Financial Management for Managers
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Lecture 21
Capital Budgeting Part 5

Welcome all. So, in the process of learning about the Capital Budgeting process. Now, we are going to learn about the next method of evaluating the investment proposals and that is the benefit cost ratio. Benefit cost ratio, we call it as sometime as the PI also profitability index also, and after this net present value method, we have the one more say option available, one more method available for evaluating the capital investment proposals and sometimes, when NPV we are not comfortable with we can have this method also.

So, this is not as good as the NPV method is there but still this method is available. So, being a student of finance and when we are talking about the capital budgeting or evaluating the capital investment proposals. We must be, means aware about that there are three important methods, which are called as the, say the part of the discounted criteria.

So, NPV we have already talked about at length, we have discussed at length, some questions pertaining to this NPV and other methods. I will do after we complete the conceptual discussion. So, after having talked at length about the NPV net present value criterion, or the net present value method under the discounted criterion.

Now, I will discuss with you the BCR this is the Benefit Cost Ratio. Benefit Cost Ratio and net benefit cost ratio we have the two ratios, we can calculate the two ratios and we can evaluate any investment proposal depending upon the cost involved in raising that project that is a cash outflows and the cash inflows coming back. So, means depending upon this, we can easily say evaluate the project any investment proposal, by using this method also.

So, either we can use the say NPV and this method together, or this method and the next method IRR together that is possible but being a student of finance and when we are talking about the capital budgeting we must be aware about this method. So, how we evaluate the investment proposal by using the benefit cost ratio, or profitability index that we are going to discuss here with the help of this particular example.

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So, a benefit cost ratio is basically, the ratio between the say you can call it as the present value of benefits divided by the initial investments. Present value of the benefits divided by the initial investment. So, here we have this say, you can call it as the model which is given to us PVB is basically the present value of benefits.

Present value of benefits means the cash inflows coming over the subsequent years the cash inflows we are getting coming over the subsequent years the present value, discounted value of those cash inflows we have to calculate and then is the initial investment that is called as the cash outflow.

So, initial investment is equal to hundred percent and the cash inflows coming over the subsequent years have to discounted against the cost of capital and finally we have to means calculate this ratio dividing the sum total of the present value of the benefits with the initial investment and with the help of that we can calculate this ratio which is called as the benefit cost ratio and what is the net benefit cost ratio? Net benefit cost ratio is given here buy this model and this is like benefit cost ratio minus 1, benefits cost ratio minus 1 is known as the net benefit cost ratio.

So, as in case of the NPV criterion, we are calculating, we are not directly calculating NPV, we are calculating the PV first, present value first. Present value of the cash inflows or the cash

outflows both, present value of all the cash flows and then when we are say subtracting the present value of the say cash inflows or the present value of the from the present value of the cash inflows when we are subtracting the present values of the cash outflows then the say balance is called as NPV net present value.

So, what is the net present value? That is the present value of all cash inflows means that is the discounted value of all cash inflows minus present value of all cash outflows is known as a net present value. Similarly, this is the benefit cost ratio and the net benefit cost ratio. So, benefit cost ratio is basically PVB divided by I Present Value of Benefits divided by the initial investment and when we have to calculate the net benefit cost ratio.

So, there we simply BCR minus 1 or we means for calculating this whatever the benefit cost ratio is calculated from that you will subtract 1. So, it is called as, this 1 is basically it represents basically the initial investment because initial investment is consider as 1 and benefit cost ratio is considered as basically the say, which is calculated based upon the present value of the benefits.

So, BCR minus 1 gives us the value of the net benefit cost ratios. So, two things are there, benefit cost ratio, the net benefit cost ratio and for understanding the concept of this how we use this concept or this particular method for evaluating the investment proposal you can just look at it here.

So, we have written here, to illustrate the calculation of these measures, let us consider a project which is being evaluated by a firm that has a cost of capital of 12 percent. So, now this is the information available where we have the initial investment of the 100,000 rupees and then we have the over the years we have the cash inflows. First year is 25,000, second year is 40,000, third year is 40,000, fourth year is 50,000.

So, now we have these four inflows, this is the outflow and now we have to make a comparison of these two and try to find out whether the project is feasible or whether the project should be taken up or not. So, rather than means we could have use the NPV criterion also that if you discount this and discounted value sum total of these four, the discounted value of a sum total of these four is say, from this the initial investment is subtracted.

So, you can calculate the NPV also but we want to evaluate with the help of benefit cost ratio BCR. So, the benefit cost ratio measures for the this project are given to us here as BCR is benefit cost ratio here is that is a 25,000 is a first cash flow and then we have to see here is that is to be discounted with this.

So, when we have to discount this, we are discounting it with the help of 25,000 divided by 1.12 and then it is the 40,000 divided by 1.12 power 2 because it is the second year and the 40,000 divided by 1.12 power 3 that it is coming in the third year and then it is the fourth year.

So, it means discounted value if it is coming in the immediate one year, next year. So, it is, that is 1 divided by, the inflow is divided by 1.12 but if the cash inflows is coming two years later. So, it means it is to be divided by 1.12 power 2, 1.12 power 3 and then divided by 1.12 power 4. So, 0.12 is basically the cost of capital. So, it is basically you understand it is 1 plus R.

So, when you calculate this so you can say that means the total present value of the benefits we have already calculated and divided by the initial investment which is in this case is 100,000 rupees. So, you calculate the final this figure comes up as how much? That is 1.145 this 1.145 is what? This is called as the benefit cost ratio, benefit cost ratio and in this case we are finding out is that the benefit cost ratio is more than more 1.

So, it means when you calculate the net benefit cost ratio you can say that this is a equal to 0.415 so it means from this you have, from this BCR when we are subtracting 1 we are getting something which is called a 0.145. So, this is called as the net benefit cost ratio. Now, how we have to say, arrive at a decision whether the project should be taken up or not, whether the project should be taken up or not.

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So, for that we have the very clear cut criterion here if we are talking about the BCR Benefit Cost Ratio or we are talking about the net benefit cost ratio and then we are going to talk about here is the rule or the rule of thumb. So, whether you are taking the decision on the basis of BCR or on the basis of NBCR or on the basis of the, means anything else.

So, it means the rule we have to find out is, we have talking in terms of the 1, so BCR if it is greater than 1 and NBCR is greater than 0, BCR is greater than 1 and NBCR is greater than 0. So, what is the rule here? That is accept the proposal, accept the proposal, and similarly, if it is

equal to 1 and if it is equal to 0, so what is the case here? We are indifferent, we are indifferent whether to go for this project or not to go for this project because the net benefit cost ratio is 0.

So, it means the initial investment, the present value of the initial investment and the present value of the benefit means the benefits we are arriving at, means the total cash inflows the present value of those sum total of those cash inflows, the present value all the cash inflows and the present value of all the cash outflows when they are means compared with each other. So, we are arriving at NBCR net benefit cost ratio is 0, it means there is no loss, no gain.

So, we are indifferent, so it may be possible that in the foreseeable period of next 4, 5 years this NBCR is coming up as a 0, but when we take the project forward we can say that there will be some positive NBCR or more than 1, greater than 1, NBCR can be generated. So, that is why we say, we can take up the proposal or we may not take up the proposal but if we have to not to take up the proposal then the rule simply says here is that if it is less than 1, and if it is less than 0 if the benefit cost ratio is less than 1 and the net benefit cost ratio is less than 0.

So, in this case the decision has to be clear cut it is it is reject. So, the decision criterion under the benefit cost ratio depends upon the benefits cost ratio, and the net benefit cost ratio. Benefit cost ratio revolves around 1 and net benefit cost ratio revolves around 0 and depending upon these two ratios, if it is greater than 1 and second one is greater than 0, equal to 1, equal to 0, and then it is the less than 1 and less than 0.

So, one is revolving around 1, another is involving around 0 and on the basis of that we have to take the accept or reject decision and in between if they are equal to 1 or equal to 0 then we are indifferent. So, it is a very important simple criterion that we can easily make use of it but largely it is comparable almost as same as NPV method, but as compared to NPV method this method or this criterion suffers from certain limitations, suffers from certain limitations that is why we do not use it generally.

In the practice we do not use this criterion because largely the process is as same as NPV but if you talk about the benefits pros and cons, then I think cons are more than the pros. So, that is why in practice this method is not very much there but yes it is one of the important method in the discounted criterion along with NPV and the next one which we are going to talk about is the

internal rate of return in between these two this is the one method and very important method and very relevant also if you want make use of it we can make use of it.

So, whether the pros measures NPV per rupee of outlay this is the most important advantage of this benefit cost ratio, what is, but how we are calculating it here? Present value of benefits divided by I initial investment, present value of benefit divided by I initial investment it means we are calculating the net present value of the project, or from the project per rupee of investment because we are dividing it by the hole investment.

In NPV we subtract the initial investment from the sum total of the discounted value of all cash inflows, the present value of the cash outflows is subtracted but in case of the this ratio present means benefit cost ratio here we calculate net present value, present value benefits means basically it is the present value.

So, NPV when you calculate or the net present value when you calculate, for example we have calculated here net benefit cost ratio that is BCR minus 1 it is basically NPV. It is basically NPV so we are calculating this and means calculating NBCR is possible with the help of BCR.

So, BCR is calculated per rupee of investment so per rupee of in outlay. So, it means in that case the NPV of the project is possible to be calculated per rupee of investment which is not possible under the net present value criterion, but the cons are very serious here and very even call it as say, creating the serious issue here that provides no means of aggregation, provides no means of aggregation.

For example, when we were talking about NPV. So, if you are, we are talking about say taking of some investment proposal which has a smaller parts A, B and C. So, if you want to make investment of say 10 lakh rupees. So, for that 10 lakh rupees we have three different projects we can take up, where the 5 lakh can be invested here, 3 lakh can be invested here, 2 lakh can be invested here. So, it means that way means we do not have the bigger project, one bigger project of investing 10 lakh rupees together but we have the smaller projects. So, we want to invest total 10 lakh rupees or 1 million rupees.

So, we can say what we can do is we can say that we can calculate this NPV of A, NPV of this B and NPV of this C and what we can do is we can sum it up and when you sum it up you can

compare that the total investment is 10 lakhs and what is NPV available here. So, it means aggregating say, properties are there in the net present value method as we discussed in the previous class which is not there in the benefit cost ratio.

So, this is the one important limitation of this method and when cash flows occur beyond the current period means you cannot take into account the cash flows occur beyond the current. For example, this current period is a foreseeable period, any cash flows when there occurring beyond the foreseeable period, beyond the current period they are not taken into account.

They are not taking into account so these are not taken into account even in the net present value also but still the net present value we go far beyond but here when you talk about the say the cash flows occurring beyond the say foreseeable period they are not taken into account.

So, it means present value of benefits and the benefit cost ratio when we calculate, we calculate it on the basis of whatever is the readily available information that is with regard to the cash outflow and the cash inflow. So, if the inflow is available for the next 4 years, we are taking into account 4 years, or 5 years, we are taking into account 5 years but what about the next 5 years? For example, the life of the project is going to be say 10 years, or 15 years. So, we are not, means taking into account the total period.

So, this is one important limitation, this limitation is second one is there in the NPV also but in the NPV the aggregations property is there. So, you, if you do not want to make total investment into one bigger project so you can divide it into the smaller projects, some can be expansion diversification, different kind of the projects can be taken up. So, or there may be a company who want to introduce a new product they can introduce a 1 or 2 products or they can introduce 1 product only.

So, depending upon the opportunities available it will be better for the compute to invest into net, say new two to three products. So, that even one fails, other two survive, but if the entire investment is invested into one project and that project does not work well, then what will happen?

The entire investment will go down in the drain, entire investment will go down in the drain, and that will create a serious problem. So, aggregation we want many times that we do not want to

put all our apples in one basket. We want to means have different baskets and different investment opportunities available.

If you want to tap them then by investing the say, fractional amount, part of the amount into the different smaller projects, you can aggregate them and aggregated NPV can be calculated which is the facility available into the NPV method but not under the benefit cost ratio but the major advantage here is that you calculate the NPV per rupee of investment but because of the lack of aggregations property, or aggregating property we do not use this measure and we only take the very limited values that is only for the foreseeable period not for the remaining period.

So, that is also one important limitations this is common with NPV this limitation but the aggregating property is a very big property which is there with NPV and which is missing in the benefit cost ratio or in the profitability index. So, this is one method, but still because we should knowing being a student of finance that this is the one important criterion in the discounted criterion. So, that is why I could discuss it with you means at length.

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Now, we go to the next and the third important criterion and that is the very very important criterion, internal rate of return. If you talk about the limitations, there are so many limitations under the internal rate of return also but it is most preferred method out of the three methods given in the discounted criteria, out of the discounted criteria three methods given net present value, benefit cost ratio, and internal rate of return.

This is the most preferred and say usable method of discounting or calculating the discounted cash flows for any investment proposals or evaluating any future investment proposals. So, why means it is a million dollar question, that why it is so popular even as against the NPV method? This is because it gives you the estimates in the percentage terms.

It gives you the rate, internal rate of return in the percentage terms which is not possible in case of NPV, NPV gives you the absolute value. So, when you make, want to make any comparison because if we talk about the inflation we talk in term of percentage, we talk about the interest rate, we talk in terms of percentage, we talk about the growth rate, we talk in the terms of percentage.

Similarly, when you are talking about the internal rate of return available from any your project or investment proposal and even your cost of capital is also in terms of the percentage terms so comparing two percentages is much better as compare to comparing one the percentage and second is absolute value that is sometime its difficult.

So, internal rate of return though it has many limitations it is cumbersome some times to make use of this method but it is the most widely used method because it is the viability of the project is interpreted in the percentage terms. So, here how it works, the internal rate of return and what is a major benefit amongst the present value method and the internal rate of return method?

The basic difference is, the basic difference is that under the net present value method, the discount rate is given to us, discount rate is given to us. For example, that we have a certain information about the cash outflow, then for the cash inflows over the subsequent number of years and it is always given to us that the cost of capital of the form is 12 percent, 15 percent, or 10 percent.

So, that discount rate, the cost of capital is basically what? That is the discount rate, when you use the say formula that is CT divided by 1 plus R. So, what is R there? R is basically the cost of capital and it is given to us. So, we against that cost of capital using it as a discount rate, we discount the cash inflows and finally we arrived at the discounted value of the future cash flows.

But in case of the internal rate of return this rate is not given to us the cost of capital is not given to us, discount rate is not given to us, cost of capital is there that we can find out but the discount rate we do not use as a cost of capital. We have to find out the discount rate that R is missing in this internal rate of return, R we have to find out that and how we take the decision that the means under this internal rate of return what we do is, we try to find out that the, there is the present value of cash out flow and it should be equal to the present value of cash inflow.

So, it means, what will happen? Present value of the cash outflow is equal to present value of the cash inflow, what is NPV? NPV is going to be 0 here, NPV is going to be net present value is going to be 0 here. For example, the present value of the cash flow is 1 lakh rupees, 100,000 and the present value of the cash outflows is 1 lakh rupees and the present value of cash inflows is also 1 lakh rupees.

So, what is NPV? NPV is in that case NPV is 0, so we want to find out that rate of discount which is called as internal rate of return that at which we can discount the future cash flows or

cash inflows at a certain rate of discount after which the sum total or the aggregated value of discounted cash inflows is equal to the present value of the, cash outflows.

Means NPV at the we have to find out that rate of discount where the NPV is 0, where the net present value is 0 where the present value of the cash out flow is equal to the present value of the means present value of the aggregated cash inflows.

There that rate is consider as the internal rate of return, means that, that is the minimum rate we want, that is the minimum rate we want that at least whatever the investment anybody wants to make in any investment proposal that should be recoverable and for that means first our say, focus is on the recovery of the investment, later on if some subsequent in the subsequent years also if further surplus cash flows are available then that is the surplus value that is the you can call it as additional return available on that investment.

But first we want to calculate that if I am investing 100,000 rupees in any investment proposal, first my object is in how many years I am going to get that investment back, that is the say focal point under the payback period method also and that is a focal point under the NPV also, and that is a focal point under the IRR also and same in the case with the benefit cost ratio also.

As I told you that in case of the benefit cost ratio what decision we take? We are indifferent here as this level, we are indifferent means when the benefit cost ratio is equal to 1 and the net benefit cost ratio is equal to 0 or in other way round you can call it as NPV is equal to 0 it means we are indifferent, it means we can go for it or we cannot go for it.

But I am saying we are in different here when this the NPV is 0 up to the foreseeable period but what about the remaining period or the life of the project? If the project is going to the last for the number of say 5 more years or 10 more years then whatever the cash flows are coming back they are going to be the above returns.

So, internal rate of return is that rate of return were the present value of the cash outflows is equal to the present value of all cash inflows put together present value of all cash inflows put together is equal to the present value of the cash out flow that rate of return is called as the internal rate of return.
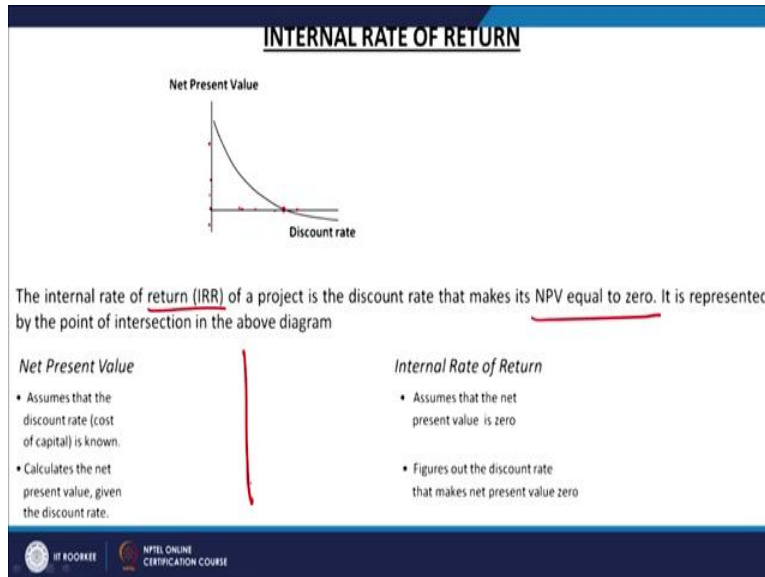
So, it means, it is written here also the internal rate of return IRR, the internal rate of return IRR of a project is the discount rate that makes its NPV equal to 0, that makes its NPV equal to 0 it is represented by the point of intersection in the above diagram.

Now, we have this above diagram here, we are taking on this X axis, X axis we have taken the net present value and on the, this Y axis we have taken the discount rate. So, if you for example, if you have this discount rate here may be the NPV can be something up to this but when you increase the discount rate.

Now, we are going to increase it will come down, when you increase up to this it will come down and when you are up to this point of intersection the NPV is this it means NPV at this point is 0, NPV at this point is 0 if you further keep on increasing the discount rate it will become negative. This NPV will become negative.

So, it means we want to arrive at this rate, we want to find out this rate where the net present value it means we simply are concerned that we want to recover our investment made in the project. We are only concerned up to that particular period of time, beyond that the remaining life of the project is certainly going to give us the cash inflows and that is going to add up into the positive NPV.

So, in how many years I am going to get back, the company is going to get back their investment that is the first important point and that we have to find out the discount rate which is not given to us and for that finding out that discount rate we have to use one method which is known as the Trial and Error method.

Trial and Error method, for example, in this structure if you use this particular discount rate your NPV will not be 0 but will be more than 1, more than that, if you further what you have to do is? Higher the NPV you have to further increase the discount rate so then the NPV will come down. The moment you keep on increasing the discount rate NPV will come down. So, lesser the discount rate NPV will be high, and higher the discount rate NPV will be low.

So, you have to increase the discount rate, so NPV will further come down and finally we have to find out that rate which is the one which is making the present value of the cash outflows equal to the present value of all the cash inflows put together. So, NPV at that point has to be 0 and the method we have to find out is because we do not know whether it is 10 percent, 15 percent, 12 percent, or 18 percent.

So, how to find it out? You have to try different rates, and under the trial and error method, by using the trial and error method you have to means follow this process and the rate which gives us the 0 NPV that rate will be called as the internal rate of return available from the project.

So, in this case before going it further we can talk about the two methods, net present value method, and internal rate of return method, if you make a comparison between these two, so what is the basic difference? Net present value method what says? Assumes that the discount rate cost of capital is known and we are given there also, we have seen in the problem we did that the cost of capital is the discount rate and that is known to us.

In this also cost of capital is known to us but the say, discount rate that we are not satisfied with that means we do not want to go for that discount rate. We want to see that or even if we apply the say, cost of capital rate here, for example our cost of capital is 15 percent and we discount the cash flows with the 15 percent it may be possible NPV is not coming 0. So, we have to increase it. It may become 18 percent or may be 20 percent and 20 percent NPV become 0 so it means we are not talking in terms of the cost of capital.

There we, it is a decision criteria that our cost of capital is 15 percent, the internal rate of return available from the project is 20 percent so it is very good, go ahead but that is also not means the basis cost of capital is not used here as the basis or the criterion whereas in the NPV this is used as the basis or the criterion for discounting the cash inflows. Calculates the net present value given the discount rate. So, whatever is the discount rate or the cost of capital is given to us using that we discount the cash inflows over the number of years.

So, we write cash flow divided by 1 plus R power the number of years, if it is the first year no power, then second is power 2, three years power 3, four power 4, power five. So, that with the NPV process goes on, whereas in case of the internal rate of return what is there? Assumes that the net present value is 0, assumes that net present value is 0, it means that rate we want to find out that we want to make the net present value means the between two outflow and outflow.

The present value from the total of the net present value, present value of cash inflows minus present value of the cash outflows NPV is 0 and figures out the discount rate that makes net present value 0. We, have to find out that rate which makes a net present value 0 and that is possible by trial and error method, we do not know which one is exact rate. So, for finding it out you have to apply different rates and that rate which makes it say, equal to 0 both the values one minus other that is known as internal rate of return.

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CALCULATION OF IRR

You have to try a few discount rates till you find the one that makes the NPV zero

Year	Cash flow	Discounting rate : 20%		Discounting rate : 24%		Discounting rate : 28%	
		Discount factor	Present Value	Discount factor	Present Value	Discount factor	Present Value
0	-100	1.000	-100.00	1.000	-100.00	1.000	-100.00
1	34.00	0.833	28.32	0.806	27.40	0.781	26.55
2	32.50	0.694	22.56	0.650	21.13	0.610	19.83
3	31.37	0.579	18.16	0.524	16.44	0.477	14.96
4	30.53	0.482	14.72	0.423	12.91	0.373	11.39
5	79.90	0.402	32.12	0.341	27.25	0.291	23.25
			NPV = 15.88		NPV = 5.13		NPV = -4.02

Now, for example we talk about here is the calculation of IRR, you are given the three different proposals. So, we are applying the three discount rates here and what is the amount given to us is we are given here the years 0 to 5 years are given to us. We are given here the cash flows that is minus 100 and then the cash inflows, subsequent cash inflows are given to us for the next 5 years, 1 to 5 years.

And then we are given the discount rates, one is the 20 percent, second is the 24 percent and then the third is 28 percent. So, these discount rates are given to us, when we discount these particular cash flows of this series of the cash flows with the 20 percent discount rate NPV comes up as 15.88. So, this is the positive NPV, we are not satisfied with this rate because under internal rate of return NPV has to be 0.

Then we increase the discount rate. When you discount the rate from 20 to 24 percent, again the cash flows remaining the same, years also remaining the same, but the discount factor changing, present value is changing, still the NPV is coming up is 5.13 which is more than 0. Then we went ahead and we increase the rate from the 24 percent here to 28 percent here and when you apply the 28 percent discount rate we could find out that this NPV is minus 4.02.

So, it means now it is clear that your discount rate lies somewhere between this and this, it is somewhere between 24 percent and 28 percent but we do not know what is the exact rate 24, whether it is 24 percent or whether it is 28 percent, because at 24 percent NPV is positive, and at the 28 percent NPV has become negative. So, it can be 25, 26, 27. So, we have to find out that exact rate, we have the method also for finding out that exact rate.

So, how to find out that exact rate means what is the process of finding out that exact rate, we will discuss that also we will learn about that also and for that I will discuss with you the process of finding out the exact discount rate, there is a method, there is a process. So, means at least we could discuss till now that 24 and 28 the rate is here, but finding out the exact rate of discount or may be how to find it out what is a process for that? What is a method for that? That I will discuss with you in the next class.

At the moment I will stop here and we could discuss two important things, benefit cost ratio and we just begin the discussion on the internal rate of return, but this is not the end of the internal

rate of return, it is very peculiar method, very very important method. So, remaining part of discussion with regard to internal rate of return I will have in the next class, till then thank you very much.