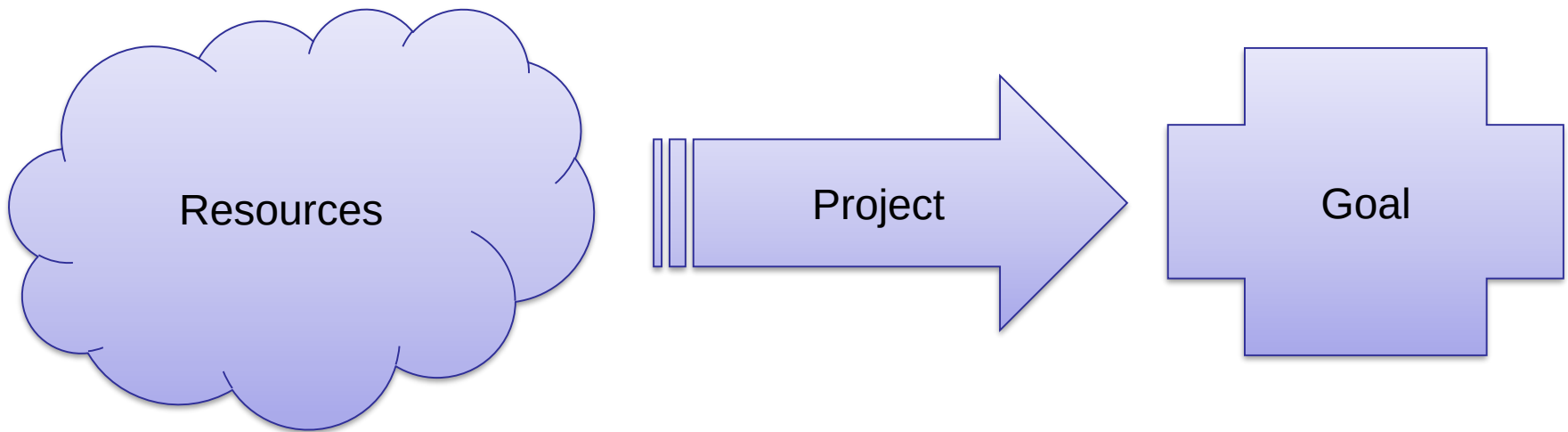
Profitability
Index

Accounting
Rate of Return
(ARR)

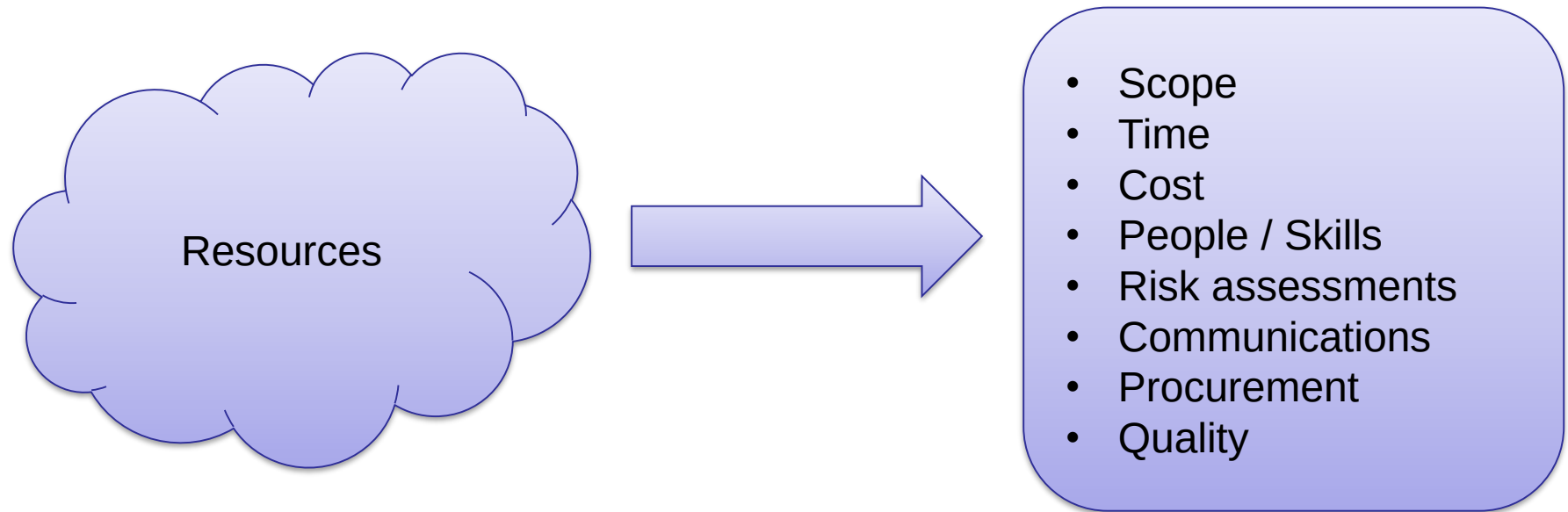
Net Present
Value
(Discounted
Cash Flow)

- What is a Project ?
- A **Project** is a temporary, unique and progressive attempt or endeavour made to produce some kind of a tangible or intangible result
 - a unique product, service, benefit, competitive advantage, etc.).
 - It usually includes a series of interrelated tasks that are planned for execution over a fixed period of time and within certain requirements and limitations such as cost, quality, performance, others.

A project is a means to achieve a goal by applying a certain amount of resources.

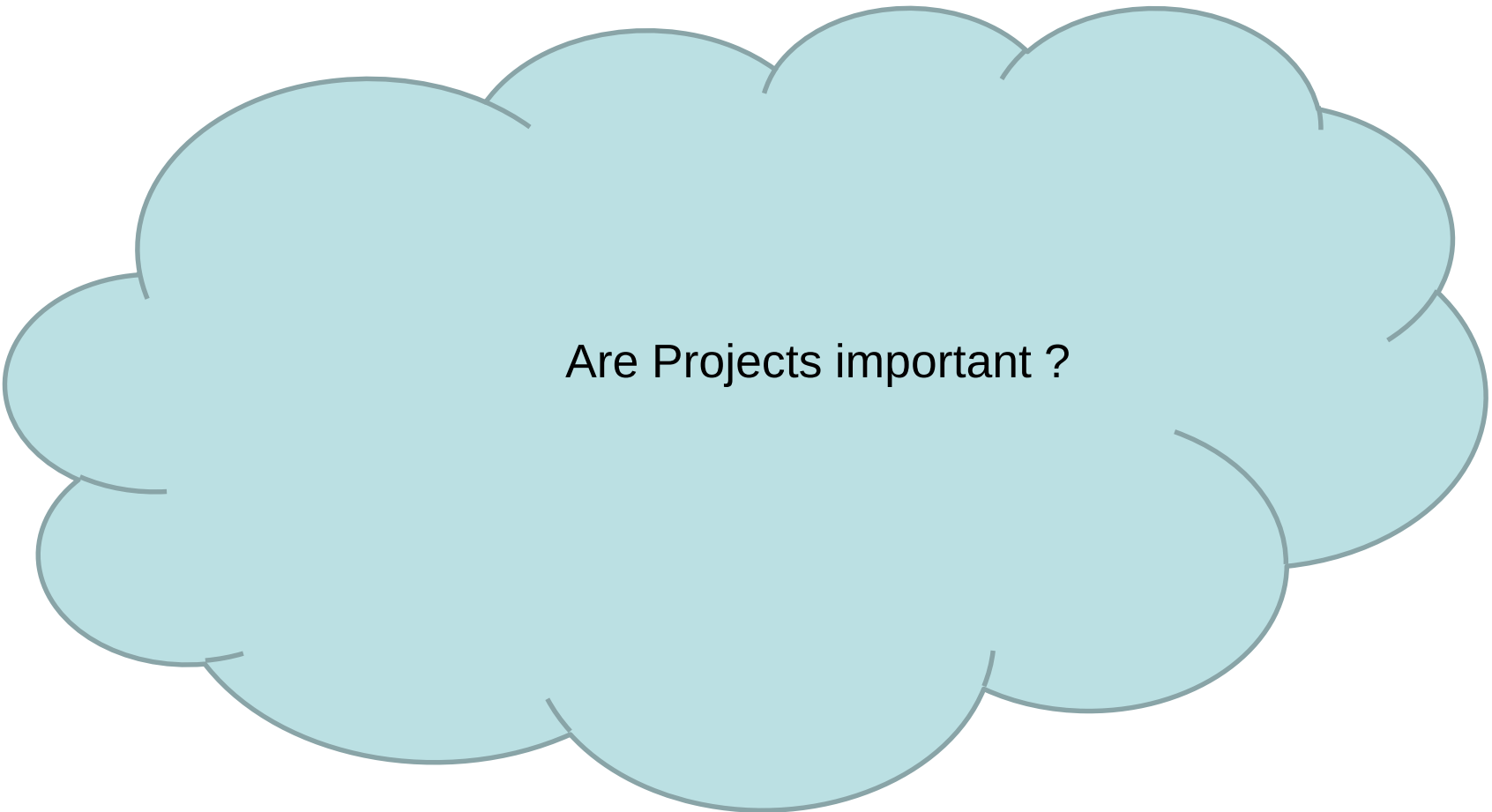


A project is a means to achieve a goal by applying a certain amount of resources.



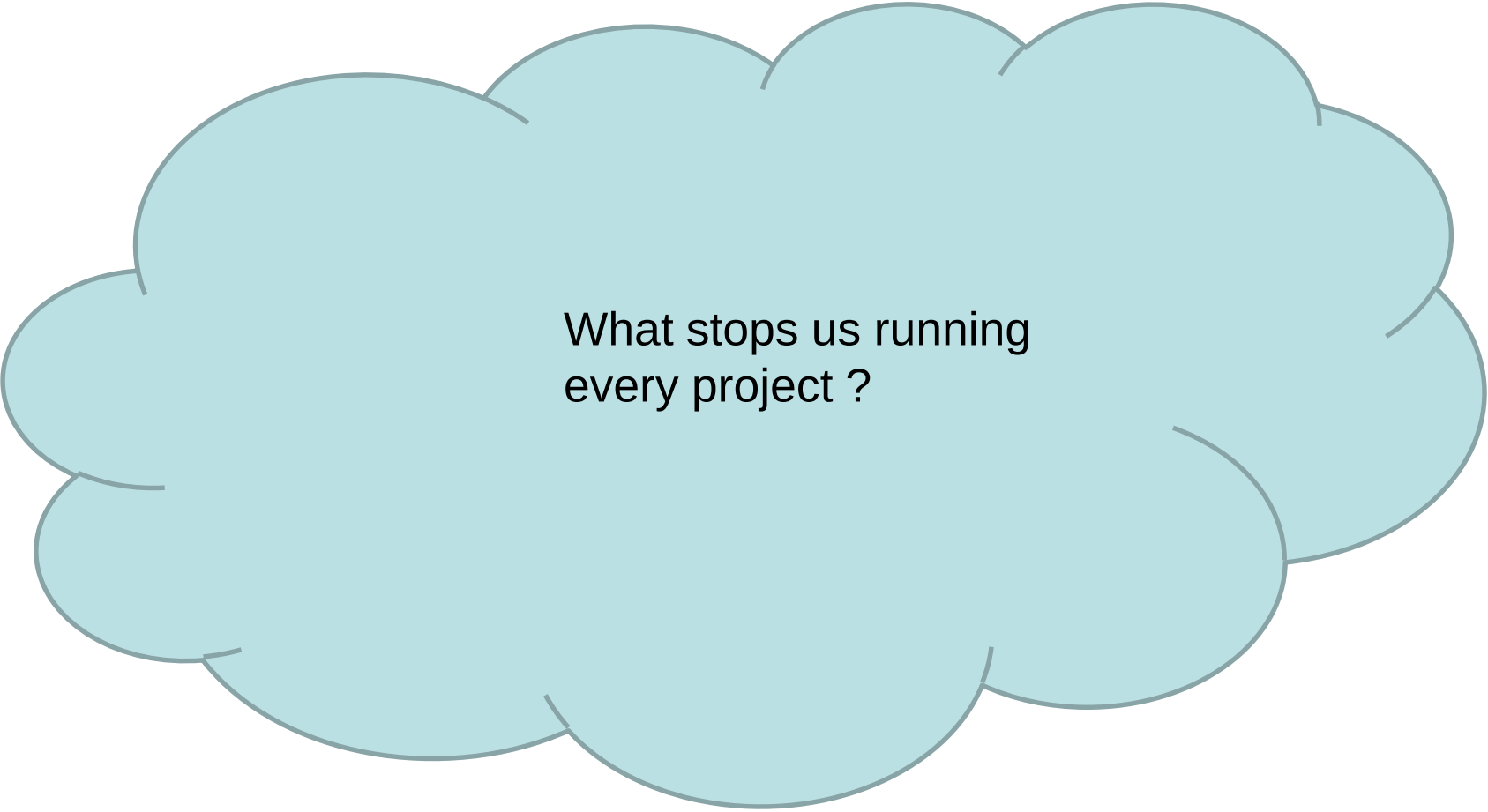
- End Goal of Projects
 - Productivity improvements
 - New Product Launch
 - Redevelop current product range
 - Plant efficiency improvements
 - Increase Capacity levels to meet increased demand
 - Cost improvements
 - Remove limiting factors from your business
 - Streamline processes
- Legal requirements eg Brexit export changes
- Health And Safety Requirements
- Environmental improvements
- Facility improvements

Project Appraisals



Are Projects important ?

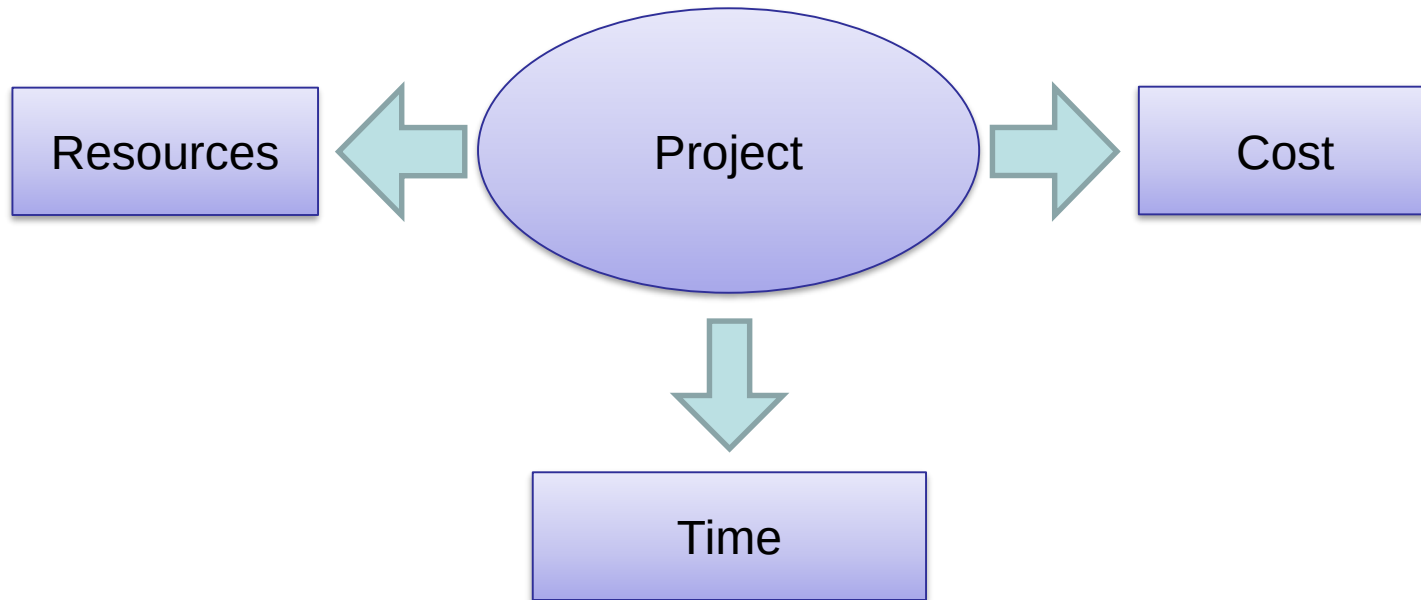
Project Appraisals



What stops us running
every project ?

Project Appraisals

- Limiting Factors



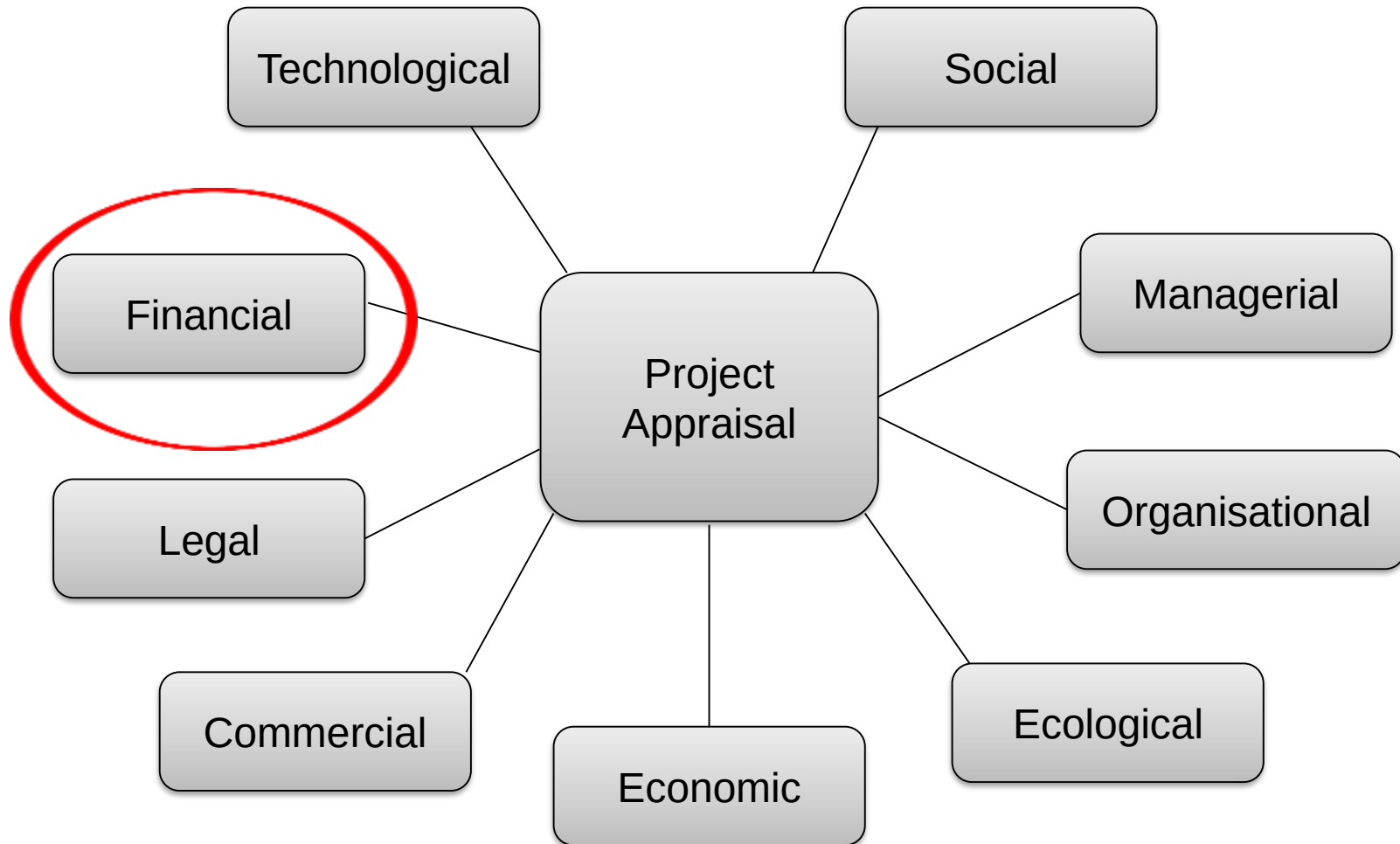
Offsets ?

Project Appraisals

- How does a business decide which projects should happen ?
- New Development
- Cost improvements
- Disruption to plant
- New Product Line launch
- Health & Safety
- Environmental
- Replacement requirements

Project Appraisals

A **Project appraisal** is a costs and benefits analysis of a proposed project with an objective to adjudicate its feasibility.



Project Appraisals

Financial Appraisals

Cost

- Fixed Cost
- Running Costs
- Cost of Funding

Versus

Benefits

- Additional Sales
- Efficiency Gains
- Gross Margin Improvements
- Productivity Gains
- Site improvement savings

Remember your analysis is only as good as the strength of your data

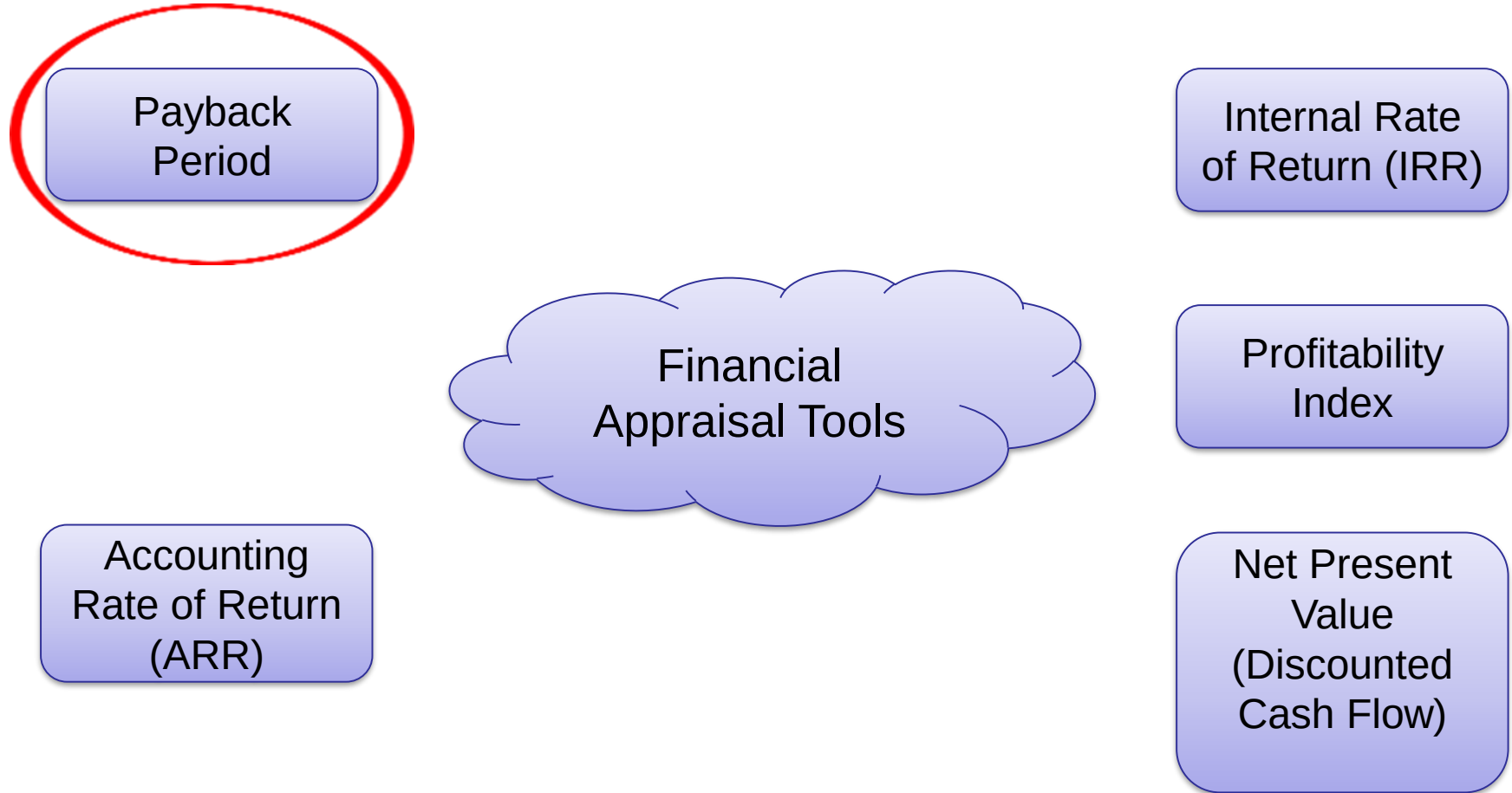
Financial Management

Capital Investment Appraisal

- Making capital investment decisions
- Methods of investment appraisal
- Capital rationing

Project Appraisals

Financial Appraisals Tools



Financial Appraisals Tools

Payback Period

- The payback period refers to the amount of time it takes to recover the cost of an investment or how long it takes for an investor to reach a breakeven position.
- Shorter paybacks mean more attractive investments, while longer payback periods are less desirable.
- The payback period is calculated by dividing the amount of the investment by the annual cash flow.

Project Appraisals

Payback Period

- Example

Project A

- Project Investment £100,000
- Net Cash Flow per year £ 25,000
- Payback Period 4 years

Project B

- £50,000
- £10,000
- 5 Years

- Which project should proceed ?

Project Appraisals

Payback Period

- Example

	Project A	Project B
• Project Investment	£10,000	£500,000
•Net Cash Flow per year	£ 1,000	£50,000
•Payback Period	10 years	10 Years

- Which project should proceed ?

- What other factors should we take into account ?

Project Appraisals

Payback Period

- Exercise
- Project A has an investment in Solar panels for a factory of £150,000 , the current monthly bill of £3,000 per month for energy and the expected savings after installation is 40% of the energy bill.
- Project B has an investment in a new production line of £1,000,000 to cope with a demand for additional capacity for a new customer, this will allow additional sales of 12,000 units per year and a sales price of £100 per unit and a net cash flow increase of 20% per item sold.
- Project C has an investment of £50,000 in improved tooling on a current line which produces 5,000 units per year. This improvement will increase capacity by 20%. The product has a sales price of £150 per unit and a net cash flow increase of 15% per item.
- Calculate the payback periods for each of the projects .

Project Appraisals

Payback Period

- Exercise

	Project A	Project B	Project C
• Project Investment	£150,000	£1,000,000	£ 50,000
•Net Cash Flow per year	£ 14,400	£240,000	£ 22,500
•Payback Period	10.41 years	4.16 years	2.22 years

- Which project should proceed ?

- What other factors should we take into account ?

Project Appraisals

Payback Period

- Strengths**

- Simple calculation
- Offers a quick evaluation
- Highlights liquidity within the calculation

- Weaknesses**

- Ignore the future value of money
- Concentrates on liquidity and can overlook profitability

Project Appraisals

- Time Value of Money

Definition

Time Value of Money is a concept that recognizes the relevant worth of future cash flows arising as a result of financial decisions by considering the opportunity cost of funds.

Concept

Money loses its value over time which makes it more desirable to have it now rather than later.

- Inflation
- Interest Rates
- Risk

Project Appraisals

- Time Value of Money

As an Example

Your company have offered you a bonus as below :-

Received this Month	£5,000
Receive in 12 Months	£5,400
Receive in 2 years	£6,000

Other Factors to consider :-

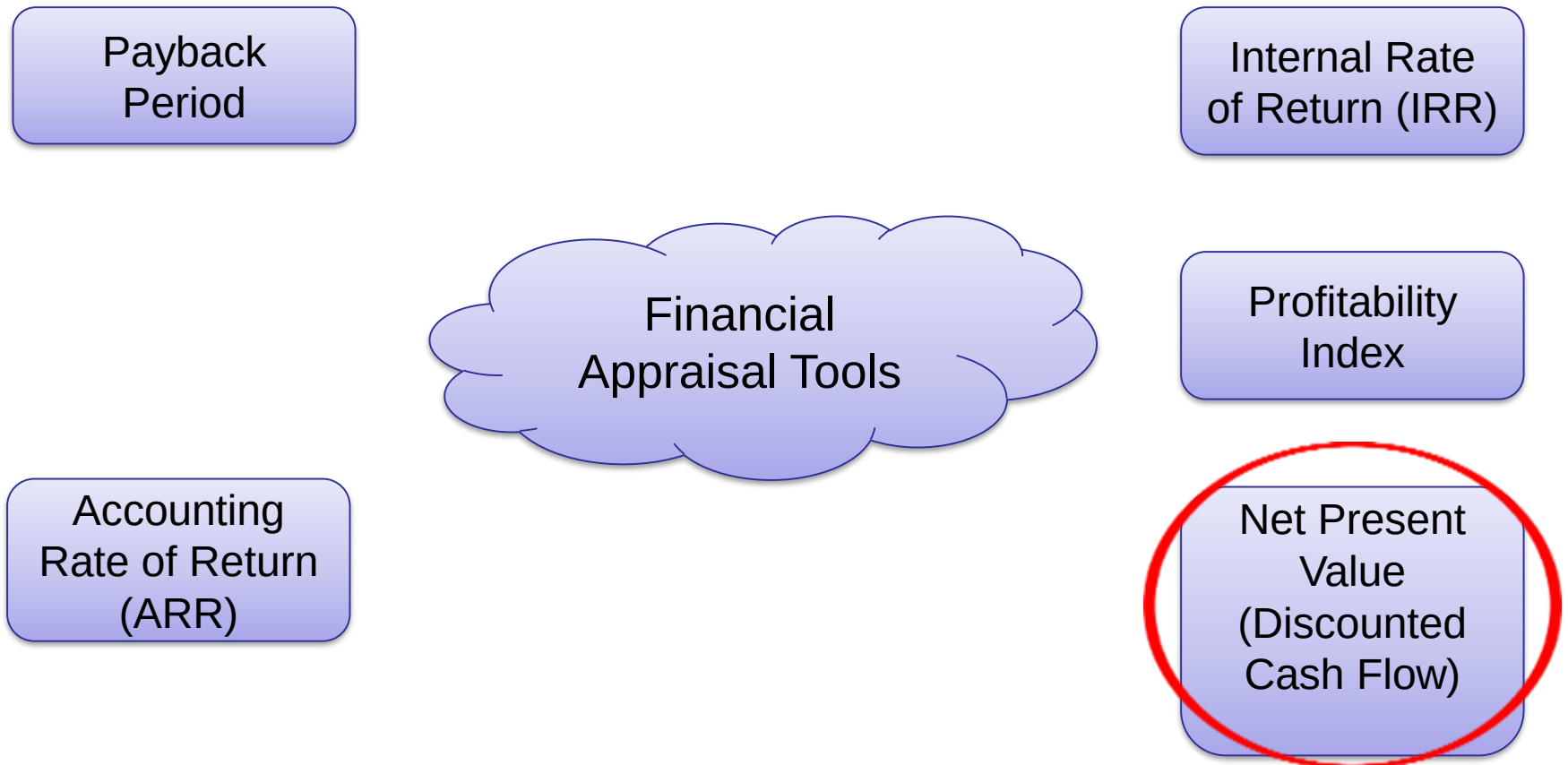
Inflation	5%
Bank Interest	3%

Which would you rather ?

Reasons ?

Project Appraisals

Financial Appraisals Tools



Project Appraisals

Financial Appraisals Tools

Net Present Value (Discounted Cash Flow)

- Net Present Value explores Cashflow In and Outs of a project with an adjustment for the Future value of money based on a discounted rate also called the Weighted average cost of Capital adjustment (WACC).
- A Positive Net Present Value calculation shows the project adds value to the organisation.
- Net Present Value adjusts the Cash Value of each year with the following formula.

$$NPV = \text{Cashflow} / ((1 + \text{discount rate})^{\text{time periods}})$$

Project Appraisals

Net Present Value (Discounted Cash Flow)

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum and a company discounted rate (WACC) of 8% for project evaluation.

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Calculate the Payback Period ?

Payback	2.5 Years
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Project Appraisals

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum and a company discounted rate (WACC) of 8% for project evaluation.

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Discount Rate (WACC)	8%
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Denominator	1.00	1.08	1.17	1.26	1.36	1.47
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Future Value	(10,000)	3,703.70	3,429.36	3,175.33	2,940.12	2,722.33
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NPV	5,971
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Positive NPV so project could achieve approval

What would happen if the Company Discount Rate was 15% ?

Project Appraisals

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum and a company discounted rate (WACC) of 15% for project evaluation.

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Payback	2.2 Years
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Discount Rate (WACC)	15%
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Denominator	1.00	1.15	1.32	1.52	1.75	2.01
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Future Value	(10,000)	3,478.26	3,024.57	2,630.06	2,287.01	1,988.71
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NPV	3,409
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NPV (Excel Calculated)	 3,409
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Project Appraisals

Net Present Value (Discounted Cash Flow)

- Example

	Project A	Project B
• Project Investment	£10,000	£500,000
• Net Cash Flow per year	£ 5,000	£166,667
• Payback Period	2 years	3 Years

- The company has a Discount Rate of 20% for reviewing projects.

- Calculate the NPV

Project Appraisals

Net Present Value (Discounted Cash Flow)

Excel has an inbuilt NPV Function

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	5,000	5,000	5,000	5,000	5,000

Payback	2 Year
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Discount Rate	20.00%
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Denominator	1.00	1.20	1.44	1.73	2.07	2.49
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Future Value	(10,000)	4,167	3,472	2,894	2,411	2,009
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NPV	4,953	PI	1.50
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NPV (Excel Calculated)	£4,953
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Project B

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(500,000)	166,667	166,667	166,667	166,667	166,667
Payback	3 Years					
Discount Rate (WACC)	20.00%					
Denominator	1.00	1.20	1.44	1.73	2.07	2.49
Future Value	(500,000)	138,889	115,741	96,451	80,376	66,980
NPV	(1,564)	PI		1.00		
NPV (Excel Calculated)	-£1,564					

Project Appraisals

Net Present Value (Discounted Cash Flow)

- Exercise
- Company Discounted Rate (WACC) is 8%
- Calculate the NPV based on the following 3 projects using Excel
- Which project should proceed and why ?

Project	Investment	1	2	3	4	5	NPV
A	(100,000)	25000	25000	25000	25000	25000	-182
B	(100,000)	5000	20000	25000	30000	45000	-5,701
C	(100,000)	45000	35000	30000	10000	5000	6,242

Discount Rate (WACC)	8%
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Project Appraisals

Net Present Value (Discounted Cash Flow)

•Strengths

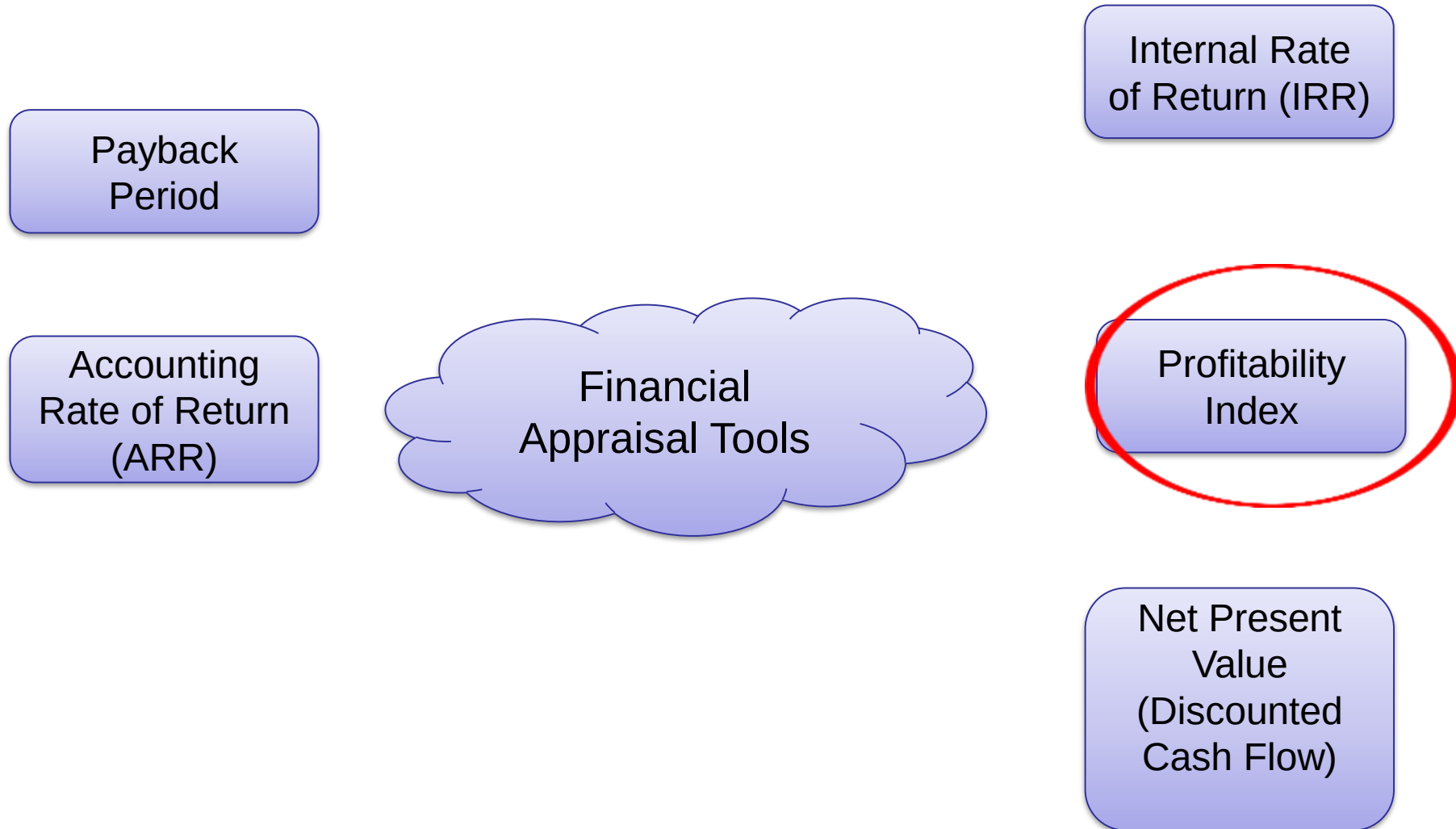
- Takes account of the time value of money
- Informs whether the project will add value to the organisation
- Excel simplifies the process

•Weaknesses

- How do you define your company's cost of capital
- Doesn't allow for a clear comparison of different size projects

Project Appraisals

Financial Appraisals Tools



Project Appraisals

Financial Appraisals Tools

Profitability Index

- Profitability index is a calculation of the potential profit of the proposed project.
- The rule is that a profitability index or ratio greater than 1 indicates that the project should proceed.
- A profitability index or ratio below 1 indicates that the project should be abandoned.
- Profitability index is a variation of the NPV rule
- The formula for PI is the present value of future cash flows divided by the initial cost of the project.

Project Appraisals

Profitability Index

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum
Calculate the PI?

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Payback	2.2 Years
---------	-----------

Discount Rate (WACC)	8%
-----------------------	----

Denominator	1.00	1.08	1.17	1.26	1.36	1.47
-------------	------	------	------	------	------	------

Future Value	(10,000)	3,703.70	3,429.36	3,175.33	2,940.12	2,722.33
--------------	----------	----------	----------	----------	----------	----------

NPV	5,971
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NPV (Excel Calculated)	5,971
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$$\text{Profitability Index} = \frac{\text{NPV of Cash Flows}}{\text{Investment}} = \frac{15,971}{10,000} = 1.60$$

Project Appraisals

Profitability Index

- Example

Project A

Project B

- Project Investment

£10,000

£500,000

- Net Cash Flow per year

£ 5,000

£166,667

- Payback Period

2 years

3 Years

Project Appraisals

Profitability Index

Calculate the PI for each Project ?

Does this change your stance on which project should proceed ?

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	5,000	5,000	5,000	5,000	5,000

Payback	2 Year
---------	--------

Discount Rate (WACC)	8%
-----------------------	----

Denominator	1.00	1.08	1.17	1.26	1.36	1.47
-------------	------	------	------	------	------	------

Future Value	(10,000)	4,630	4,287	3,969	3,675	3,403
--------------	----------	-------	-------	-------	-------	-------

NPV	9,964	PI		2.00
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NPV (Excel Calculated)	9,964
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Project B

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(500,000)	166,667	166,667	166,667	166,667	166,667

Payback	3 Years
---------	---------

Discount Rate (WACC)	8%
-----------------------	----

Denominator	1.00	1.08	1.17	1.26	1.36	1.47
-------------	------	------	------	------	------	------

Future Value	(500,000)	154,321	142,890	132,306	122,505	113,431
--------------	-----------	---------	---------	---------	---------	---------

NPV	165,453	PI		1.33
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NPV (Excel Calculated)	165,453
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Project Appraisals

Profitability Index

- Exercise
- Calculate the PI and payback for the following 3 projects
- Which Project Should Proceed and why ?

Project	Investment	1	2	3	4	5
A	(100,000)	25000	25000	25000	25000	25000
B	(100,000)	5000	20000	25000	30000	45000
C	(100,000)	45000	35000	30000	10000	5000

NPV
-182
-5,701
6,242

PI	Payback
1.00	4.00 Years
0.94	4.44 Years
1.06	2.33 Years

Project Appraisals

Profitability Index

•Strengths

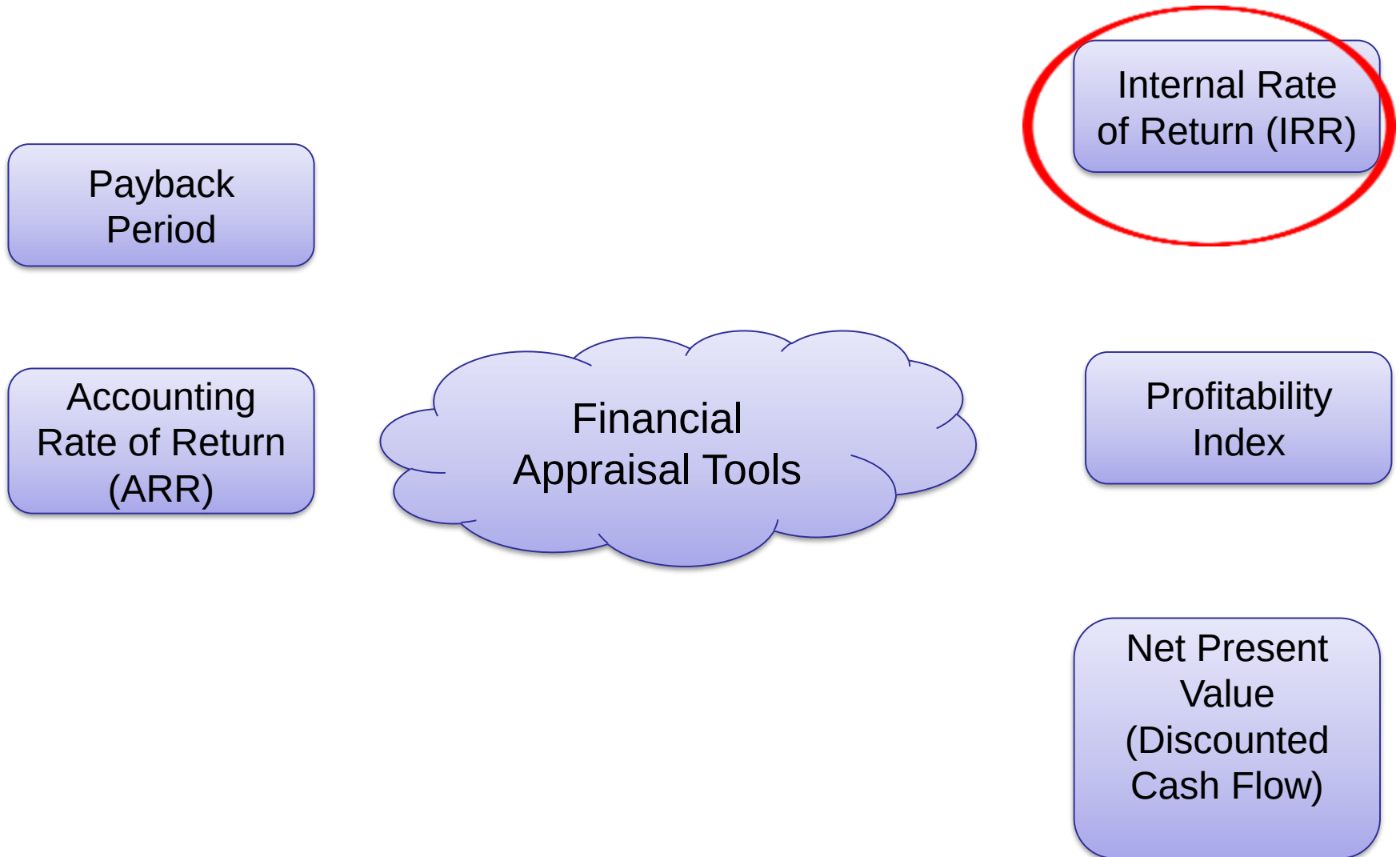
- Takes account of the time value of money
- Reviews liquidity of projects
- Simple calculation

•Weaknesses

- Ignores the sizes of projects
- How do you define your companies cost of capital

Project Appraisals

Financial Appraisals Tools



Project Appraisals

Financial Appraisals Tools

Internal Rate of Return (IRR)

- IRR calculates discount rate that causes the net present value of future cashflows from an investment to equal zero.

Formula

Internal Rate of Return:

$$= R1 + [(NPV1 \times (R2 - R1)\% \div (NPV1 - NPV2)]$$

Where:

R1 = Lower discount rate

R2 = Higher discount rate

NPV1 = Higher Net Present Value (derived from R1)

NPV2 = Lower Net Present Value (derived from R2)

Ignore the Formula

Project Appraisals

Internal Rate of Return (IRR)

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum

Calculate the Payback Period?

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Payback Period - $2\frac{1}{2}$
Years

Internal Rate of Return (IRR)

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Payback	2.5 Years
---------	-----------

Present Value	(10,000)	4000	4000	4000	4000	4000
---------------	----------	------	------	------	------	------

Payback	2.5 Years
---------	-----------

Discount Rate (WACC)	8%
-----------------------	----

Denominator	1.00	1.08	1.17	1.26	1.36	1.47
-------------	------	------	------	------	------	------

Future Value	(10,000)	3,703.70	3,429.36	3,175.33	2,940.12	2,722.33
--------------	----------	----------	----------	----------	----------	----------

NPV	5,971
-----	-------

$$\text{Profitability Index} = \frac{\text{NPV of Cash Flows}}{\text{Investment}} = \frac{15,971}{10,000} = 1.60$$

Calculate NPV based on a Discount Rate of 8% and the Profitability Index

Internal Rate of Return (IRR)

Example

Project A has an investment of £10,000 with a cashflow In of £4000 per annum

Calculate IRR Rate

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000

Payback	2.2 Years
---------	-----------

Discount Rate	8.00%
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Denominator	1.00	1.08	1.17	1.26	1.36	1.47
-------------	------	------	------	------	------	------

Future Value	(10,000)	3,703.70	3,429.36	3,175.33	2,940.12	2,722.33
--------------	----------	----------	----------	----------	----------	----------

NPV	5,971
-----	-------

NPV (Excel Calculated)	5,971
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Internal Rate of Return	28.65%
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Internal Rate of Return (IRR)

Example

Excel Formula

Project A						
	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	4000	4000	4000	4000	4000
Payback	2.5 Years					
Discount Rate	8.00%					
Denominator	1.00	1.08	1.17	1.26	1.36	1.47
Future Value	(10,000)	3,703.70	3,429.36	3,175.33	2,940.12	2,722.33
NPV	5,971					
NPV (Excel Calculated)	5,971					
Internal Rate of Return	28.65%					
IRR =	Excel Formula = '(range of Cashflow so C4 to H4, Guessed Discount Rate)					
so the formula in this instance is	IRR=(C4:H4,20%)					

Project Appraisals

Internal Rate of Return (IRR)

- Example

	Project A	Project B
• Project Investment	£10,000	£500,000
• Net Cash Flow per year	£ 5,000	£166,667
• Payback Period	2 years	3 Years

- Calculate the IRR based on the Cashflows for the next 5 years.
- Which Project has the higher Internal Rate of Return ?

Project Appraisals

Internal Rate of Return (IRR)

Project A

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(10,000)	5,000	5,000	5,000	5,000	5,000

Payback	2 Year
---------	--------

Discount Rate (WACC)	41.04%
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Denominator	1.00	1.41	1.99	2.81	3.96	5.58
-------------	------	------	------	------	------	------

Future Value	(10,000)	3,545	2,513	1,782	1,264	896
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NPV	0
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IRR (Excel Calculated)	41.04%
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Project B

	Investment	Yr1	Yr2	Yr3	Yr4	Yr5
Present Value	(500,000)	166,667	166,667	166,667	166,667	166,667

Payback	3 Years
---------	---------

Discount Rate (WACC)	19.86%
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Denominator	1.00	1.20	1.44	1.72	2.06	2.47
-------------	------	------	------	------	------	------

Future Value	(500,000)	139,054	116,016	96,795	80,758	67,378
--------------	-----------	---------	---------	--------	--------	--------

NPV	0
-----	---

IRR (Excel Calculated)	19.86%
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Project Appraisals

Internal Rate of Return (IRR)

- Exercise
- Calculate the IRR based on the following 3 projects using Excel
- Which project has the highest Internal Rate of Return?

Project	Investment	1	2	3	4	5	IRR
A	(100,000)	25000	25000	25000	25000	25000	7.9%
B	(100,000)	5000	20000	25000	30000	45000	6.3%
C	(100,000)	45000	35000	30000	10000	5000	11.2%

Project Appraisals

Internal Rate of Return (IRR)

•Strengths

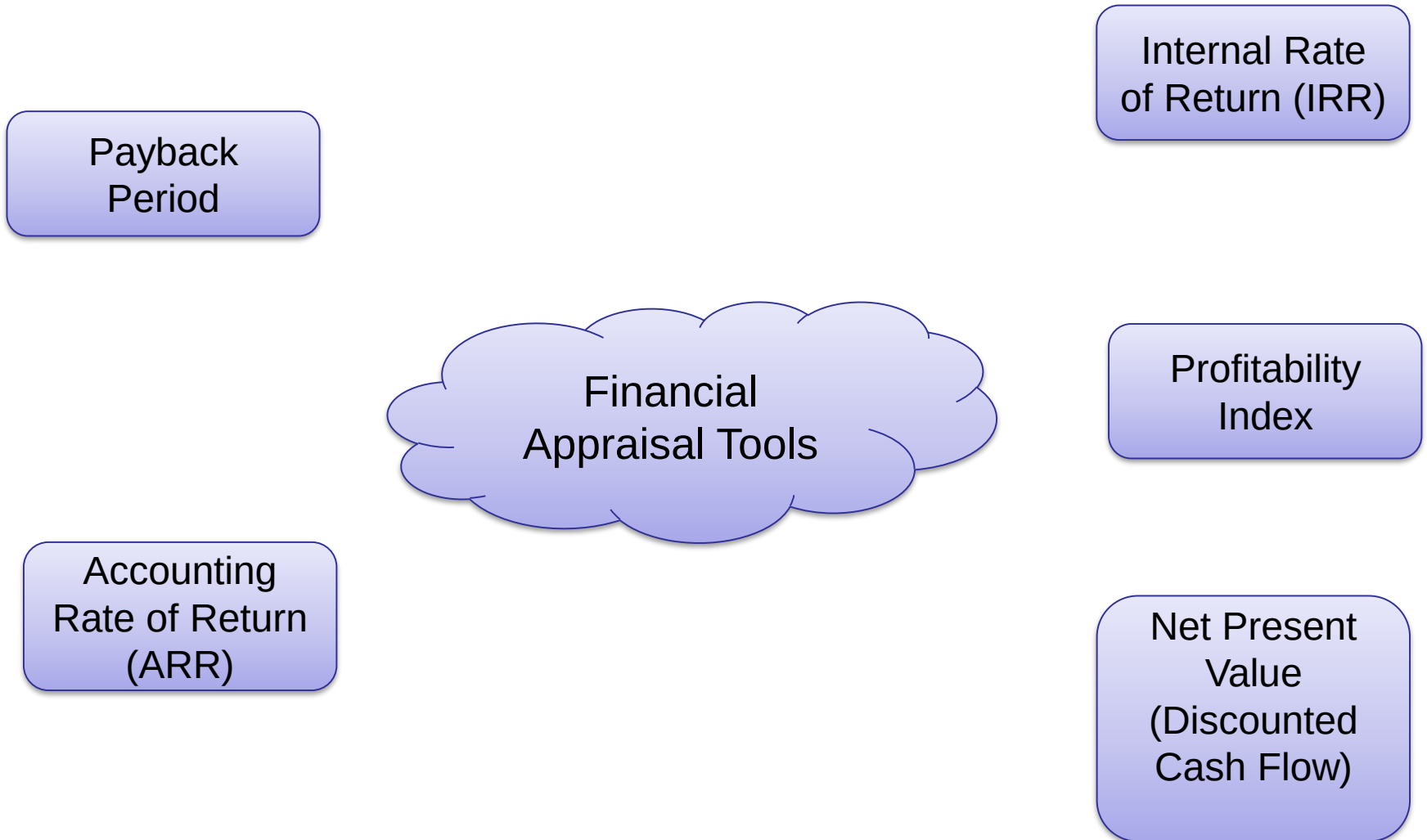
- Takes account of the time value of money
- Reviews liquidity of projects
- Excel simplifies the process

•Weaknesses

- Doesn't allow for a clear comparison of different size projects
- Can be tedious to calculate manually

Project Appraisals

Financial Appraisals Tools



Project Appraisals

Project	Investment	1	2	3	4	5
A	(150,000)	50000	50000	50000	50000	50000
B	(200,000)	60000	50000	40000	30000	20000
C	(175,000)	50000	60000	65000	60000	70000

Calculate

- 1) Payback Period
- 2) Calculate the IRR (Internal Rate of Return)

Do any of the above project pass the Company Criteria of:

- 1) Payback Period of less than 3 years and Internal Rate of Return greater than 20 %

Project Appraisals

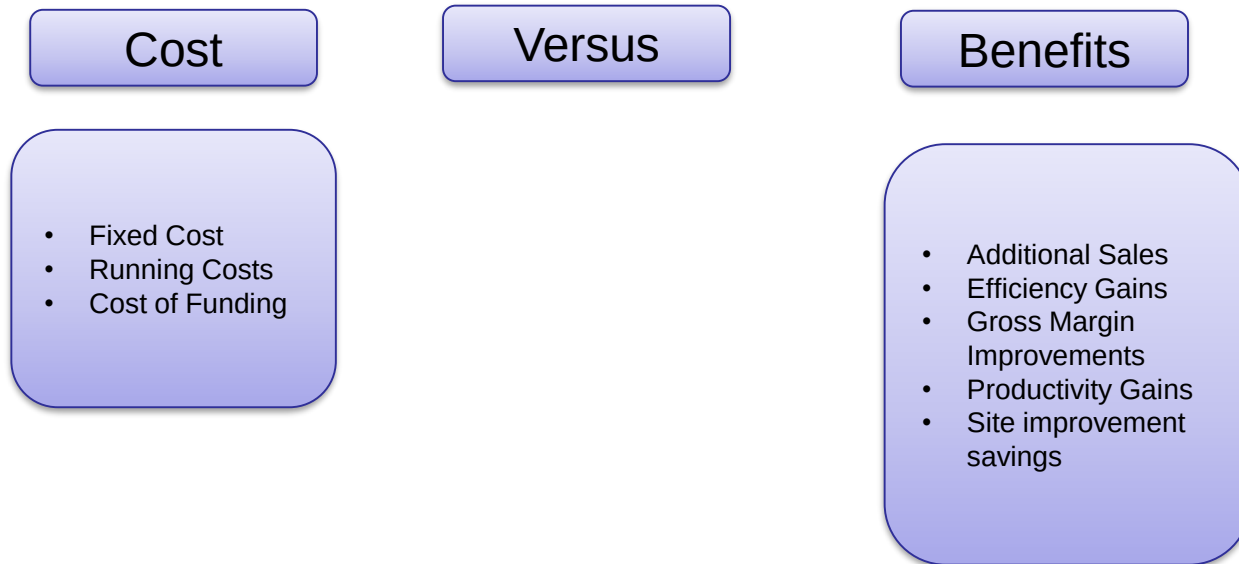
Project	Investment	1	2	3	4	5	IRR	Payback
A	(150,000)	50000	50000	50000	50000	50000	19.9%	3 years
B	(200,000)	60000	50000	40000	30000	20000	0.0%	5 Years
C	(175,000)	50000	60000	65000	60000	70000	20.7%	3 years

Project A + C are pretty close from a financial perspective.

What else could you take into account ?

Project Appraisals

Financial Appraisals



Remember your analysis is only as good as the strength of your data

Next Time

- Use of these tools
- Capital Rationing