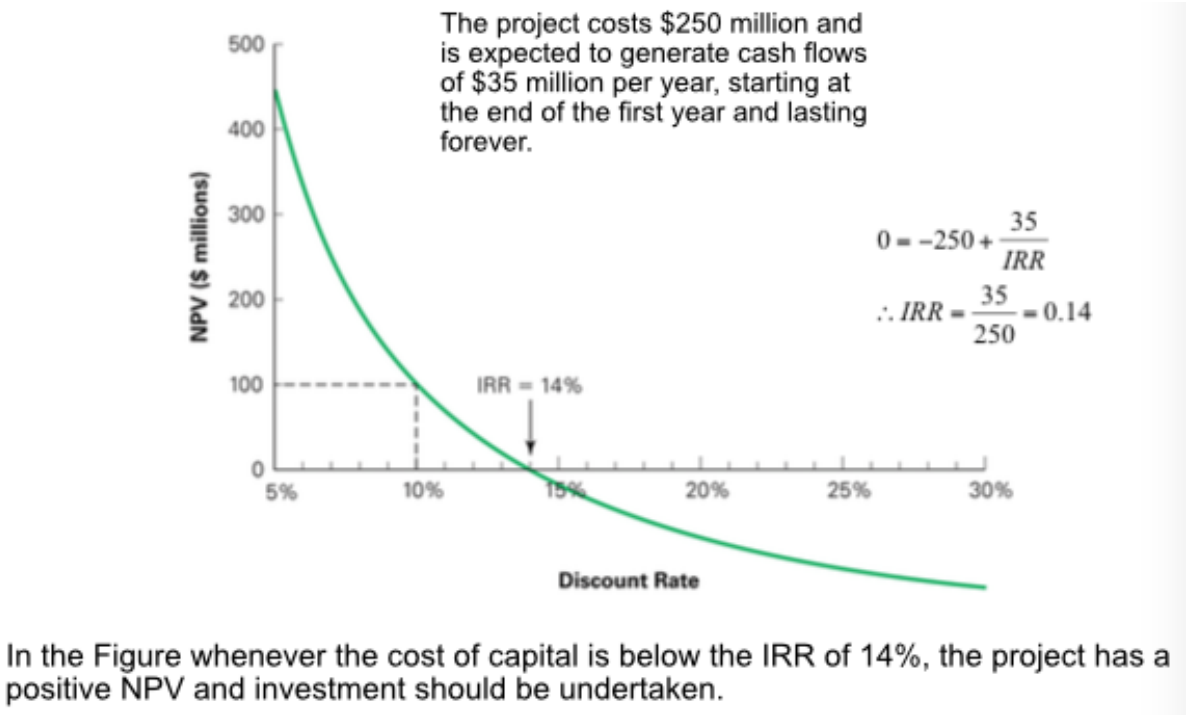

In the Figure whenever the cost of capital is below the IRR of 14%, the project has a positive NPV and investment should be undertaken.

- There exist a number of situations where the IRR rule and NPV may be in conflict (thus making the IRR incorrect):
    - **1. Lending or borrowing** – Not all cash-flow streams have NPVs that decline as the discount rate rises. With some cash flows, the NPV of the project increases as the discount rate increases.
        - **Example** – You are paid $1 million up front to write a book. You estimate it will take three years to write, which will cause you to give up your job ($500,000 per year). You estimate your opportunity cost to be 10%.
            - The IRR rule gives us 23.38% (accept), but the NPV is negative (reject).
    - **2. Multiple rates of return** – Certain cash flows can generate NPV = 0 at two different discount rates. Projects whose cash flows change sign more than once; there will be more than one IRR.
        - **Example** – The publisher now offers you a $550,000 advance and $1,000,000 in four years when the book is published. It will still take three years to write, which will cause you to give up your job ($500,000 per year).
            - The IRR rule gives us 7.164% and 33.673%. Because there is more than one IRR, the rule cannot be applied.
            - Between 7.164% and 33.673%, the book deal has a negative NPV. Since the opportunity cost of capital is 10%, you should reject the deal.
    - **3. Nonexistent IRR** – It is possible to have a zero IRR and a positive NPV. Projects should be accepted if it has a positive NPV, even without a IRR.

        - **Example** – Finally, suppose you are able to get the publisher to increase their advance to $750,000, in addition to the $1 million when the book is published in four years.
            - With these cash flows, no IRR exists; there is no discount rate that makes NPV equal to zero.
    - **4. Mutually exclusive projects** – When you can accept one project or another competing project, or reject both; but cannot accept both. For mutually exclusive projects, accept the project with the higher NPV. A project with a higher NPV need not be the one with a higher IRR.
        - With mutually exclusive projects, IRR can be misleading. IRR sometimes ignores magnitude of scale of the project. IRR is also unreliable in ranking projects that offer different patterns of cash flows over time.
    - **5. More than one opportunity cost of capital** – IRR does not allow for differ discount rates to be used for different time periods. We assume that discount rates are stable during the term of the project. This assumption implies that all funds are invested at the IRR – a false assumption.
- Both IRR and NPV are DCF methods, so both can allow for risk and time value of money. Both, properly used, give the same accept/reject decisions. But, they may not give the same ranking – this is a problem when selecting from mutually exclusive projects. **NPV is typically the better technique**.
- **Weaknesses of NPV** – NPV ignores the value of real options (expansion, abandonment, change of use). NPV calculation are only a part of capital budgeting. Other parts include generating ideas for projects, developing forecasts and organisational politics.
- **Payback rule** – Only accept projects that "payback" in the desired time frame.
    - **Payback period** – The number of years it takes before the cumulative forecasted cash flows equal the initial outlay.
    - This rule is used by many companies because of its simplicity, however this method is flawed, primarily because it ignores the time value of money, ignores cash flows beyond the payback horizon, it can also be inconsistent (ranking the projects may be changed by packaging with other projects). Project accepted on payback criteria may not even have a positive NPV.

$$Payback = \ year\ before\ \ full\ \ recovery + \frac{unrecovered\ \ cost\ \ at\ \ start\ \ of\ \ year}{cash\ \ flow\ \ during\ \ year}$$

- Book Rate of Return – Average income divided by average book value over project life. Also called the accounting rate of return.
    - Book Rate of Return = av. book income / av. book assets.
    - Managers rarely use this measurement to make decisions. The components reflect tax and accounting figures, not market values or cash flows.
- When resources are limited, the **profitability index (PI)** provides a tool for selecting among various project combinations and alternatives.