MINERAL ECONOMICS AND BUSINESS

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Week 5

Lecture 25 : Valuation models and Evaluation techniques

Hello and welcome to my lecture. After three consecutive classes on the time value of money, today we will discuss the generic valuation model and the ideas about valuation techniques. Now, in this, the different concepts that we cover include the well-known model called the Hoskold approach. There are different evaluation techniques.

Hoskold approach of mine valuation

- The **Hoskold Formula** is a widely used method for valuing mines and other depleting assets.
- It takes into account both risk and time value of money while estimating the present worth of future income from a mine.
- Hoskold formula is based on the idea that the dividend received from a mining investment is comprised of two constant parts:
  - *Interest on the original investment (at a rate which is considered commensurate with the risk).*
  - *Return on capital, which later must be of such amount that when reinvested at compound interest (security rate), it will equal the amount of the original investment when the mine is exhausted.*

We will take two of them, like the payback period and accounting rate of return, in this lecture. For mine valuation, as I have been telling in this series of lectures, we need to understand the value in terms of money, but the valuation cannot be done as easily as with any other material. The Hoskold formula is widely used for the valuation of mines and other depleting assets, meaning as you continue mining, your natural resources deplete. It takes into account both the risk and time value of money, which you have now studied, while estimating the present worth of the future income from any mine.

Hoskold approach

- The **Hoskold formula** for present worth is given by:

$$V_p = \frac{A}{\left(\frac{r}{(1+r)^n - 1} + r'\right)}$$

where,

- V_p *is present worth*
- *r is safe rate of redemption of capital (representing a* ***risk-free return****)*
- *r' is speculative rate on invested capital (representing a* ***risk-adjusted return*** *on capital invested)*
- *A is uniform annual profit*
- *n is life of mine in years*

So, the Hoskold formula is based on the idea that the dividend received from a mining investment is comprised of two constant parts. One is the interest on the original investment at a rate considered commensurate with the risk, and the return on capital. So, these two major components will use two different rates in the formula. This return on capital must later be of such an amount that, when reinvested at compound interest, it will equal the original investment, also known as the sinking fund.

otherwise known as sinking fund also. The Hoskold formula for present worth is given by this one:

$$V_p = \frac{A}{\left(\frac{r}{(1+r)n-1} + r'\right)}$$

Where,

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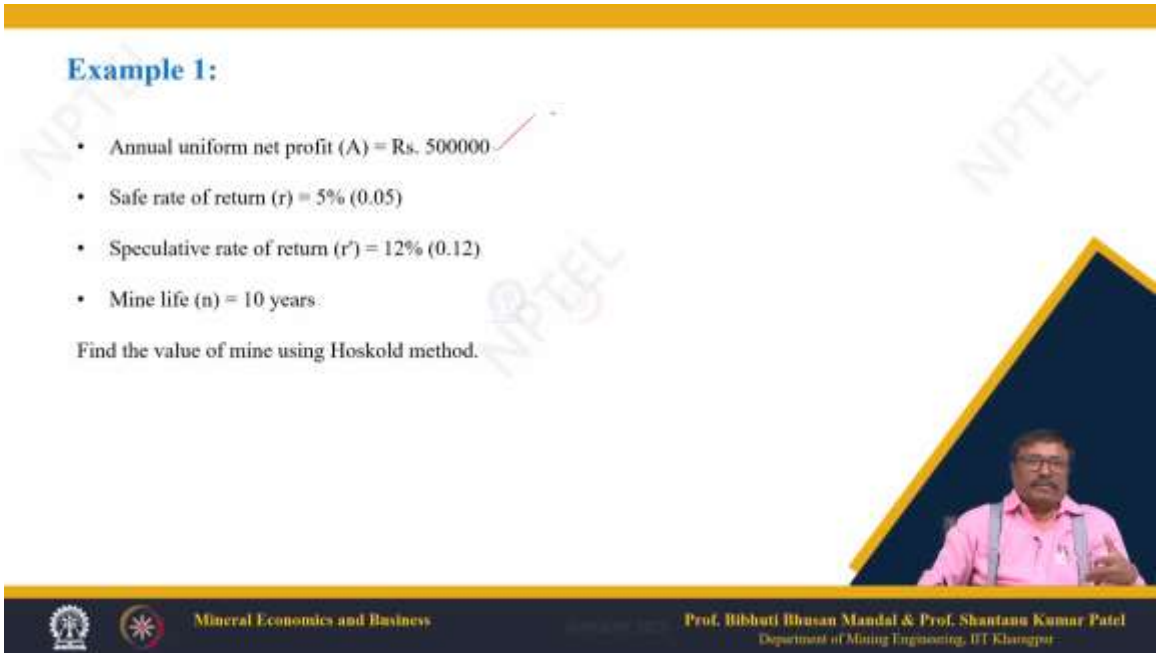
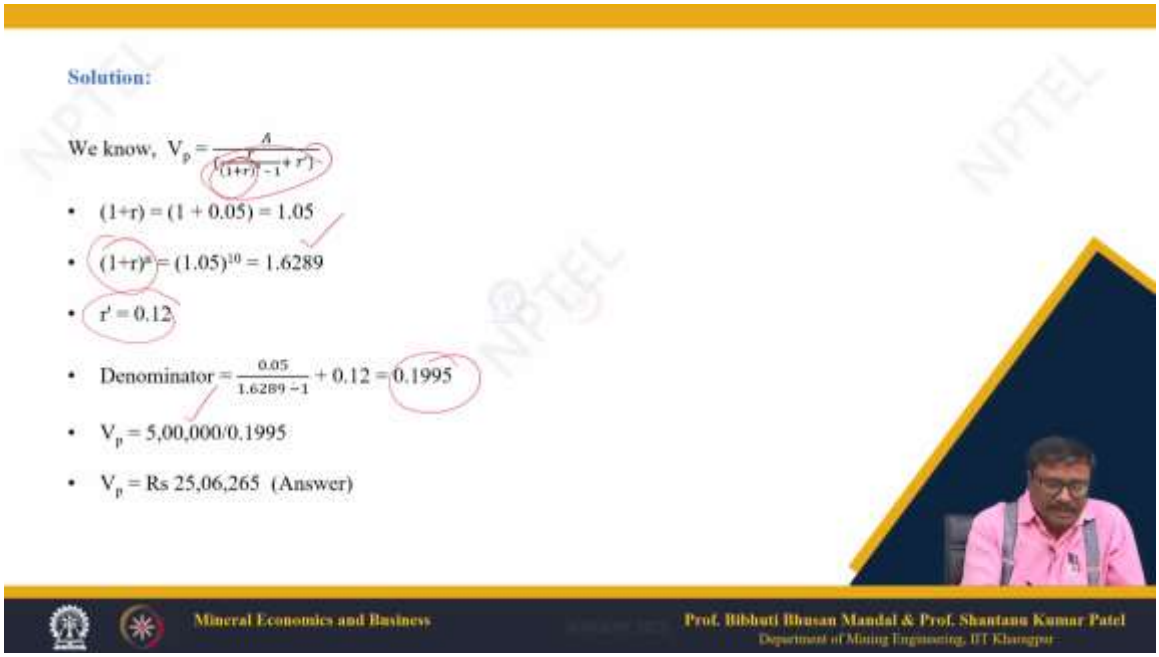
- r is safe rate of redemption of capital (representing a **risk-free return**)
- r' is speculative rate on invested capital (representing a **risk-adjusted return** on capital invested)
- A is uniform annual profit
- n is life of mine in years



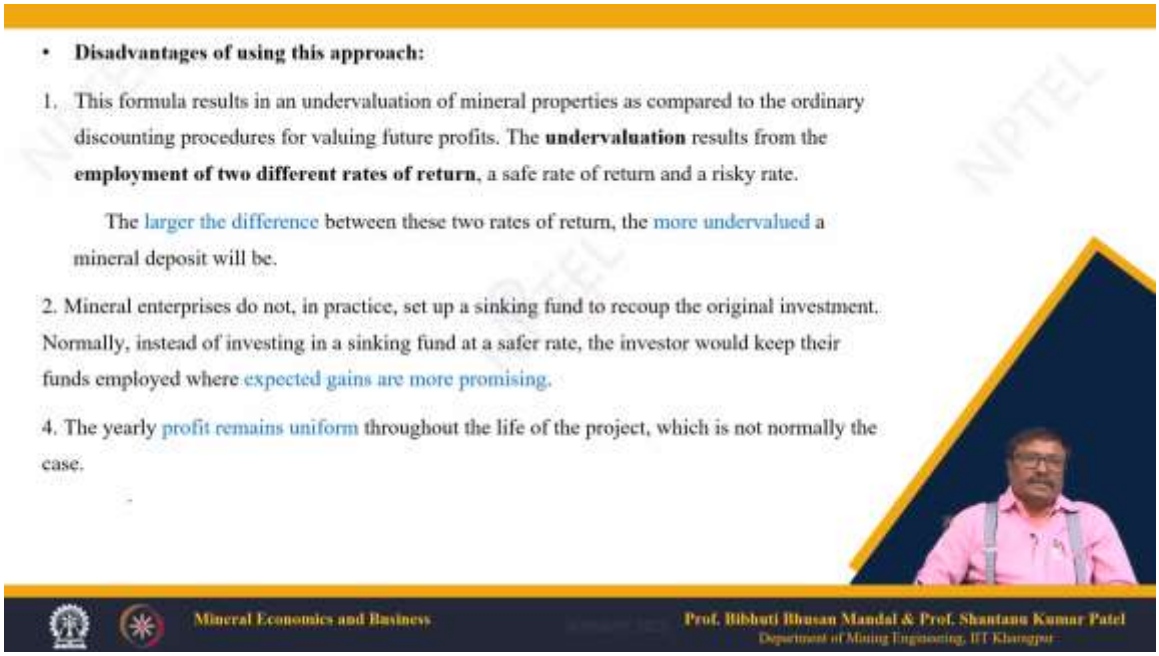
For example, we take this value 500000 pass black this is just for ah for your evaluation you can take 5 crores also 5000 crores also anything, but I mean how it looks like. The safe rate of return as we said risk free is the this 5 percent and the speculative rate of return is 12 percent that we think that it will give us a 12 percent data over a period of 10 years. Now, the question is that you have to find out the value of mine using Hosskoll method. So, here you see that we need to know the uniform net profit rate must know the approximately the lifespan of the deposit for mining and 2 rates of return one is safe rate and one is the speculative rate of return.

If we use the formula which we have seen in the previous slide and just put the values there what you see is that you get this r dash value assuming this is 0.12. So, 1 plus r raise to the power n becomes 1.6289 this part and then we put the values here in this place here the denominator part this part can be calculated as 0.1995 almost like 0.2 you can say. So, the BP become this 5 lakhs divided by 0.2 approximately 25 lakhs is the answer. So, this is the present value of the mine present value of the of the mine. So, you must have two different rates for calculating this present value.



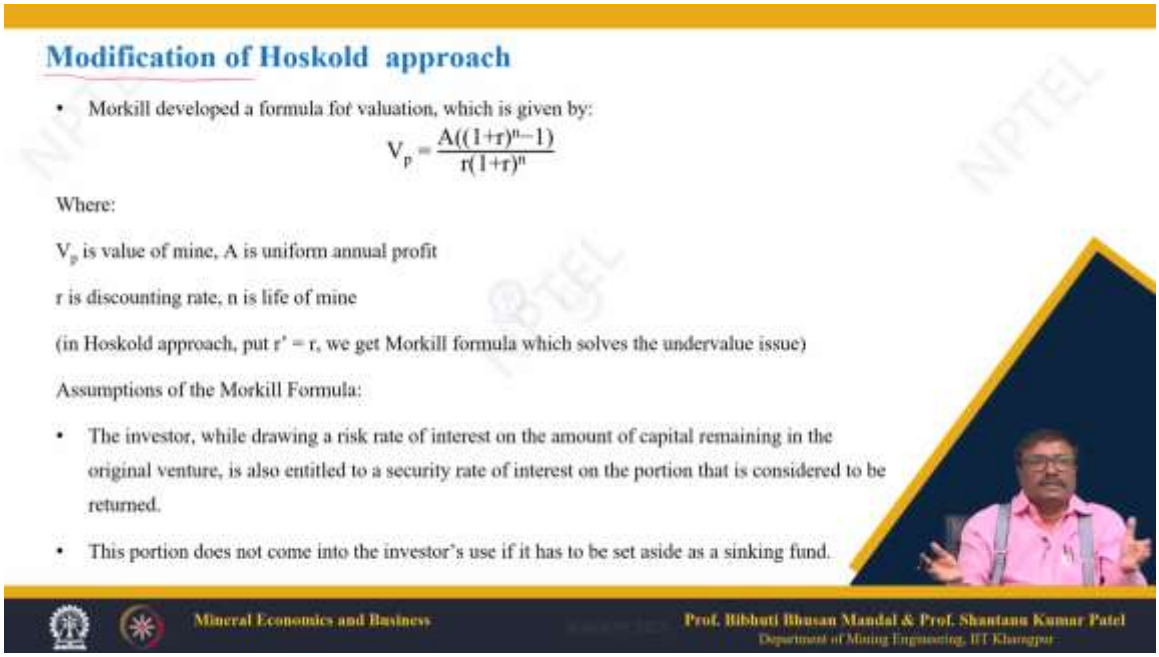
What are the disadvantages or rather shortcomings of using this approach? This formula actually results in an undervaluation, it is understood by many that it undervaluates underestimates the value of the mineral property compared to the discounting cash flow techniques. So, the undervaluation results from the employment of 2 rates of return 2 rates of return and if the difference between these 2 like we had 1 as 5 percent and the other has 12 percent. So, there is a 7 percent difference, if this difference increases then

there will be this undervaluation will further increase, the degree of undervaluation you



can say.

Secondly, we had something that I talked about the sinking fund. So, usually mineral enterprise will not in practice set up a sinking fund. to recover the original investment. So, instead of putting into a sinking fund at a safer rate because if you are putting in the bank, if bank will give a nominal rate of interest which will get for guarantee and it is a safer rate, but investor will try to keep that money other somewhere else even you can think of mutual fund or somewhere else to get better returns. So, where the expected gains are more promising people will try to invest there instead of putting just in the bank and get a fixed deposit kind of interest rate which is very low.



The the yearly profit remains uniform as we have calculated like for A we have taken. So, this is uniform throughout the life of the project which is not normally the case it varies and sometimes widely. So, that that is not a good assumption. Now so, there is a modification in the Hoskold approach actually it is a simplification I must not say that it is a modification of the Hoskold approach, but it is a simplification where the rate of interest has been taken only one. That means, the discounting rate is taken a single discount rate has been taken.

That means instead of r and r dash two different rates you put one value like r. So, there it will change the whole thing into a much simplistic approach. Simplistic approach that is that part is fine it gives a certain advantage and also it has got some certain disadvantage also. So, here what we do?

we compare in this slide as you see that then what is the the difference between the Hoskold and the Morkill and what conclusions that we draw from such valuation method. So, in Hoskold method we have two rates safe rate and risk rate and it uses Morkill uses only one rate risk adjusted discount rate. This has to be found out by a specific method that how to find out a discount rate which is more realistic. There are method which will be taught in this series of lectures. Now, risk handling this separates risk free return from mining risk.

We have two different rates. Now, here assumes that it all risk is incorporated into one discount rate which has been found out or derived from all the factors that influence or likely to influence the discount rate. Complexity, this is more complex, this is absolutely simpler rather simpler compared to the Hosskull approach. This is best for the minds with predictable annual income.

This is good with mines that are fluctuating or on certain incomes. So, between the Hoskold and Merkel methods, these are the features, and these are where they fundamentally differ. The use also indicates different areas of implementation. What we can say about this thing is the Hoskold method is more conservative. And favored in classical mine valuation, most popular. But the Merkel method is more aligned with modern financial approaches, like discounted cash flow, and the discount is scientifically computed.

Based on the parameters, as I said, that influence or are likely to influence the value discount rate. If you want higher accuracy in handling risk separately, go with the Hoskold approach. If you want a simpler technique, straightforward calculation, go with , Morkill, but remember that Morkill is not as simple as it looks because the risk-adjusted discount flow has to be computed scientifically. That is the difference between these two approaches. I hope I could make this clear.

In general project evaluation techniques, The importance of these things can be described as I speak about it. The nature of capital investment may be defined as the use of today's funds to generate tomorrow's profits. So, we try to evaluate a project based on its future prospects, meaning we are investing the funds today and what profit it gives back to us. So, there lies the concept of the valuation.

So, for that valuation for attaching that value we evaluate the worth of net worth of that project in present terms and there are different evaluation techniques for that. So, it is vitally important to to the future growth and profitability of any company and based on that we can take the capital investment in decision. So, a single investment possibility may be referred to as a as a as a project here, whenever we are talking about the project evaluation, we refer to as a project a single investment possibility. Sometimes it is not true, but in the beginning we understand that what stage we are going to invest. May be there will be 2, 3 in important stages, but we know we know the total funds to be available for that.

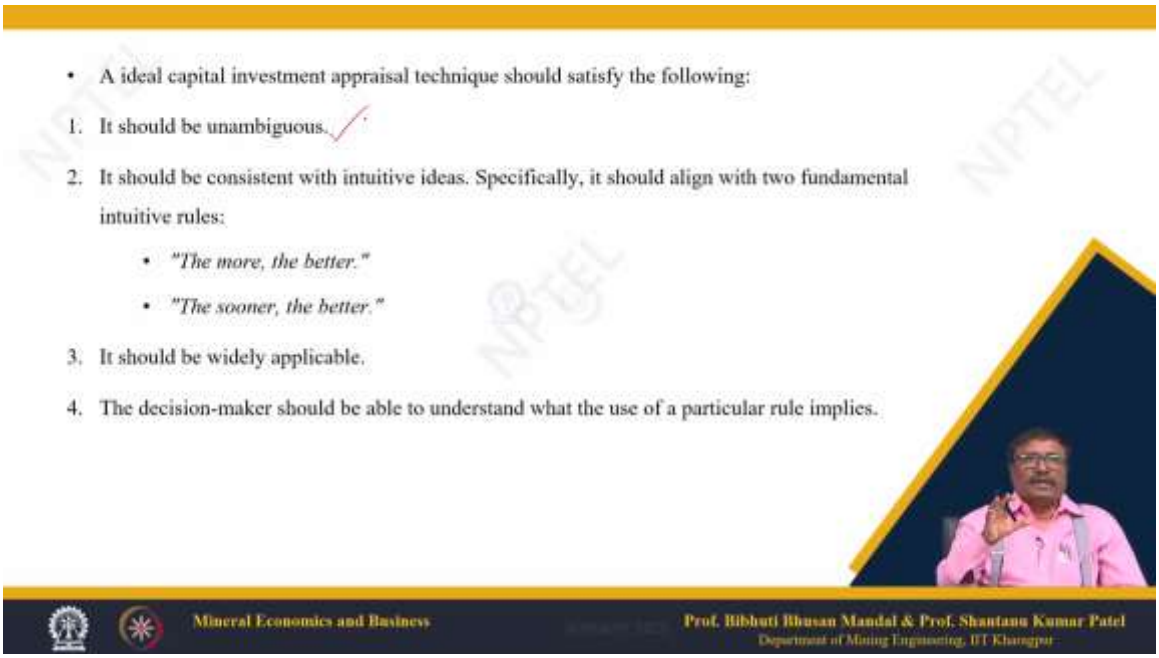
So, the objective of this capital investment appraisal is to provide a rule for deciding in the case of any given capital investment project, whether the project should be undertaken or not. This is a decision making process. So, the objective is to set up a decision rule for accepting or rejecting the investment. So, we can say that it operates on three stages. So, reduce all available information about the project and its associated cash flow to a single number.

For example, payback period, net present value, etcetera. Everything has to be transformed or reduced to a single number, single quantity. Now compare this number with some given threshold or cutoff value that you want to compare to take a decision. So, if the number associated with the project is better than the threshold project, the project threshold level the project is accepted otherwise it is so rejected. So, this is the decision rule we transform all the cash flows into a single quantity

- The objective of any capital investment appraisal is to set up a decision rule for accepting or rejecting investments. Most decision rules for capital investment appraisal operate using three stages:

1. Reduce all available information about the project and its associated cash flows to a single number (e.g., payback period, NPV, etc.).
2. Compare that number with some given threshold or cut-off level.
3. If the number associated with the project is better than the threshold level, the project is accepted; otherwise, it is rejected.

And we I mean following a certain framework, then we compare this number with some given threshold or cutoff level that we have fixed. And then we take a decision that

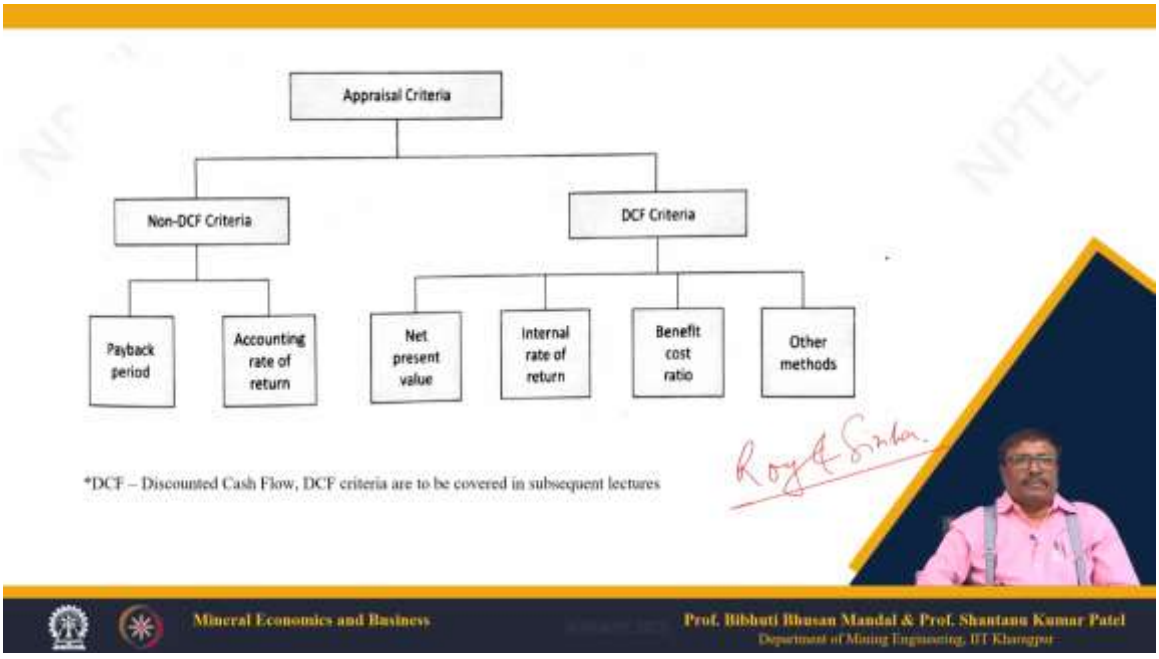


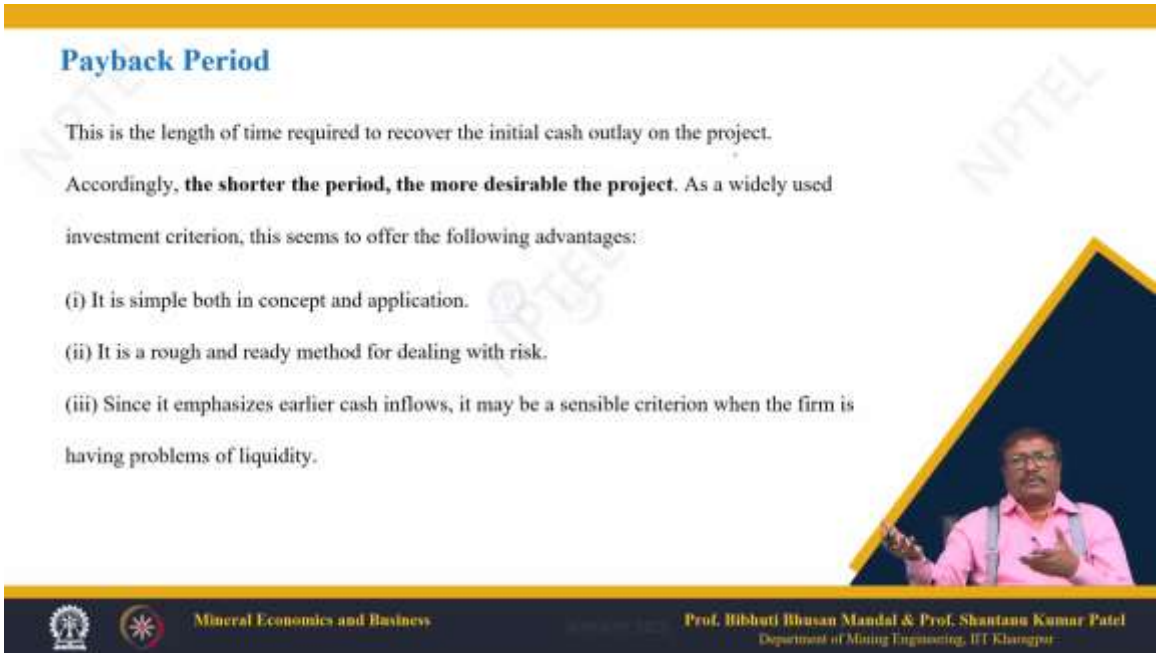
whether we should go ahead with the investment or not. So, then this capital investment proposal technique should satisfy the following at least. It should be unambiguous in the means there should not be grey area, it should be clear the right from the mineral reporting procedure, the mining techniques, its return, the computational method, the accounting method everything should be clearly stated. And then what should be our return from the investment everything should be clearly stated.

It should align with the two fundamental intuitive rules like the more the better more you get we will consider this better. And of course, we get the payback as soon as possible not to wait for years after years to get the money back. It should be widely applicable means not a very very very specific case then it can be easily understood because it has been widely used earlier for other project. So, naturally we should also apply these things in the in the present project. So, and the decision maker should be able to understand.

So, what particular thing is the most attractive part in this project. So, that decision maker should be a price that this is how it has been calculated and it is attractive or it should be rejected. The appraisal criteria this I have taken from Roy and Sinha's book. which I have mentioned in the reference section. The appraisal criteria can be divided like non discounted cash flow technique criteria or discounted cash flow criteria.

So, for non-DCF, we have the payback period or accounting rate of return, which we will be discussing today. And for discounted cash flow criteria, we will have separate lectures on this, such as NPV, IRR, benefit-cost ratio, and any other method. So, there are two distinctions: one is the non-discounted cash flow technique, and the other is the discounted cash flow criteria. Now, let us see. The payback period is a simpler calculation. So, this is the length of time—this is something like that.



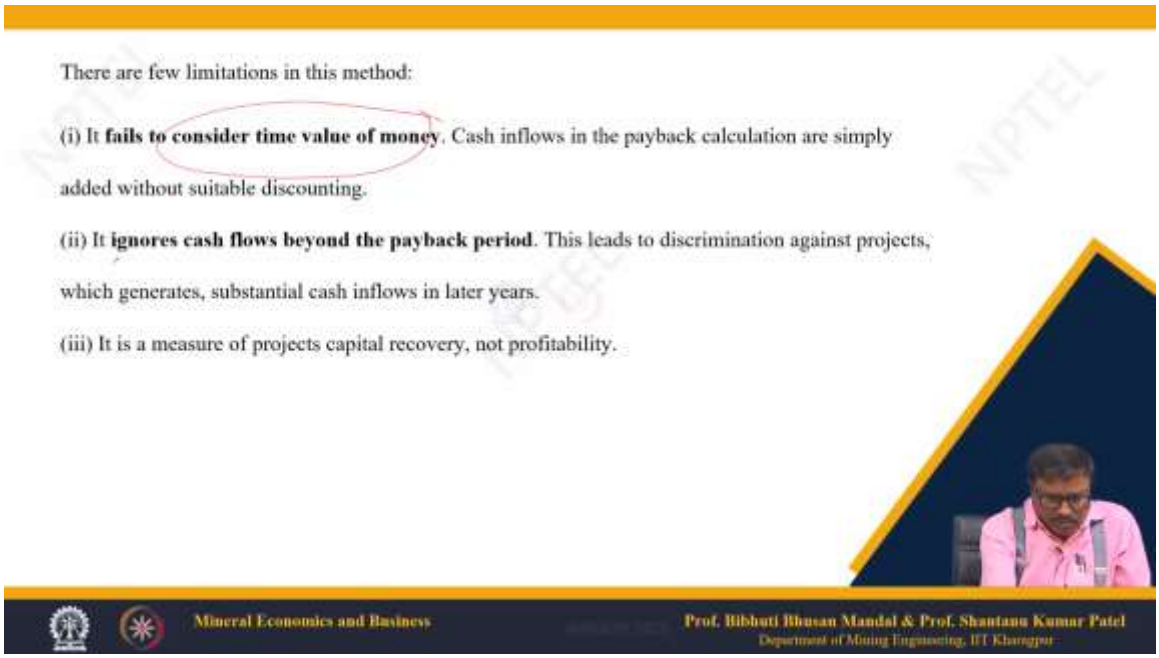


So, if I give you, say, 5 crores, 10 crores, or 50 crores, the first thing is when I am getting this money back. Then, whatever I get will be my profit—the additional outcome of the investment return on investment. So, first, we will try to know how many years you will take—how long you will keep my money without a return. That means the capital will be blocked. The shorter the period, the more desirable the project is.

If I say within 2 years or within 5 years, I get the entire money back—that is very good. If somebody says, 'No, sir, it will take at least 20 years to get your money back,' then it is not immediately attractive unless there is something very special about it. So, as a very widely used investment criterion, this seems to offer the following advantages. It is simple in concept and application—that I will give this money when I am getting this return. It is a rough and ready method.

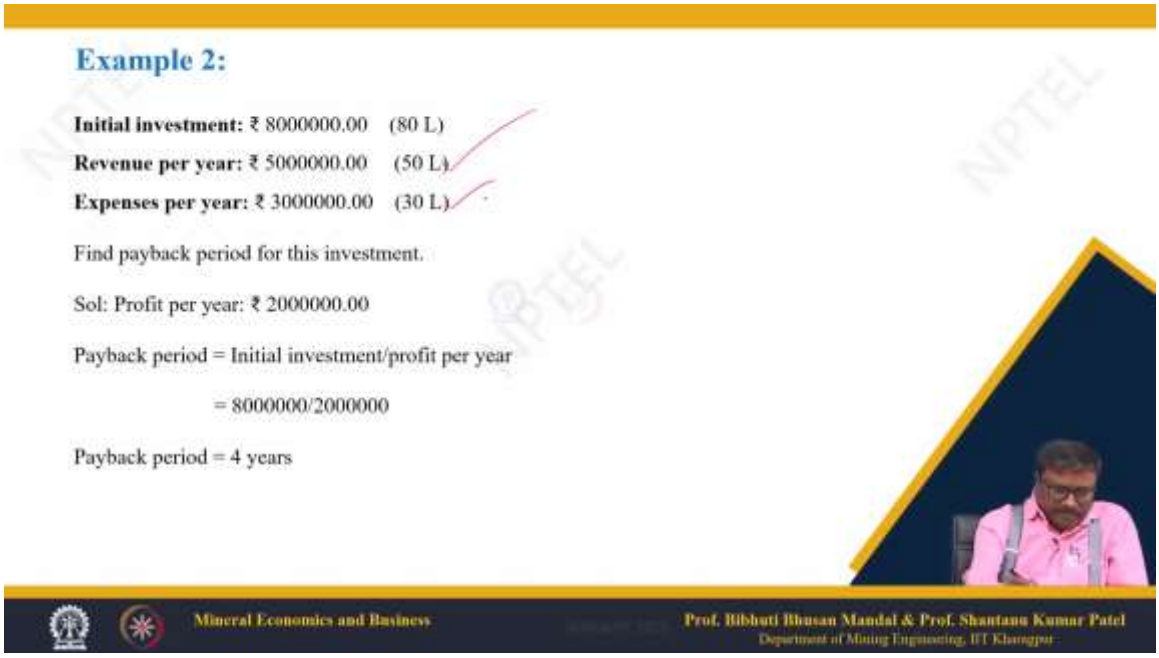
It is a broad method; it does not have complicated calculations like the NPV or IRR to deal with the risk. Approximate tonnage per year that it can generate, how much capital is required for shaft sinking or capital development, what we can expect from the mine development, and how many years it takes to get the money back. So, it is a rough and ready method for dealing with this risk. Since it emphasizes earlier cash flows, it may be a sensible criterion when the firm is having liquidity problems, meaning it cannot have

cash held up somewhere. So, that will create a problem for liquidity issues if they require some money.



They will not, at least in 2-3 years, if they get a return, then it becomes easier for them to invest and rest assured that the payback period is less. There are certain limitations; it does not truly consider the time value of money. So, it is a simple calculation; it ignores the cash flows beyond the payback period. After that, how much we are getting makes the project evaluation more detailed. If, after the payback period, it continues to give returns, then that part should be more attractive than the immediate payback period, is it not? In, say, 5 years, you are getting the entire few crores of money back, but after that, it continues to give you money back. So, you should rather concentrate on a project which has a long-term return on investment, but in this case, we try to give importance only to the payback period.

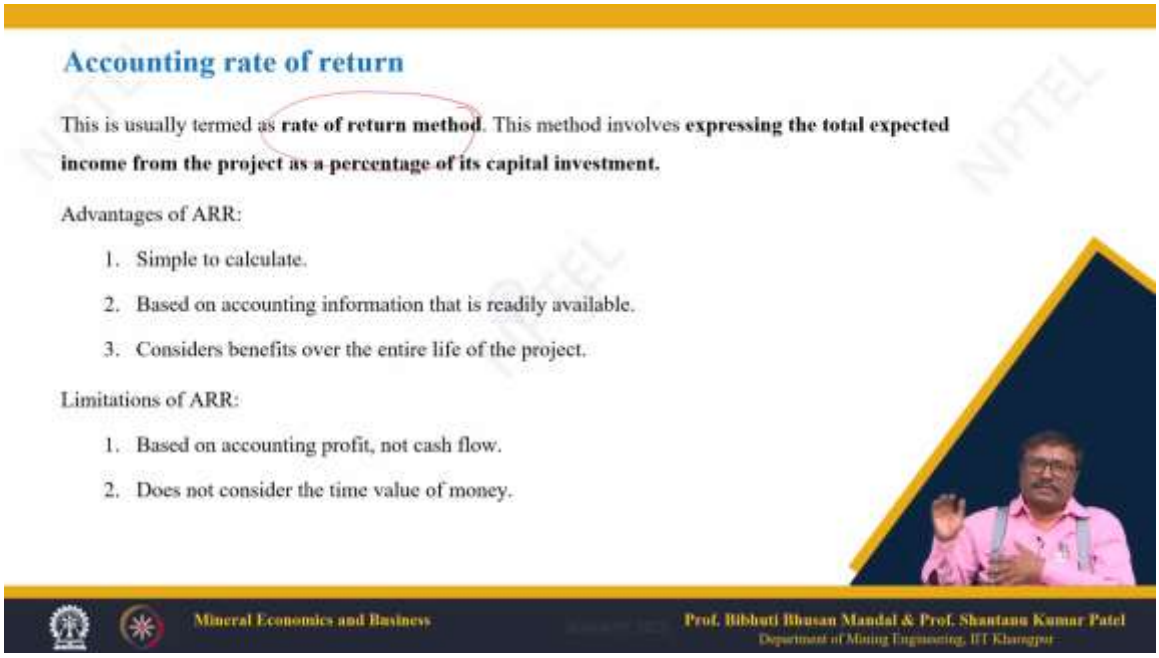
So, this ignores the cash flow beyond the payback period; it is a measure of capital recovery. Capital recovery, payback period is capital recovery, but not the profitability of the project. For example, we have an 80 lakh initial investment, estimated revenue is 50 lakhs, and expenses per year are 30 lakhs. Now, the payback period for this: the profit per year is 20 lakhs, and the initial investment is 80 lakhs. So, in 4 years, you are getting the money back; it is as simple as that.



You can think in terms of crores also, but it is as that I mean you have to roughly calculate, broadly calculate. We can reduce, say, every day 2000 tons from so many stoves for mine or from an open cast mine we can produce about 10,000 tons per day. After so many years, then this is going to give us this much revenue. So, if I divide the initial investment by the revenue per year. So, in so many years, we are going to get the payback. So, the initial investment is returned.

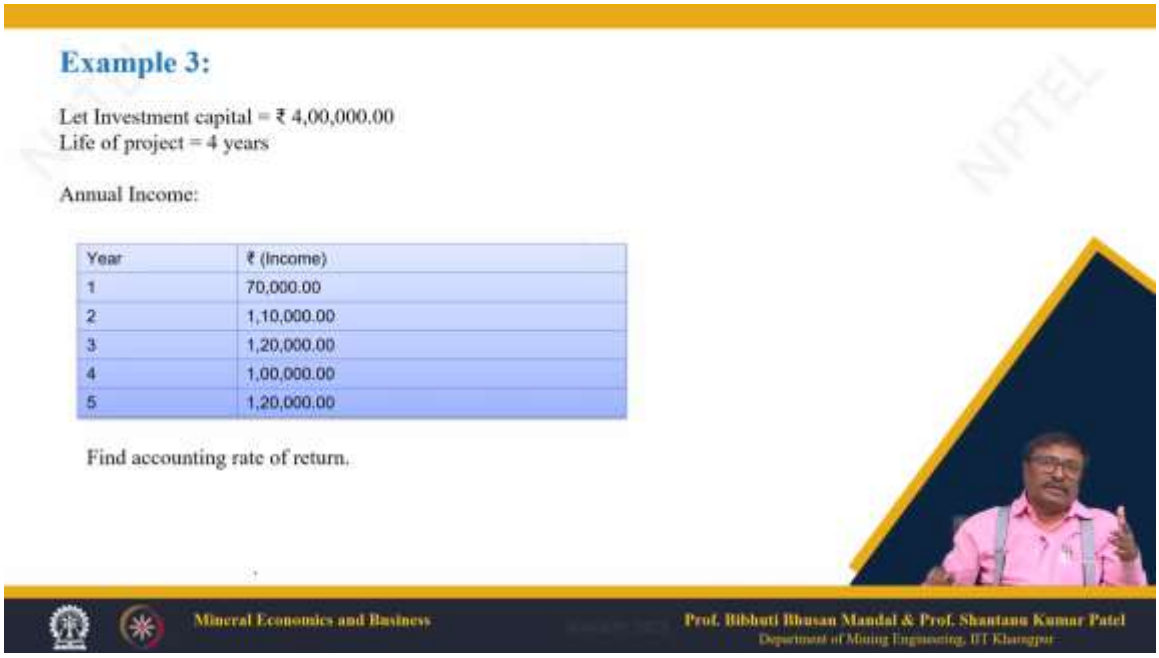
What happens after this, we do not know or are not interested to know in the payback method, payback period method. Here we are getting a 4-year term for the payback of the initial investment. Now, there is one more in this particular lecture, that is the accounting rate of return. This is termed as the rate of return method, and this is different from the so-called IRR, which will be dealt with separately. So, this method involves expressing the total expected income from the project as a percentage of its capital investment.

That means we are expecting an income from the project divided by the total capital investment. So, you will get a percentage, maybe you are getting 5 percent, 10 percent, 20 percent. In that case, that percentage will be called the ARR, accounting rate of return. This is totally different from the internal rate of return. So, this is a simplistic method, and it is simple, really simple to calculate that way, and based on the accounting information that is readily available and considers benefits over the entire life of this project. What are the limitations of the ARR method here, accounting rate of return?



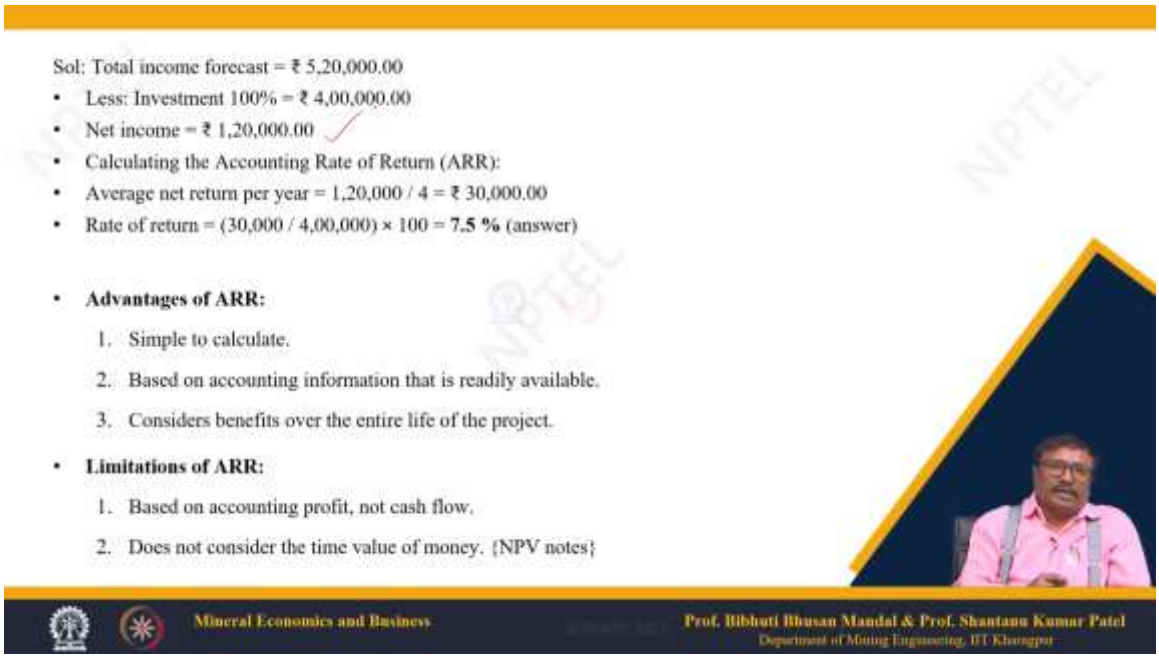
Here I think I could make it simple that you have to calculate the return total return divided by total investment capital investment. Somebody says you will get some 20 percent return on investment accounting rate of return is called. or somebody says no no no you will get 200 percent return if you invest this much over this period again the period come definitely. But in this case we are not do we are silent about the period, but we are saying if you invest the here this much then you get 200 percent or 300 percent return that is a simple accounting rate of return. So, this is based on accounting profit not the cash flow truly and again it does not take into account the time value of money.

We have discussed about the different types of the the valuation methods, evaluating techniques and the payback period method and accounting rate of return. to a simplistic, but still it gives a rough and ready idea about what would be the return from this from any new project. For example, if the investment capital is 400,000 and life of the project is 4 years And we have distributed this for a period of 5 years, we know that these are the incomes that we are going to get. This is just for just for example, this is not a true example from the mining.



But for illustration purpose for accounting rate of return, we have to just see the investment capital, we must know the project life say here 4 years. And then when you are getting the what are the returns that you are getting over the real. Now, how to calculate this thing? Total income forecast is this much, but the investment whatever we have given. So, net income is this much.

Now, calculating the accounting rate of return will be this whole amount, 1,20,000, divided by 4, which is 30,000. So, if per year you are getting 30,000 rupees as return. So, from there we can calculate the percentage: 30,000 by 4 lakh into 100 is 7.5 percent, which is the accounting rate of return. What is the advantage of this method? It is very simple to calculate, as I said, and based on the accounting information, as I mentioned earlier, it is readily available and considers the benefits over the entire life of the



project because the whole rate of return on investments is scheduled. This is based on the accounting profit and not cash flow, and of course, as I said, it does not take the time value of money. Here we are not calculating the time value of money. It is a simplistic approach, but it can be used effectively for understanding the value of the project. In this particular lecture, we have covered up to the payback period and accounting rate of return, but the NPV, net present value, and other things like IRR will be taught separately in another class.

Here, we have tried to understand the Hoskold approach and Morkill approach for the purpose of mine valuation. So, you can see this in mineral project evaluation or also from the book by Professor Ray and Professor Sinha, 'Mine and Mineral Economics,' where you can find a lot of material. We will take up the remaining issues, such as the net present value and the IRR, separately and in much more detail because those are widely used, very successful, and popular methods. Thank you very much.